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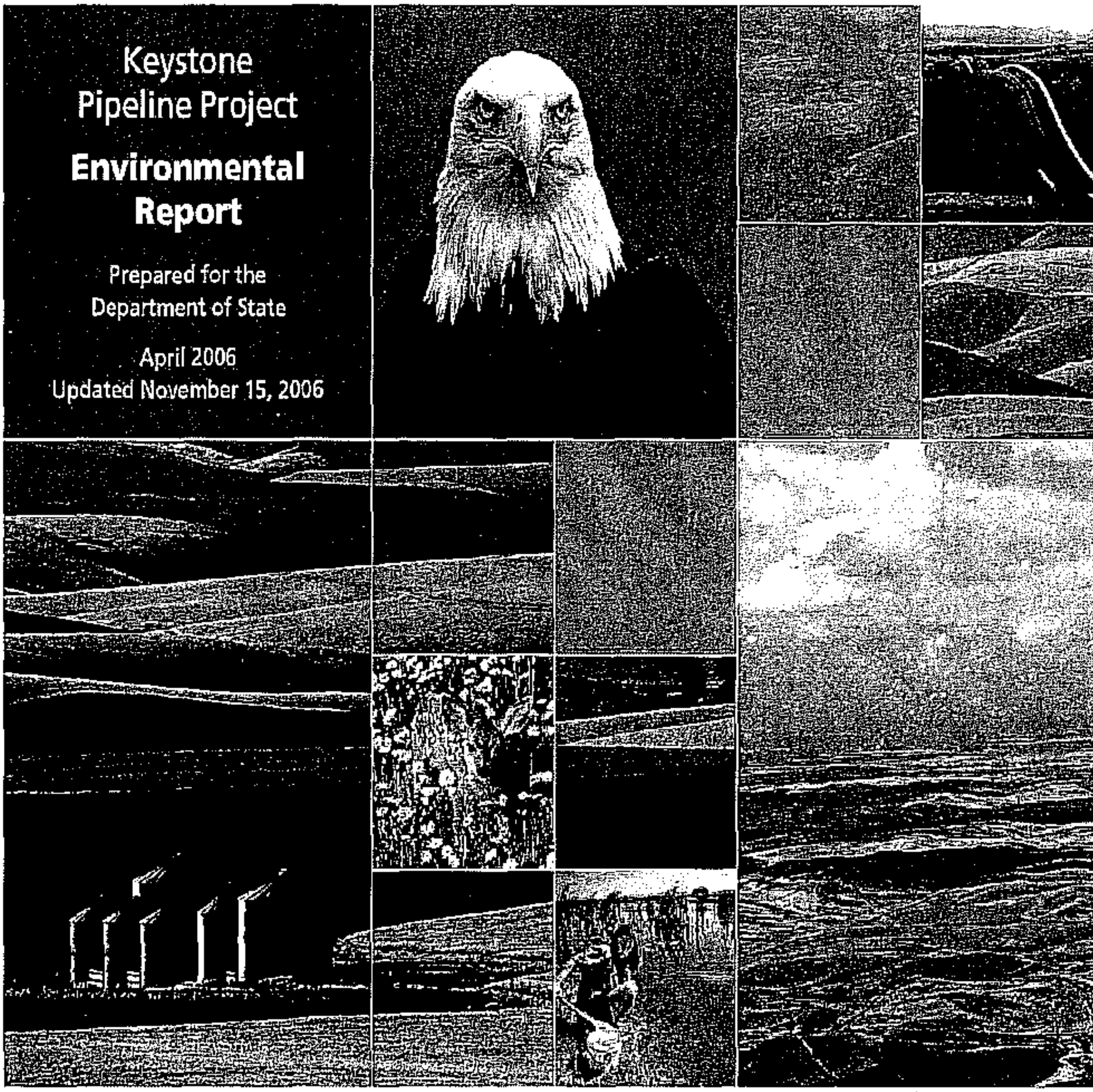
Keystone
Pipeline Project

Environmental Report

Prepared for the
Department of State

April 2006
Updated November 15, 2006



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November 15, 2006

Elizabeth A. Orlando
Office of Environmental Policy
U.S. Department of State
OES/ENV
Washington, DC 20520

Re: TransCanada Keystone Pipeline, L.P.
Application for Presidential Permit: Supplemental Filing No. 3

Dear Ms. Orlando:

Enclosed for filing are an original and four electronic copies of Supplemental Filing No. 3 in support of the Application of TransCanada Keystone Pipeline, L.P. (Keystone) for a Presidential Permit Authorizing the Construction, Operation, and Maintenance of Pipeline Facilities for the Importation of Crude Oil to be Located at the United States-Canada Border at Cavalier County, North Dakota.

This Supplemental Filing includes the following information:

- An updated version of the Environmental Report originally submitted with Keystone's Presidential Permit application on April 19, 2006. The updated Environmental Report reflects the following information:
  - Updated pump station information, including pump station number and locations.
  - Updated valve locations.
  - Densitometer information, including number and locations.
  - Preliminary locations for temporary workspace areas.
  - Updated information regarding Native American lands crossed. Changes resulting from route refinements and survey activities completed since the April submittal.
  - Significant route refinements are described and reasons are provided.
  - Electrical powerline analysis for revised powerline locations.
  - Updated photo-mosaic route sheets.

- Updated powerline route sheets.

- Site-specific drawings for horizontal directional drill ("HDD") crossings.

- Environmental Field Survey Reports, including:

  - Cultural surveys – Status reports discussing Class III surveys, results, eligibility, testing, and status of remaining surveys. Keystone's cultural surveys are 77 percent complete.

  - Wetland surveys – Preliminary report discussing spring/summer 2006 surveys, results, and status of remaining surveys. Keystone's wetland surveys are 82 percent complete.

  - Final report on Topeka Shiner.

  - Final report on Winged Mapleleaf and Scaleshell Mussels.

  - Final report on native grasslands surveyed in spring/summer 2006.

  - Raptor survey report.

As previously indicated, Keystone plans to conduct an open season to solicit binding shipper support for the proposed Cushing Extension in late 2006 or early 2007. Preliminary shipper expressions of interest received by Keystone have indicated that the Cushing Extension would be required in late 2010. Accordingly, in the revised Environmental Report, Keystone has adjusted its plan for constructing the proposed Cushing Extension to reflect an in-service date of late 2010. In addition, based on operational and hydraulic considerations, Keystone has adjusted its plans for the Cushing Extension to utilize 36-inch diameter pipe, with no change to the proposed right-of-way width.

The environmental information submitted by Keystone to date, including the revised Environmental Report and accompanying materials submitted herewith, should constitute sufficient information for the Department of State to proceed with preparation of a Draft Environmental Impact Statement. As noted in this Supplemental Filing, Keystone will provide additional survey results in early 2007, including survey results for the Cushing Extension.

Should you require additional information or have questions with respect to this Supplemental Filing, please call me at (202) 736-8785.

Respectfully submitted,

James P. White
An Attorney for
TransCanada Keystone Pipeline, L.P.

Enclosures

ACRONYMS AND ABBREVIATIONS

ACRONMYS AND ABBREVIATIONS

°F	degrees Fahrenheit
µg/m^3	micrograms per cubic meter
µS/cm	microSiemens per centimeter; a measure of conductivity
ACHP	Advisory Council on Historic Preservation
AEUB	Alberta Energy and Utilities Board
AIRFA	American Indian Religious Freedom Act of 1978
amsl	above mean sea level
APC	Area of Probable Concern
APE	Area of Potential Effects
APHIS	Agriculture, Animal, and Plant Health Inspection Service
API	American Petroleum Institute
AQCR	Air Quality Control Regions
ARG	American Resources Group, Ltd.
BA	Biological Assessment
bpd	barrels per day
C&SD	Conservation and Survey Division
CAA	Clean Air Act
CAPP	Canadian Association of Petroleum Producers
CFR	Code of Federal Regulations
CLSWMA	Carlyle Lake State Wildlife Management Area
CO	carbon monoxide
CWA	Clean Water Act
dBA	decibels on the A-weighted scale
DEQ	Department of Environmental Quality
EIA	Energy Information Administration
EO	Executive Order
ER	Environmental Report
ERP	Emergency Response Plan
ESA	Endangered Species Act
FBE	fusion-bonded epoxy
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FR	Federal Register
GAP	National Gap Analysis Program
GIS	Geographic Information System
GLO	General Land Office
GPA	Game Production Area
gpm	gallons per minute
HDD	horizontal directional drill
IPL	Institute of Public Law
ISGS	Illinois State Geological Survey
KGS	Kansas Geological Survey
KSDA	Kansas Department of Agriculture
kV	kilovolt
L_{dn}	day-night sound level
LEPC	Local Emergency Planning Committee

LULC	Land Use and Land Cover
MACT	Maximum Achievable Control Technology
MAOP	maximum allowable operating pressure
MCD	Missouri Conservation Department
MDA	Missouri Department of Agriculture
mg/l	milligrams per cubic liter
MP	milepost
MUID	Map Unit Identification
MVA	million volt-amp
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native America Graves Protection and Repatriation Act
NAUS	National Atlas of the United States
NDA	Nebraska Department of Agriculture
NDDA	North Dakota Department of Agriculture
NDGFD	North Dakota Game and Fish Department
NEDEQ	Nebraska Department of Environmental Quality
NEDNR	Nebraska Department of Natural Resources
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act of 1986
NO_2	nitrogen dioxide
NO_X	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRD	Natural Resources District
NRHP	National Register of Historic Places
NRI	National Rivers Inventory
NSA	noise sensitive areas
NSPS	New Source Performance Standards
NSR	New Source Review
NVCS	National Vegetation Classification System
NWI	National Wetland Inventory
NWP	Nationwide permits
O_3	Ozone
OAFF	Oklahoma Agriculture Food and Forestry
OPS	Office of Pipeline Safety
ORV	Outstanding Resource Values
PADD II	Petroleum Area for Defense District II
Pb	Lead
PCB	polychlorinated biphenyls
Plan	Upland Erosion Control, Revegetation, and Maintenance Plan
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
ppm	parts per million
Procedures	Wetland and Waterbody Construction and Mitigation Procedures
PSC	Public Service Commission

PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psig	pounds per square inch, gauge
PWS	Public Water Supplies
ROW	right-of-way
SCADA	Supervisory Control and Data Acquisition
SDCL	South Dakota Common Law
SDDENR	South Dakota Department of Environment and Natural Resources
SDGFD	South Dakota Game and Fish Department
SDSGS	South Dakota State Geological Survey
SGSK	State Geological Survey of Kansas
SHPO	State Historic Preservation Officer
SIP	State Implementation Plans
SO_2	sulfur dioxide
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
SWCA	SWCA Environmental Consultants
TCP	traditional cultural properties
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TSS	total suspended solids
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USDA-SCS	U.S. Department of Agriculture-Soil Conservation Service
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCSB	Western Canadian Sedimentary Basin
WHMA	Wildlife Habitat Management Area
WMA	Wildlife Management Area
WSRA	Wild and Scenic Rivers Act

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INTRODUCTION

CHAPTER 1

1.0 INTRODUCTION

1.1 Background and Overview

TransCanada Keystone Pipeline, L.P. (Keystone) proposes to construct and operate a crude oil pipeline and related facilities from Hardisty, Alberta, Canada, to Patoka, Illinois, in the United States (U.S.). The project, known as the Keystone Pipeline Project or Keystone, initially will have the capacity to deliver 435,000 barrels per day (bpd) of crude oil from an oil supply hub near Hardisty to existing terminals in Wood River and Patoka, Illinois. If market conditions warrant expansion in the future, additional pumping capacity could be added to increase the average throughput to 591,000 bpd. Based on shipper interest, Keystone also is considering the construction of two pipeline extensions to take crude oil from terminals in Fort Saskatchewan, Alberta, and deliver to Cushing, Oklahoma.

In total, the Keystone Pipeline Project will consist of approximately 1,845 miles of pipeline, including about 767 miles in Canada and 1,078 miles within the U.S. These distances will increase if the potential pipeline extension to Cushing, Oklahoma, is constructed as discussed below.

In Canada, the project will involve the sale to Keystone of an existing 537-mile, 34-inch-diameter pipeline currently owned by TransCanada Limited, and conversion of that line to crude oil service; the construction of a new 230-mile pipeline extension from Hardisty to the existing pipeline and the construction of a pipeline extension from the existing pipeline to the U.S.-Canada border (**Figure 1.1-1**). Conversion of the existing natural gas pipeline will significantly reduce environmental impacts and overall construction costs associated with the project. Appropriate regulatory authorities in Canada will conduct an independent environmental review process for the Canadian facilities.

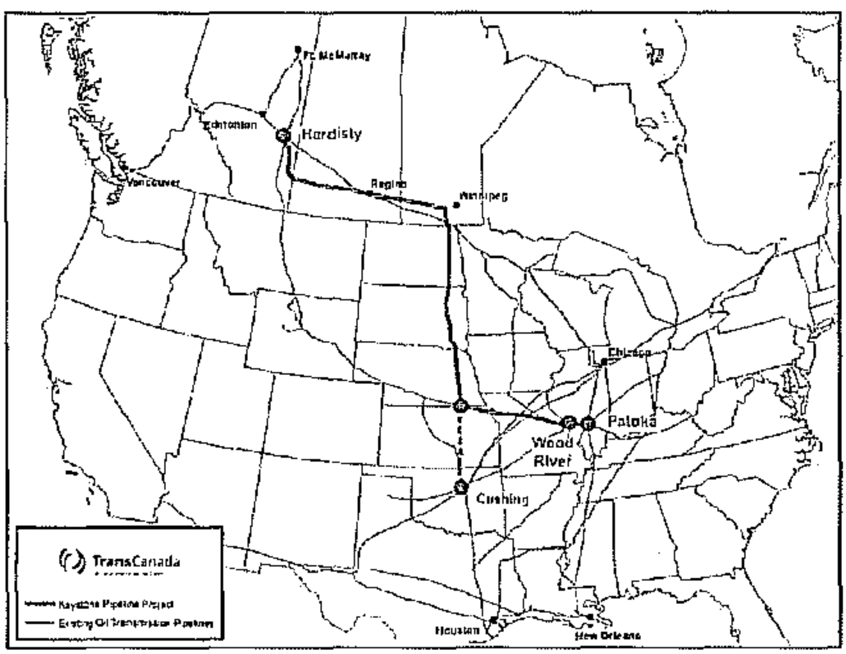


Figure 1.1-1 Proposed Keystone Oil Pipeline Route
(Potential expansion represented by the dotted line)

In the U.S., Keystone will construct and operate a new 1,078-mile pipeline (Keystone Mainline) that will transport crude oil from the Canadian border to existing terminals in the Midwest. The proposed pipeline will consist of 1,023 miles of 30-inch pipe between the Canadian border and Wood River, Illinois and a 55-mile segment of 24-inch pipeline between Wood River and Patoka, Illinois. Depending on the results of an additional binding Open Season to be held later in 2006 or early 2007, Keystone also may construct a 292-mile, 36-inch pipeline extension to Cushing, Oklahoma (Cushing Extension). Thus, there will be 1,370 total miles of new pipeline in the U.S. if the Cushing Extension is constructed. Unless specified, the remainder of this Environmental Report (ER) describes and evaluates the U.S. portion of the Keystone Pipeline Project, including both the Keystone Mainline and Cushing Extension, and the additional facilities required to increase capacity to 591,000 bpd.

Keystone will construct the 30- and 36-inch pipelines within a 110-foot-wide corridor, consisting of both a temporary 60-foot-wide construction right-of-way (ROW) and a 50-foot permanent ROW. In Illinois where a portion of the Keystone Pipeline will be a 24-inch pipeline, the project will be constructed within a 95-foot-wide corridor, consisting of both a temporary 45-foot-wide construction ROW and a 50-foot permanent ROW. Ownership of land crossed by the Keystone Pipeline Project is identified in **Table 1.1-1**.

Table 1.1-1 Ownership of Land Crossed by Keystone (miles)[1]

	Federal	Tribal	State	Private[2]	Total
KEYSTONE MAINLINE					
North Dakota	0.0	0.0	0.8	216.1	216.9
South Dakota	0.0	0.0	0.5	218.4	218.9
Nebraska	0.0	0.0	0.0	213.7	213.7
Kansas	0.0	0.0	0.0	98.8	98.8
Missouri	0.1	0.0	1.9	271.1	273.1
Illinois	3.0	0.0	0.0	53.5	56.5
Keystone Mainline subtotal	*3.1*	*0.0*	*3.2*	*1,071.6*	*1,077.9*
CUSHING EXTENSION					
Nebraska	0.0	0.0	0.0	2.4	2.4
Kansas	3.6	0.0	0.0	206.1	209.7
Oklahoma[3]	0.0	0.0	5.2	74.5	79.7
Cushing Extension Subtotal[3]	3.6	*0.0*	5.2	283.1	*291.8*
Keystone Pipeline Project Total	**6.7**	**0.0**	**8.4**	**1,354.6**	**1,369.7**

[1]Slight discrepancies in total values due to rounding.

[2]Includes privately owned lands with a federal or state easement.

[3]No tribal lands crossed in Oklahoma with the revised alignment as described in Section 2.4.1.4.

The Keystone Pipeline Project also will require the construction of pump stations (some with pigging facilities), delivery facilities, densitometer sites (for detection of crude oil batch interfaces), and mainline valves. Pump stations will be placed along the pipeline at locations necessary to maintain adequate flow through the pipeline. Valves will be installed and located as dictated by the hydraulic characteristics of the pipeline, as required by federal regulations, and with the intent to enhance public safety and environmental protection as part of Keystone's integrity management practices. Densitometer sites for detection of crude oil batch interfaces will be located at Steele City (junction of Mainline and Cushing Extension), Wood River, Patoka, Ponca City and Cushing. Delivery metering and power facilities at Wood River, Patoka, Ponca City, and Cushing will measure the amount of product transported and delivered to terminals. Finally, electrical powerlines will be constructed by local power providers to provide power for the new pump stations and to power remotely activated valves and densitometer sites located along the pipeline route.

The Keystone Pipeline Project will require the issuance of a Presidential Permit by the U.S. Department of State to cross the U.S./Canadian border. Issuance of the Presidential Permit is considered a federal action and is subject to environmental review pursuant to the National Environmental Policy Act (NEPA) (42 United States Code [USC] § 4321 et seq.). This ER is intended to provide the Department of State and other involved agencies with adequate information to commence review of the Keystone Pipeline Project under NEPA. This ER includes an objective disclosure of environmental impacts, both beneficial and adverse, resulting from the Keystone Pipeline Project, as well as a set of reasonable alternatives. Keystone is submitting preliminary field survey reports for spring and summer 2006 to the Department of State (November 15, 2006). Final 2006 field survey reports will be submitted in January 2007.

While the Keystone Pipeline Project will require electrical transmission powerline and facility upgrades in multiple locations along its route, Keystone will not perform and will not be responsible for the permitting of new electrical transmission lines and related facility construction. Rather, local power providers will be responsible for obtaining any necessary approvals or authorizations from federal, state, and local governments for such facilities. The permitting process for the electrical facilities is an independent process and no applications have been submitted for the electrical facilities to date. Construction and operation of these facilities, however, are considered connected actions under NEPA and, therefore, are evaluated within this ER.

The crude oil transported by the Keystone Pipeline to market destinations in the U.S. will be stored in existing storage tanks, will be integrated into the existing U.S. crude oil pipeline system, and will be processed at existing refineries. Based on Keystone's understanding of the operations and plans of the destination facilities (Wood River, Patoka, Ponca City, and Cushing), no additional oil storage facilities have been proposed because of this new oil supply. It is likely that refineries will shift feedstock from overseas sources transported by barge or other pipelines to the deliveries provided by the Keystone pipeline.

1.2 Purpose and Need for the Project

The purpose of the Keystone Pipeline Project is to transport incremental crude oil production from the Western Canadian Sedimentary Basin (WCSB) to meet growing demand by refineries and markets in the U.S. The Keystone Pipeline Project, depicted in **Figure 1.1-1**, will initiate at the crude oil supply hub near Hardisty, Alberta, Canada and terminate near the crude oil storage and pipeline hub near Patoka, Illinois. Keystone also will interconnect with other existing crude oil pipelines that supply refinery markets in Cushing and the U.S. Gulf Coast.

The need for the project is dictated by a number of factors including:

1) Increasing WCSB crude oil supply combined with insufficient export pipeline capacity;
2) Increasing crude oil demand in the U.S. and decreasing domestic crude supply;

3) The opportunity to reduce U.S. dependence on foreign offshore oil through increased access to stable, secure Canadian crude oil supplies; and
4) Binding shipper commitments to utilize the Keystone Pipeline Project.

1.2.1 Supply Component

Established crude oil reserves in the WCSB are estimated at 179 billion barrels (Canadian Association of Petroleum Producers (CAPP), April 2005). Over 97 percent of WCSB crude oil supply is sourced from Canada's vast oil sands reserves located in northern Alberta. The Alberta Energy and Utilities Board (AEUB) estimates there are 175 billion barrels of established reserves recoverable from Canada's oil sands. Alberta has the second largest crude oil reserves in the world, second only to Saudi Arabia (Oil and Gas Journal, December 2004).

CAPP estimates that, as a result of increasing production from the oil sands, the current level of crude oil production from the WCSB of about 2.3 million bpd is expected to increase by about 1.3 million bpd by 2015. (CAPP, July 2005). CAPP also has made a high case forecast, which estimates potential growth of over 2 million bpd over the same 10-year timeframe.

Existing crude oil export pipeline capacity out of the WSCB is insufficient to accommodate the forecasted crude oil supply growth, as shown in **Figure 1.2-1**. After accounting for Canadian domestic consumption, approximately 850,000 bpd of incremental export pipeline capacity will be required by 2015 to accommodate increased WCSB crude supply, based on CAPP's moderate forecast. Additional capacity above supply requirements also is required to avoid potential pipeline apportionment situations where short-term supply exceeds export pipeline capacity.

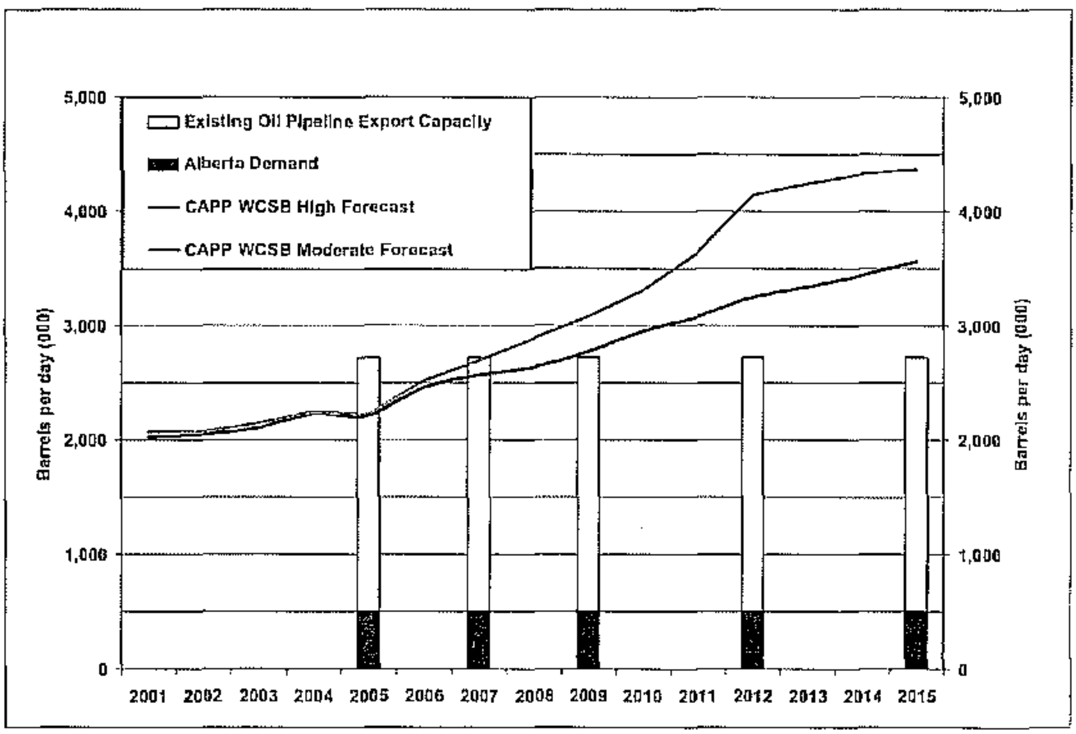


Figure 1.2-1 Existing WCSB Oil Pipeline Capacity versus CAPP Production Forecasts

As shown in **Figure 1.2-2**, the Keystone Pipeline Project initially will provide 435,000 bpd of incremental export capacity to address this deficiency. With expansion, Keystone could provide up to approximately 600,000 bpd of incremental export capacity Thus, the addition of the Keystone pipeline will significantly increase the WCSB pipeline export capacity needed to address forecasted supply growth.

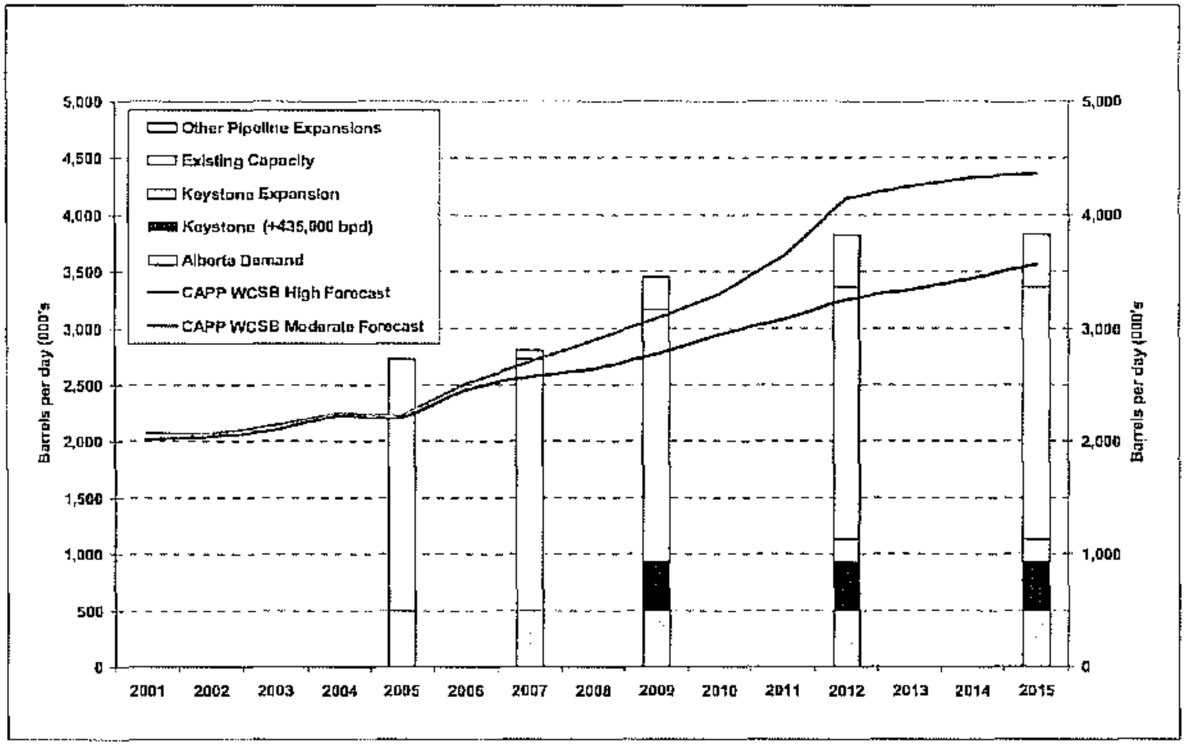


Figure 1.2-2 WCSB Oil Pipeline Capacity with Keystone versus CAPP Production Forecast

1.2.2 Demand Component

According to the Energy Information Administration (EIA), U.S. demand for petroleum products has increased by over 17 percent or 3 million bpd over the past 10 years and is expected to increase further. The EIA estimates that total U.S. petroleum consumption will increase by approximately 5.3 million bpd over the next 20 years, representing average demand growth of about 265,000 bpd per year (EIA Annual Energy Outlook 2006).

At the same time, domestic U.S. crude oil supplies continue to decline. For example, domestic crude production in the Petroleum Administration for Defense District II (PADD II), Keystone's initial target delivery area, continues to decline at an average rate of about 3 percent per year. Over the past 20 years, PADD II crude oil production has decreased by over 600,000 bpd or 60 percent (CAPP 2005).

The U.S. historically has compensated for decreases in domestic production through increased imports from Canada and foreign offshore sources. Canada is currently the largest supplier of imported crude oil and refined products to the U.S. (CAPP, April 2005), providing over 2.1 million bpd. Ten percent of oil consumed in the U.S. comes from Canada. U.S. imports of foreign crude and refined products continue to increase.

Crude and refined petroleum product imports into the U.S. have increased by over 4.3 million bpd over the past 10 years. In 2004, the U.S. imported over 13 million bpd of crude oil and petroleum products (United States Energy Information Administration 2006).

Keystone will provide a number of opportunities for refiners in the U.S. to utilize Canadian crude oil. Keystone's incremental pipeline capacity will provide the U.S. access to secure and growing Canadian crude supplies. Access to incremental Canadian crude supply also will provide an opportunity for the U.S. to offset declines in domestic crude oil production and decrease its dependence on offshore foreign crude supplies.

Keystone conducted a binding Open Season in December 2005 to provide shippers an opportunity to participate in the Keystone Pipeline Project by entering into contractual commitments for pipeline capacity. Binding contracts for 340,000 bpd were received, which Keystone has deemed sufficient to enable it to proceed with regulatory applications and, pending successful regulatory and environmental approvals, with construction of the pipeline. These binding commitments demonstrate the need for incremental pipeline capacity and access to Canadian crude supplies and represent a clear endorsement of the Keystone Pipeline Project. Keystone expects that the remainder of the excess capacity will be utilized by non-contract shippers at the tariff rate approved by the Federal Energy Regulatory Commission (FERC).

Shippers, including producers, marketers and refiners, evaluate the merits of various pipeline proposals and ultimately decide which projects to support. Shippers have expressed significant interest in securing additional crude oil pipeline capacity on the Keystone Pipeline Project. Definitive shipper interest has been demonstrated through the execution of binding contracts for capacity on the Keystone Pipeline Project. Potential shippers also have expressed strong interest in a proposed pipeline extension to the Cushing market area.

1.3 Federal Approval Process and Authorizing Actions

A number of federal agencies have permitting, environmental review, and regulatory roles with respect to the Keystone Pipeline Project. The roles of federal agencies with respect to Keystone are summarized below.

1.3.1 Department of State

Executive Order (EO) 11423 (33 Federal Register [FR] 11741), as amended by EO 12847 (58 FR 29511) and EO 13337 (69 FR 25299), governs the U.S. Department of State's issuance of Presidential Permits authorizing the construction of pipelines carrying petroleum, petroleum products, and other liquids across U.S. international borders. Within the Department of State, the Bureau of Economic and Business Affairs, Office of International Energy and Commodity Policy, receives and processes Presidential Permit applications. Upon receipt of a Presidential Permit application for a cross-border pipeline, the Department of State is required to request the views of the Secretary of Defense, the Attorney General, the Secretary of the Interior, the Secretary of Commerce, the Secretary of Transportation, the Secretary of Energy, the Secretary of Homeland Security, the Administrator of the U.S. Environmental Protection Agency (USEPA), and such other government department and agency heads as the Secretary of State deems appropriate. The Department also solicits comments from the public through publication of a notice in the Federal Register.

In evaluating Presidential Permit applications, the Department of State complies with the environmental review requirements imposed by NEPA, as well as other applicable statutes. After consideration of the views obtained from various authorities and interested party commenters, the Department of State makes a determination whether the proposed pipeline will serve the national interest. If it is determined that the issuance will serve the national interest, the Department of State prepares a permit including such terms and conditions as the national interest may, in the Department of State's judgment, require. The Department of State is further required to notify those agencies required to be consulted of its proposed determination. If any of those agencies disagrees with the determination within 15 days of notification, it may ask the Department of State to refer the matter to the President for his consideration and a final decision. If no agency disagrees within the 15-day period, the Department of State shall issue or deny the permit in accordance with the proposed national interest determination.

On October 11, 2006, the Department of State published a Notice of Intent To Prepare an Environmental Impact Statement and To Conduct Scoping Meetings and Notice of Floodplain and Wetland Involvement (71 FR 59849). Thirteen scoping meetings were held between October 24, 2006 and November 16, 2006, in cities located along the pipeline route. The public scoping period began with the publication of the Notice of Intent in the Federal Register and will continue until November 30, 2006.

1.3.2 U.S. Army Corps of Engineers Section 404 Nationwide Permits and Section 10 (Rivers and Harbors Act) Under the Clean Water Act

Section 404 of the Clean Water Act (CWA) establishes a permit program administered by the U.S. Army Corps of Engineers (USACE) to regulate the discharge of dredge and fill materials into the waters of the U.S., including their adjacent wetlands. The Keystone Pipeline Project will be under the jurisdiction of the multiple USACE districts. Keystone began field surveys along the Keystone Mainline in the spring of 2006. All areas along the Keystone Mainline where survey permission has been obtained will be surveyed by the end of 2006. Field surveys for the Cushing Extension are scheduled to begin in the spring of 2007. These field surveys will identify USACE jurisdictional waters of the U.S. and wetland delineations for applicable waterbodies that will be crossed by the project will be conducted. Keystone will file this information with the USACE and will apply for a Section 404 permit. Certain nationwide permits (NWP) may be applicable, including NWP 33 for access and dewatering and NWP 12 for temporary construction. Keystone also may require approvals under Section 10 (Rivers and Harbors Act). Keystone intends to submit its Section 404 permit applications to the appropriate USACE District offices in 2007.

1.3.3 National Park Service

The Keystone Pipeline Project will be constructed parallel to the existing Kaneb Pipeline crossing of the Missouri National Recreational River near Yankton, South Dakota. This portion of the Missouri River, between Gavins Point Dam and Ponca State Park, is classified as a national recreational river segment, as defined in the Wild and Scenic Rivers Act (WSRA) (P.L.90-542, as amended) (16 USC 1271-12870). The river segment subject to WSRA is managed by the National Park Service (NPS) and administered by the Secretary of the Interior. Furthermore, administration of this river segment is conducted in coordination with, and pursuant to, the advice of a Recreational River Advisory Group that has been established by the Secretary of Interior. This group may include representatives of the affected States and political subdivisions thereof, affected federal agencies, and other organized private groups as the Secretary of Interior deems desirable. The Keystone Pipeline Project will require approval of the proposed river crossing from the Secretary of the Interior. In evaluating the proposed river crossing, the Secretary is required by NEPA to consider environmental impacts. The issues to be considered by the Secretary are included in this ER.

Keystone conducted discussions with the NPS and other agencies related to the proposed horizontal directional drill (HDD) of the Missouri River. The proposed crossing lies within a Wild and Scenic Recreational River segment. The proposed crossing would be located within NPS Wild and Scenic River jurisdiction, but no land owned by the NPS would be affected. A meeting was held in Yankton, South Dakota, on May 19, 2006, to discuss the proposed HDD under the Missouri River and preliminary crossing drawings were provided (Appendix D). A Special Use permit was required from the NPS to conduct geotechnical drilling near the banks of the river. Keystone filed a Special Use Permit Application with the NPS on August 17, 2006, and the NPS approved this plan on September 18, 2006. Initial data collected during this investigation suggests that HDD is technically feasible for this crossing.

1.3.4 Advisory Council on Historic Preservation

Section 106 of the National Historic Preservation Act (NHPA), as amended, requires the lead federal agency to take into account the effects of its undertakings on historic properties or historic resources that are listed in, or eligible for listing in, the National Register of Historic Places (NRHP) and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment if there will be adverse effects to NRHP-eligible properties. Historic properties are prehistoric or historic districts, sites, buildings, structures, objects, or properties of traditional religious or cultural importance, which are listed or eligible for listing in the NRHP, including artifacts, records, and material remains related to such a property or resource.

The Department of State, as lead federal agency, is responsible for NHPA Section 106 compliance for all lands, both public and private, affected by the Keystone Pipeline Project. The Department of State is using the services of Keystone, as the applicant, to prepare information, analyses, and recommendations necessary to comply with Section 106, in accordance with ACHP's regulations at 36 Code of Federal Regulations [CFR] Section 800.2.

To date, Keystone has completed files and records reviews for the Keystone Pipeline Project area. Protocols for field surveys were prepared by Keystone and reviewed and approved by state historic preservation officers (SHPOs). Field surveys started in the spring of 2006 along the Keystone Mainline. Several potentially eligible sites were located within the project area of potential effect (APE) during the field surveys. Keystone is either avoiding or conducting evaluative testing in order to definitively determine NRHP eligibility for these sites. For those sites in which avoidance was not feasible, evaluative testing was started in early September 2006. To date, evaluative testing has been started at 14 sites. One of the 14 sites has been determined eligible for the NRHP, three have been determined not eligible, and the results of testing on the remaining 10 sites are pending. Field surveys will be conducted along the Cushing Extension starting in the spring of 2007.

Information from the files and records searches and field surveys will be documented in reports and submitted to the Department of State, SHPOs, and land managing agencies, as appropriate. The Department of State will consult with each SHPO to determine site eligibility for the NRHP and the project's effects on NRHP-eligible sites within the APE. If the Keystone Project will adversely affect NRHP-eligible sites, the Department of State will require the preparation and implementation of treatment plans to mitigate adverse effects. No construction will begin until all required consultations and approvals are received.

As the lead agency, the Department of State also is responsible for complying with the tribal consultation requirements of Section 106 of the NHPA, as amended, the Native American Graves Protection and Repatriation Act (NAGPRA), and American Indian Religious Freedom Act (AIRFA). Compliance involves contacting Native American groups with traditional or historical ties to the lands crossed by the proposed Keystone Project and ensuring that the requirements of the NHPA, AIRFA, and NAGPRA are met.

Tribal consultation was initiated by Keystone with 44 tribes that were recognized as having a potential past or present affiliation with the proposed project area. To date, two tribes have responded to the initial consultation letters. Neither tribe identified any areas of tribal importance within the project APE. At this time, follow-up phone calls to the tribes have not been conducted. The Department of State has indicated that it will continue consultation with the tribes from this point forward.

1.3.5 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) is responsible for ensuring compliance with the Endangered Species Act (ESA). The Department of State, as the lead federal agency, is responsible for initiating informal consultation with the USFWS to determine the likelihood of effects on listed species. Section 7 of the ESA, as amended, states that any project authorized, funded, or conducted by any federal agencies should not "...jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined...to be critical..." [16 USC § 1536(a)(2)(1988)]. The Department of State, or the applicant as a non-federal party, is required to consult with the USFWS to determine whether any federally listed or proposed endangered or threatened species or their designated critical habitat occur in the vicinity of the proposed project. If, upon review of existing data, the Department of State determines that these species or habitats may be affected by the proposed project, the Department of State is required to prepare a Biological Assessment (BA) to identify the nature and extent of adverse impact and to recommend mitigation measures that will avoid the habitat and/or species or that will reduce potential impact to acceptable levels. If, however, the Department of State determines that no federally listed or proposed endangered or threatened species or their designated critical habitat will be affected by the proposed project, no further action is necessary.

Keystone consulted with the USFWS regarding potential occurrence of special status species along the pipeline route. Based on USFWS input, Keystone developed a list of special status species that would require surveys and identified appropriate survey protocols. Once the survey protocols were approved by the USFWS, surveys were initiated in the fall of 2006 and will continue during the spring of 2007.

Keystone continues to consult with the USFWS regarding potential impacts of the pipeline to special status species and mitigation measures to reduce possible impacts. Based on the results of field surveys and potential impacts to sensitive species, Keystone will prepare an applicant-prepared Biological Assessment. This document will be submitted to the Department of State following the completion of field surveys. The Department of State will then review the Biological Assessment and submit the document to the USFWS for its concurrence.

1.3.6 Office of Pipeline Safety

The Office of Pipeline Safety (OPS), Pipeline and Hazardous Materials Safety Administration, within the U.S. Department of Transportation (USDOT) is the primary enforcement agency that regulates the safety of interstate transportation of hazardous liquids by pipelines, including crude oil. Federal regulations governing the construction and safe operation of pipelines are enforced by the OPS. To comply with federal regulations (49 CFR Parts 194 and 195), Keystone will be required to develop a comprehensive Emergency Response Plan for the Keystone Pipeline Project and areas of operation. The OPS will need to review and approve Keystone's Emergency Response Plan prior to operation. Additionally, the OPS will conduct regular inspections of pipeline facilities in the future to enforce continual compliance with federal regulations. This will include the review and approval of Keystone's Integrity Management Plan for High Consequence Areas.

Keystone prepared a preliminary evaluation of spill risk, including the likelihood of an inadvertent release, the probable size of a release, and the potential impacts of an accidental release. This preliminary evaluation was submitted to the Department of State on July 1, 2006. Keystone will continue to update and refine this evaluation as the project progresses in accordance with U.S. federal regulations.

1.4 Permits and Relationship to Non-federal Policies, Plans, and Programs

A preliminary list of federal, state, and local permits and approvals is provided on **Table 1.4-1**. Individual road crossing and road use permits have not been included in this table, since such permits will be a standard requirement in all counties crossed.

Table 1.4-1 **Permits, Licenses, Approval, and Consultation Requirements**

Agency	Permit or Consultation/Authority	Agency Action
FEDERAL		
Department of State (DOS)	Presidential Permit, Executive Order 11423 of August 16, 1968 (33 Fed. Reg. 11741)	Approve cross-border facilities. DOS is lead Federal agency for NEPA purposes.
U.S. Corps of Engineers (USACE) – Omaha, St. Louis, Kansas City, and Tulsa Districts	Section 404, Clean Water Act (CWA)	Section 404 permits for the placement of dredge or fill material in waters of the U.S., including wetlands.
	Section 10 Permit (Rivers and Harbors Act of 1899)	Section 10 permits for pipeline crossings of navigable waters.
Federal Highway Administration	Encroachment Permit	Permits for the crossing of federally funded highways.
Office of Pipeline Safety	49 CFR Part 195	Review and approval of Integrity Management Plan for High Consequence Areas.
	49 CFR Part 194	Review and approval of Emergency Preparedness Plan.
U.S. Environmental Protection Agency (EPA), Regions V, VI, VII, VIII	Section 401, CWA, Water Quality Certification	Water use and crossing permits for non-jurisdictional waters. Implemented through each state's Water Quality Certification Program.
	Section 402, CWA, National Pollutant Discharge Elimination System (NPDES)	Review and issue NPDES permit for the discharge of hydrostatic test water. Implemented through each state's Water Quality Certification Program.
NORTH DAKOTA		
Public Service Commission	Energy Conversion and Transmission Facility Siting Act Corridor certificate; Route Permit	Permit for construction of a pipeline within an approved corridor, and along an approved route.
Department of Health, Division of Water Quality	Section 401, CWA, Water Quality Certification	Permit for stream and wetland crossings/consultation for COE 404 process.
	NPDES Temporary Dewatering / Hydrostatic Testing Permit (NDG07000)	Permit regulating hydrostatic test water discharge, and construction dewatering to waters of the state.
	NPDES Storm Water Discharge Permit	Permit regulating discharge of storm waters from the construction work area. Reviewed in conjunction with Section 401 application.
		Permit for construction of pipeline in a floodway. Reviewed in conjunction with 401 permit application.

Table 1.4-1 Permits, Licenses, Approval, and Consultation Requirements

Agency	Permit or Consultation/Authority	Agency Action
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways.
County Road Departments	Encroachment Permits	Permits for encroachment on county roads.
SOUTH DAKOTA		
Public Utilities Commission	Energy Conversion and Transmission Facilities Act	Permit for a pipeline and associated facilities.
Department of Environment and Natural Resources, Surface Water Quality Program	Section 401, CWA, Water Quality Certification	Permit for stream and wetland crossings/ consultation for 404 process.
	National Pollutant Discharge Elimination System (NPDES) Temporary Discharge Permit (General Permit for Temporary Discharges and a Temporary Water Use Permit)	Permit regulating hydrostatic test (HT) water discharge, and construction dewatering to waters of the state.
	NPDES Storm Water Discharge Permit (SWD General Permit for Storm Water Discharges Associated with Industrial or Construction Activities)	Permit regulating discharge of storm waters from the construction work area. Submitted in conjunction with Section 401 application.
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways.
County Road Departments	Encroachment Permits	Permits for encroachment on county roads.
NEBRASKA		
Department of Environmental Quality (DEQ), Division of Water Resources	Section 401, CWA, Water Quality Certification.	Permit for stream and wetland crossings/ consultation for 404 process.
	NPDES Excavation Dewatering and Hydrostatic Testing Permit	Permit regulating hydrostatic test water discharge, and construction dewatering to waters of the state.
	NPDES Storm Water Discharge Permit	Permit regulating discharge of storm waters from the construction work area.
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways.
County Road Departments	Encroachment Permits	Permits for encroachment on county roads.
KANSAS		
Kansas Corporation Commission	Certificate of Convenience and Authority to Transport the Business of a Liquids Pipeline Carrier.	Certificate to construct pipeline and associated facilities across all land.
Department of Health and Environment, Division of Water Resources	Section 401, CWA, Water Quality Certification	Permit for stream and wetland crossings/ consultation for 404 process.
	NPDES Temporary Discharge Permit	Permit regulating hydrostatic test water discharge.
Kansas Department of Wildlife and Parks	Action Permit	Permit for potential effects on federal and state-listed species.

Table 1.4-1 Permits, Licenses, Approval, and Consultation Requirements

Agency	Permit or Consultation/Authority	Agency Action
Kansas Department of Agriculture	Temporary and Term Water Appropriations Permits	Permits for appropriation of water for hydrostatic testing and watering ROW for dust suppression.
	Stream Channel Modification Permits	General pipeline crossing permit and/or specific permits for stream channel crossings.
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways.
Kansas Turnpike Authority	Permission to construct	Permits to construct across jurisdictional roads.
County Road Departments	Encroachment Permits	Permits for encroachment on county roads.
MISSOURI		
Department of Natural Resources, Division of Water Resources	Section 401, CWA, Water Quality Certification	Permit for stream and wetland crossings/ consultation for 404 process.
	NPDES Storm Water Discharge Permit	Permit regulating discharge of storm waters from the construction work area.
	NPDES Temporary Discharge Permit	Permit regulating hydrostatic test water discharge, and construction dewatering to waters of the state.
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways.
County Planning Departments	Development permit/application	Permit to construct in floodplains. Reviewed in conjunction with 401 application.
County Road Departments	Encroachment Permits	Permits for encroachment on county roads.
ILLINOIS		
Illinois Commerce Commission	Certificate of Good Standing	Certificate to construct pipeline and associated facilities across all lands.
Illinois EPA, Division of Water Pollution Control	Joint Application for Section 401, CWA, Water Quality Certification	Permit for stream and wetland crossings/consultation for 404 process.
	NPDES Temporary Discharge Permit (General Forms 1 and 2E and Form ILG67)	Permit regulating hydrostatic test water discharge, and construction dewatering to waters of the state.
	NPDES Storm Water Discharge Permits (NOI, Form ILR10, and NOT)	Permit regulating discharge of storm waters from the construction work area.
Illinois Department of Natural Resources, Office of Water Resources	Joint Application for Section 401, CWA, Water Quality Certification (Statewide Permit 8 - Floodplain Development Permit)	Permit for construction of pipeline in a floodway. Submitted in conjunction with Section 401 application.
Illinois Department of Transportation	Encroachment permits	Permits for encroachment on state highways.

Table 1.4-1 **Permits, Licenses, Approval, and Consultation Requirements**

Agency	Permit or Consultation/Authority	Agency Action
County Road Departments	Encroachment Permits	Permits for encroachment on county roads.
OKLAHOMA		
Department of Environmental Quality (DEQ), Division of Water Resources	Section 401, CWA, Water Quality Certification	Permit for stream and wetland crossings/consultation for 404 process.
Oklahoma Corporation Commission	Notice of Surface Discharge of Hydrostatic Test Water	Permit regulating hydrostatic test water discharge.
Water Resources Board	Water Appropriations Permit, Temporary Water Lease Permit	Permit to withdraw ground or surface water from public or private sources for hydrostatic testing and watering ROW for dust suppression.
Department of Transportation	Encroachment Permits	Permits for encroachment on state highways.
Oklahoma Turnpike Authority	Construction Permit	Permits to construct across jurisdictional roads.
County Road Departments	Encroachment Permits	Permits for encroachment on county roads.

1.5 ROW Acquisition Process

Keystone will seek to acquire the necessary ROW for the Keystone Pipeline Project by negotiating easements with landowners along the pipeline route. Keystone will negotiate permanent easements that will grant the company the right to construct, operate, and maintain the pipeline in the permanent ROW. Keystone also will negotiate temporary easements for additional workspace needed to construct the pipeline. Landowners will receive monetary compensation in return for granting easements, including loss of use during construction, crop loss, loss of nonrenewable or other resources, and the restoration of any unavoidable damage to property during construction. If an easement cannot be negotiated with the landowner, Keystone may acquire easements needed for pipeline construction under state eminent domain laws. State statutes define the prerequisites to utilizing eminent domain and set forth the eminent domain process in each state. Keystone also will acquire a limited number of sites in fee for the siting of pump stations.

Keystone initiated land acquisition in Illinois in October 2006 and anticipates initiating land acquisition in eastern Missouri and for the pump stations in late 2006. All other land acquisition will be initiated in early 2007.

1.6 Public Participation and Issues

1.6.1 Public Participation and Open Houses

Keystone has been engaged in public consultation since the project was first announced in February 2005. Keystone's public participation activities to date are summarized with reference to the following major U.S. pipeline route iterations:

1. Initial Route (through North Dakota, South Dakota, Iowa, Missouri, and Illinois) – This was the general route announced with the project announcement in February 2005. A more detailed and slightly refined version was used through the November 2005 Open Houses.

2. Spring 2006 Mainline Route (through North Dakota, South Dakota, Nebraska, northeastern Kansas, Missouri, and Illinois) – This proposed route was described in detail in the April 2006 ER filing. It also is the route discussed at the spring 2006 Open Houses.

3. Cushing Extension Route – This proposed extension was described in the original ER filing in April 2006 and was discussed at the June 2006 Cushing Extension Open Houses.

4. Major Route Variations – Reroutes with significant changes from the routes described in #2 and #3 above are the subject of ongoing consultation.

Keystone is committed to ongoing and regular correspondence, communication, and consultation with all stakeholders. Keystone shares information about the project and provides opportunities for identification and resolution of questions, issues, and concerns through a number of channels, including press releases, the project web site (www.transcanada.com/keystone), e-mail (keystone@transcanada.com), toll free telephone numbers for general inquiries (1-866-717-7473) and for landowner issues (1-877-860-4881), one-on-one discussions between landowners and land agents, and direct mailings. Public participation and consultation activities will continue throughout the life of the project.

Keystone's public participation program included meetings with community leaders and open houses. Keystone met with over 700 community leaders during 2005 and 2006. These meetings were designed to:

- Introduce the project, listen to and capture initial thoughts and concerns, and describe ways for interested parties to get additional information from TransCanada and the Keystone project team;
- Discuss plans for more detailed public participation and consultation with local landowners and stakeholders ensuring community leaders were comfortable with Keystone's approach;
- Assist in planning effective open houses by asking community leaders to identify potentially interested constituencies and potential local issues and concerns; and
- Begin to establish a business relationship between Keystone and the local units of government and communities neighboring the pipeline.

Keystone conducted three sets of open houses to inform communities and other interested stakeholders about the proposed Keystone Pipeline Project and to initiate the public input and feedback process.

In November 2005, 16 open houses were held along the Initial Route in the following locations:

North Dakota
Grafton (Walsh County)
Finley (Steele County)
Lisbon (Ransom County)

Iowa
Akron (Plymouth County)
Anthon (Woodbury County)
Harlan (Shelby County)
Creston (Union County)

Illinois
Greenville (Bond County)

South Dakota
Clark (Clark County)
Howard (Miner County)
Parker (Turner County)

Missouri
Trenton (Grundy County)
Keytesville (Chariton County)
Mexico (Audrain County)
Troy (Lincoln County)
St. Charles (St. Charles County)

Twelve open houses were held along the spring 2006 Mainline Route in:

North Dakota
Michigan (Nelson County)
Lisbon (Ransom County)

South Dakota
Alexandria (Hanson County)
Yankton (Yankton County)

Nebraska

Stanton (Stanton County)

Seward (Seward County)
Odell (Gage County)

Kansas

Seneca Kansas (Nemaha County)

Missouri
Faucett (Buchanon County)
Carrollton (Carroll County)
Troy (Lincoln County)

Illinois
Collinsville (Madison County)

In June 2006, four open houses were held along the Cushing Extension Route in:

Kansas
Washington (Washington County)
Abilene (Dickinson County)
El Dorado (Butler County)

Oklahoma
Morrison (Noble County)

1.6.1.1 Consultation on Route Variations

In response to feedback received, agency input and as a result of survey work done to date and ongoing engineering, portions of the route shared publicly at the spring 2006 and June 2006 open houses have been changed. Consultation with new landowners who may be affected by these reroutes is accomplished largely through one-on-one interactions with field personnel. Additionally, these new stakeholders are provided with information to allow them to access project information and to provide feedback by other means. Feedback on reroutes is also being solicited from local officials in areas near the reroutes.

These consultation activities continue to take place.

1.6.2 Agency Coordination and Consultation

An initial meeting was held between the Department of State and Keystone in July 2005. A follow-up meeting was held on January 24, 2006. The purpose of these meetings was to introduce the project to the Department of State and discuss the NEPA process. In February 2006 subsequent meetings were held among Keystone and USACE, NPS, and USFWS both at the federal and regional levels to discuss the project, identify any potential issues with these agencies, and initiate the permitting processes. Similar meetings were held with state agencies during February and March 2006.

Keystone filed a Presidential Permit application and supporting Environmental Report with the Department of State on April 19, 2006. Subsequent filings with the Department of State include a Preliminary Risk Assessment and draft Emergency Response Plan (filed July 1, 2006); a line list, electronic shapefiles for the refined centerline and pump station location, and documentation of agency consultation for wetlands, cultural, and biological resources (September 15, 2006).

PROPOSED ACTION AND ALTERNATIVES

CHAPTER 2

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

Keystone proposes to construct and operate an interstate crude oil transmission system from an oil supply hub near Hardisty, Alberta, in Canada to destinations in the U.S. In the U.S., the Keystone Mainline will consist of 1,078 miles of new pipeline constructed from the U.S./Canadian border in Cavalier County, North Dakota, to existing terminals and refineries in Wood River (Madison County) and Patoka (Marion County), Illinois. The proposed pipeline will consist of 1,023 miles of 30-inch pipe between the Canadian border and Wood River, Illinois and a 55-mile segment of 24-inch pipeline between Wood River and Patoka, Illinois. The Cushing Extension will consist of approximately 292 miles of 36-inch pipeline commencing in Jefferson County near the Nebraska-Kansas border and terminating at existing crude oil terminals in Cushing (Payne County), Oklahoma. Table **2.1-1** summarizes the mileage by state.

Table 2.1-1 Miles of Pipe per State

	North Dakota	South Dakota	Nebraska	Kansas	Missouri	Illinois	Oklahoma	TOTAL
KEYSTONE MAINLINE								
(miles)	216.9	218.9	213.7	98.8	273.1	56.5	0.0	1,077.9
CUSHING EXTENSION								
(miles)	0.0	0.0	2.4	209.7	0.0	0.0	79.7	291.8
PROJECT TOTAL	**216.9**	**218.9**	**216.1**	**308.5**	**273.1**	**56.5**	**79.7**	**1,369.7**

In addition to the pipeline, Keystone will construct aboveground facilities including pump stations, delivery facilities, mainline valves, and densitometers. Powerlines required for pump stations, remotely activated valves, and densitometers will be constructed and operated by local utility providers, not by Keystone. An overview map of the project location is provided in **Figure 2.1-1**, while **Figures 2.1-2** to **2.1-9** are state-specific maps showing the pipeline route and aboveground facilities.

Keystone proposes to begin construction of the project in early 2008. Construction will occur over an approximately 18-month period. Keystone is proposing an in-service date for the Keystone Mainline of no later than November 2009. Work on the Cushing Extension will begin in late 2009 or early 2010, with a Cushing Extension in-service date of 2010.

The pipeline will be constructed primarily in rural areas, with more populated areas occurring around Troy and the St. Louis area (Missouri) and Wood River and Edwardsville (Illinois). The pipeline will be constructed of high-strength steel pipe (American Petroleum Institute [API] 5L). An external coating (fusion bonded epoxy [FBE]) will be applied to the pipeline and all buried facilities to protect against corrosion. Cathodic protection will be provided by impressed current. All pipe will be manufactured, constructed, and operated in accordance with applicable local, state, and federal regulations.

Aboveground facilities for the Keystone Mainline will include 23 pump stations (certain stations will contain pigging facilities), two delivery sites, and 45 mainline valves and three densitometer sites within the ROW (**Table 2.1-1**). Each pump station will have one additional block valve. These additional valves are not included within the mainline valve totals. The pump stations will enable Keystone to maintain the pressure required to make crude oil deliveries. Meters within the delivery facilities will measure crude oil deliveries to proposed customer locations Wood River, Illinois and Patoka, Illinois. The Wood River delivery facility site will be constructed outside of the receiving terminal, while the delivery facility in Patoka will be located within the terminal.

Aboveground facilities for the Cushing Extension will include three pump stations, two delivery facilities (with the delivery facilities containing pigging facilities), 12 mainline valves and two densitometer sites within the ROW. The Keystone delivery facility will be located adjacent to operational tanks in Ponca City and Cushing, Oklahoma.

If future market conditions warrant, one to three additional pumps will be added at the existing pump stations along the Keystone Mainline and Cushing Extension to achieve a throughput to 591,000 bpd. Such increased throughput will require one additional pump station (Pump Station Number 38, containing two pumps) to be constructed along the Keystone Mainline in Bond County, Illinois.

As previously mentioned, electric power infrastructure for the Keystone Pipeline Project will be constructed, permitted, and operated by local utility providers, not by Keystone.

2.1.1 Land Requirements

Table 2.1-2 summarizes the land requirements for the proposed Keystone Pipeline Project. Keystone will construct the Keystone Mainline using 30-inch pipe except in Illinois where 24-inch pipe will be used between Wood River and Patoka. The Cushing Extension will consist of 36-inch pipeline. With the exception of Illinois, Keystone will construct both the Mainline and the Cushing Extension within a 110-foot-wide corridor, consisting of both a temporary 60-foot-wide construction ROW and a 50-foot permanent ROW. In Illinois, where a portion of the Keystone Pipeline will be a 24-inch pipeline, the project will be constructed within a 95-foot-wide corridor, consisting of both a temporary 45-foot-wide construction ROW and a 50-foot permanent ROW. **Figures 2.1-10** through **2.1-13** illustrate the typical construction ROW and equipment work locations in areas where the proposed pipeline is not located near an existing pipeline. **Figures 2.1-14** through **2.1-17** illustrate the proposed construction ROW in areas where the pipeline will be located parallel to an existing pipeline. Keystone will reduce the construction ROW width to 85 feet in certain wetlands, shelterbelts, other forested areas, residential areas, and commercial/industrial areas.

Surface disturbance associated with the construction and operation of the Keystone Pipeline Project is summarized in **Table 2.1-2**. For the Keystone Mainline, approximately 16,648 acres of land will be disturbed during construction. This total includes temporary construction workspace and approximately 6,595 acres, which will be retained as permanent ROW. All disturbed acreage will be restored and returned to its previous aboveground use after construction, except for approximately 61 acres of permanent ROW, which will not be restored but will serve to provide adequate space for aboveground facilities, including pump stations, valving, etc. for the life of the pipeline.

For the Cushing Extension, approximately 4,573 acres of land will be disturbed during construction. This total includes temporary construction workspace and approximately 1,789 acres, which will be retained as permanent ROW. All disturbed acreage will be restored except for approximately 13 acres of permanent ROW, which will not be restored but will serve to provide adequate space for aboveground facilities, such as pump stations and valving, for the life of the pipeline.

Almost all of the land affected by the construction and operation of the Keystone Pipeline Project will be privately owned; less than one percent will be public lands. A detailed description of land ownership is presented in **Table 1.1-1**.

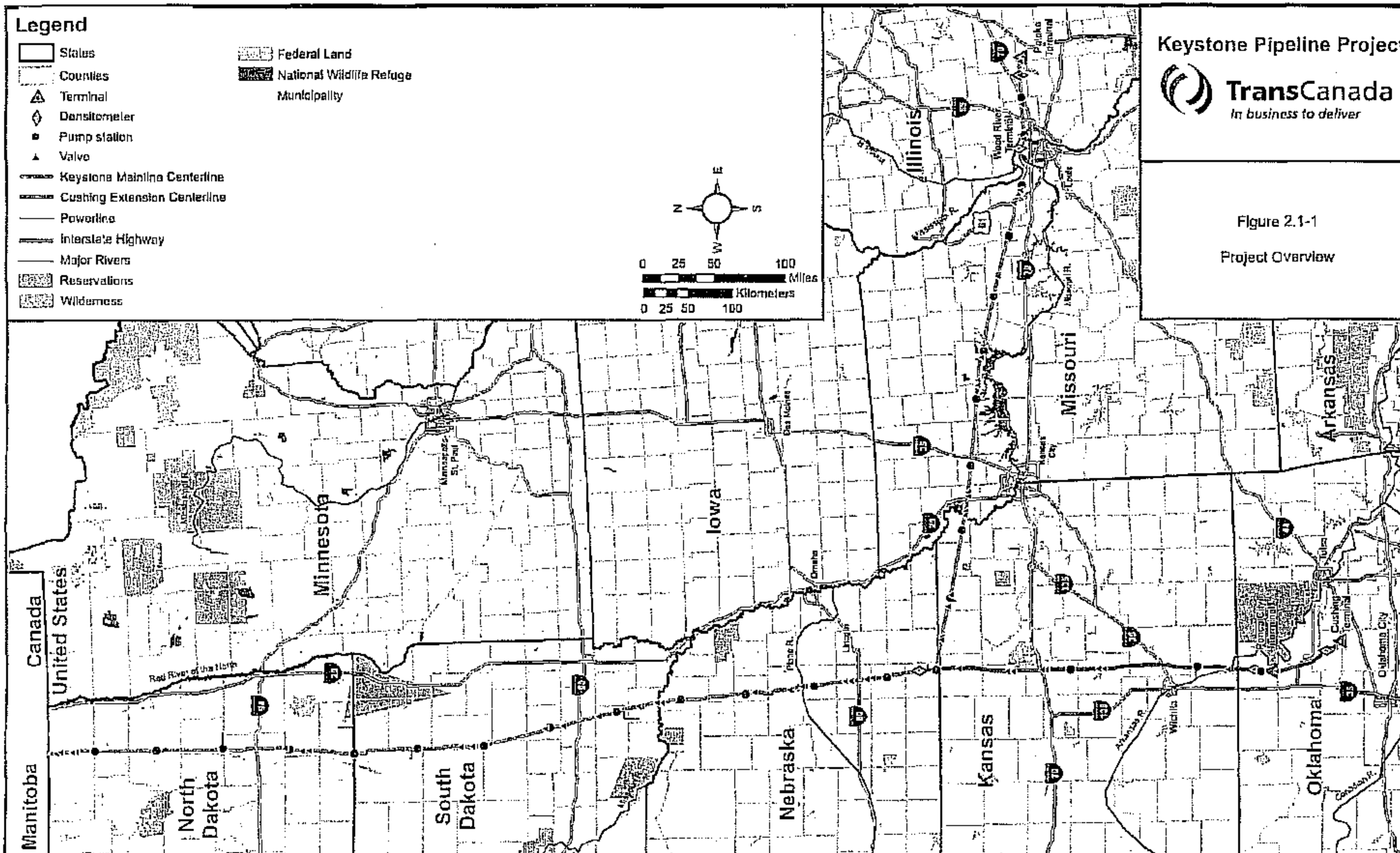
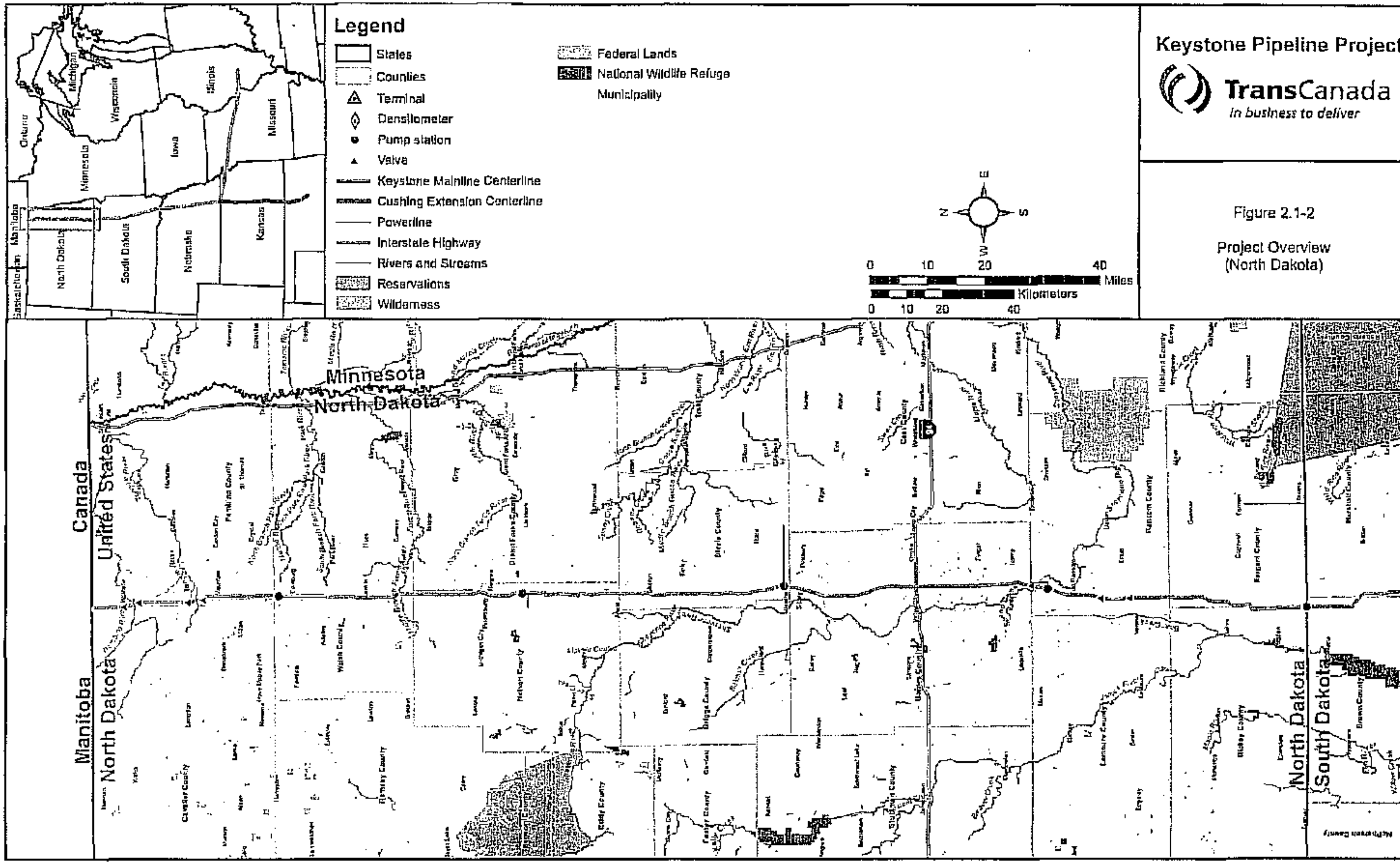


Figure 2.1-1

Project Overview


Legend
States
Counties
Terminal
Densitometer
Pump station
Valve
Keystone Mainline Centerline
Cushing Extension Centerline
Powerline
Interstate Highway
Rivers and Streams
Reservations
Wilderness
Federal Lands
National Wildlife Refuge
Municipality
0 10 20 40 Miles
0 10 20 40 Kilometers
Keystone Pipeline Project
TransCanada
In business to deliver
Figure 2.1-2
Project Overview
(North Dakota)
Canada
United States
Manitoba
North Dakota
Minnesota
South Dakota

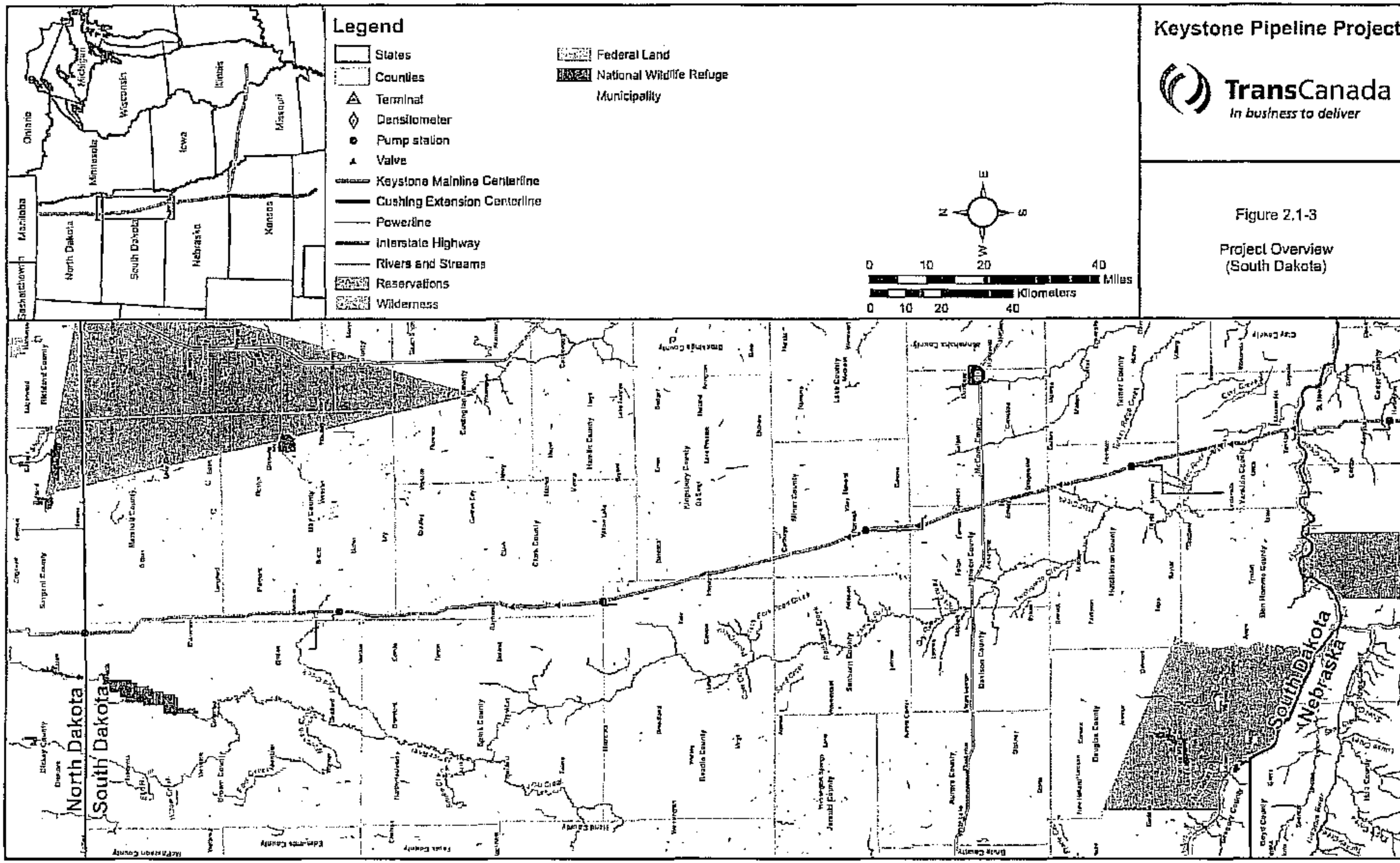
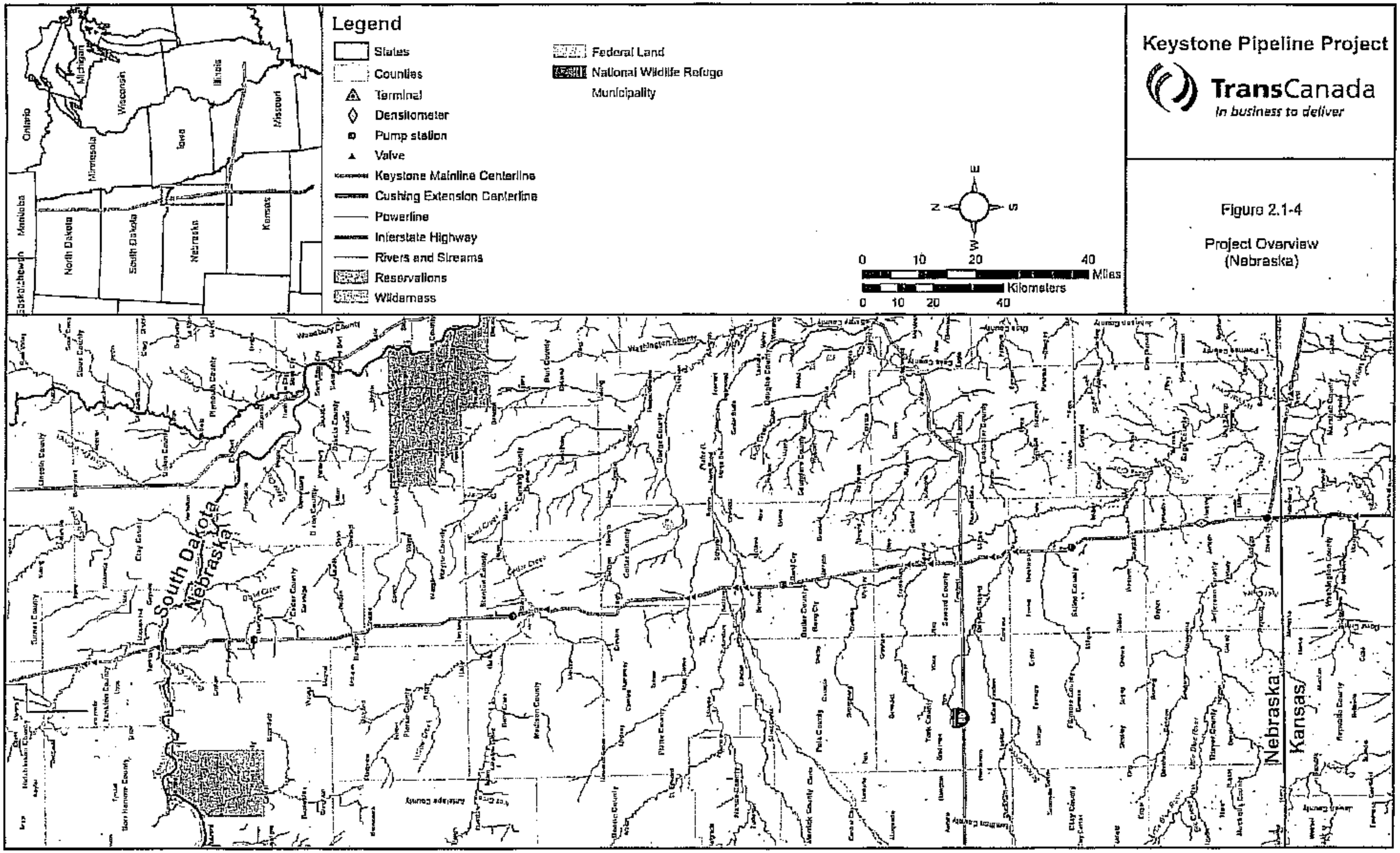
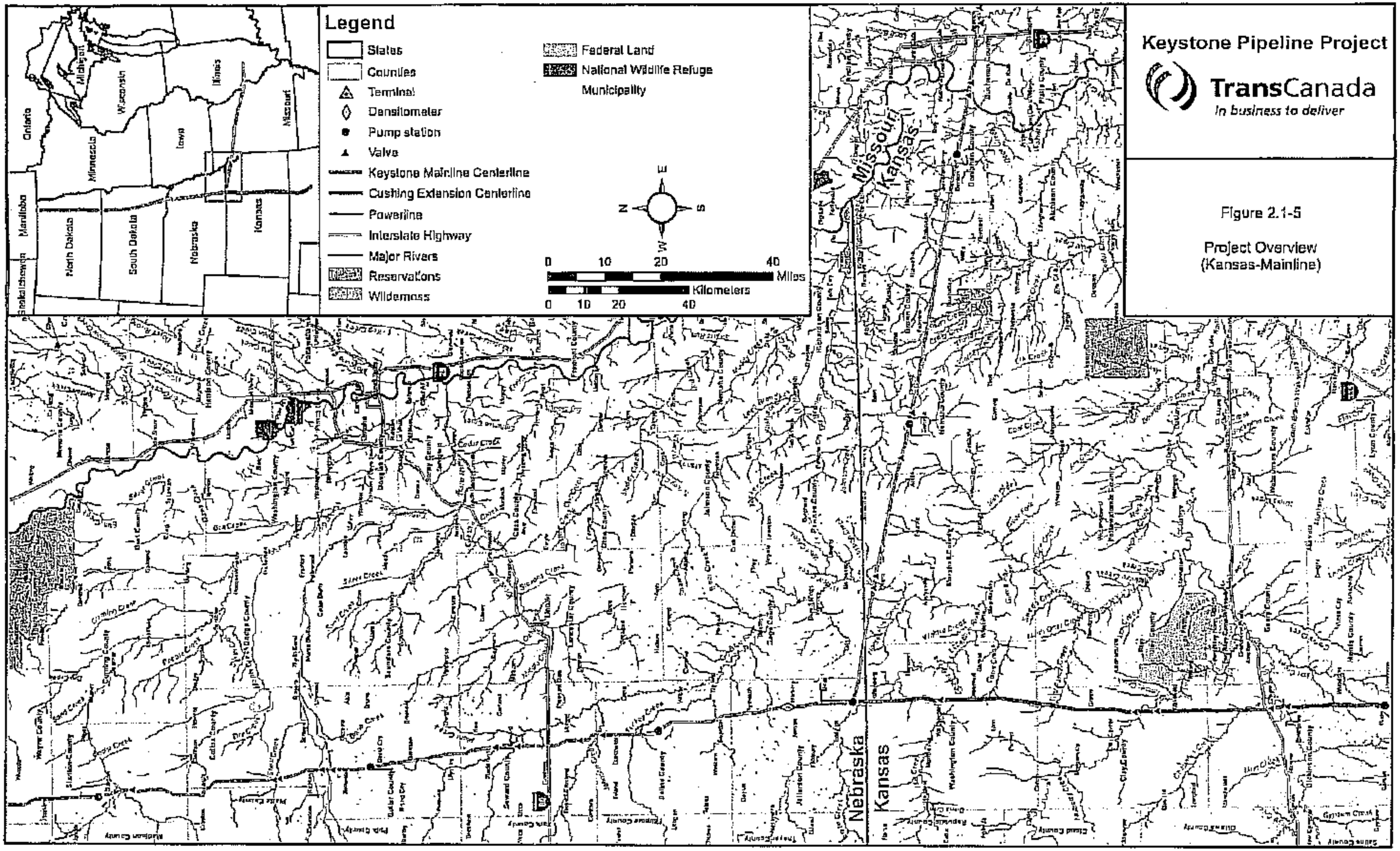
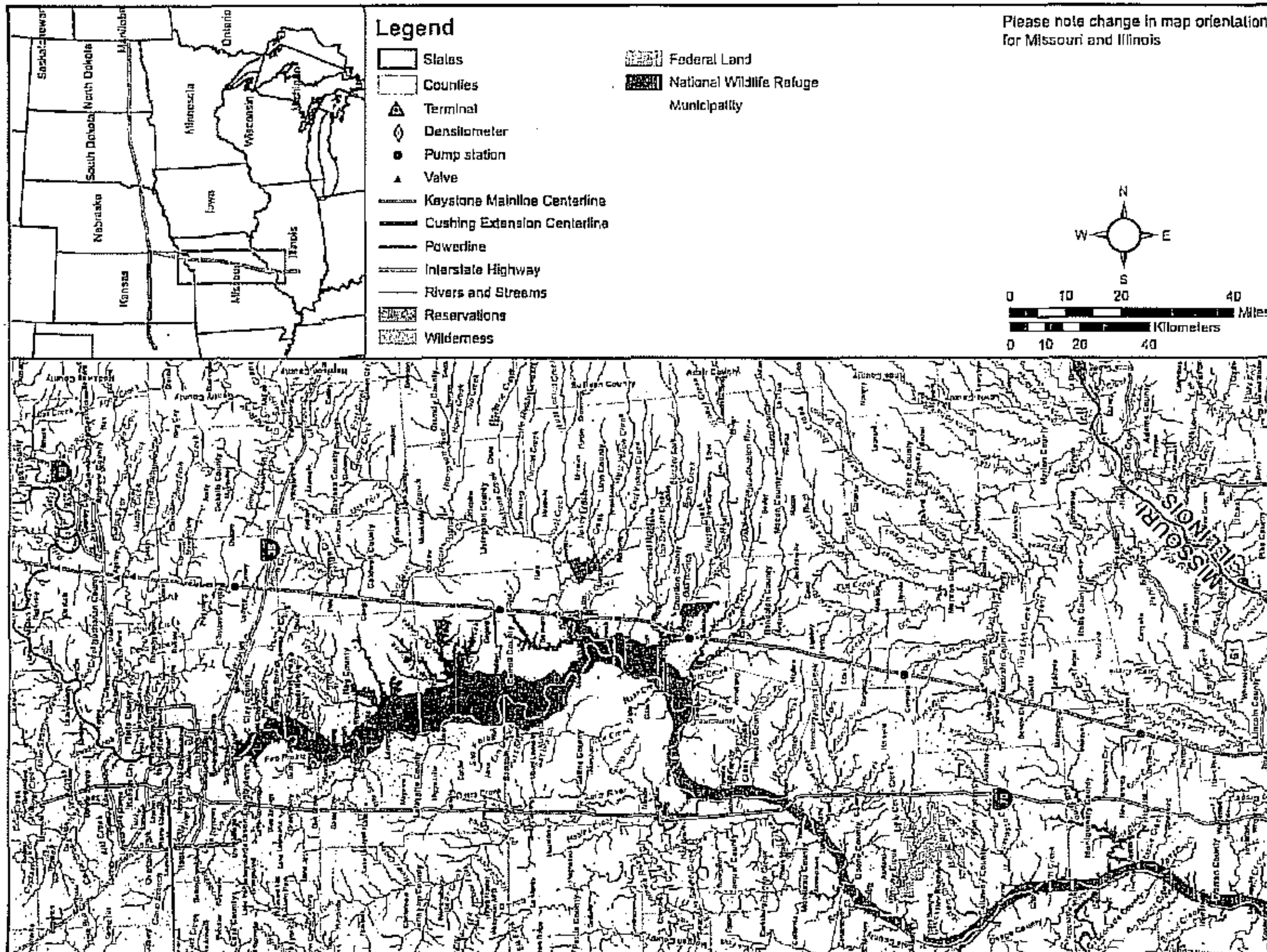


Figure 2.1-3

Project Overview
(South Dakota)


Legend
States
Counties
Terminal
Densitometer
Pump station
Valve
Keystone Mainline Centerline
Cushing Extension Centerline
Powerline
Interstate Highway
Rivers and Streams
Reservations
Wilderness
Federal Land
National Wildlife Refuge
Municipality
0 10 20 40 Miles
0 10 20 40 Kilometers
South Dakota
Nebraska
Kansas
Keystone Pipeline Project
TransCanada
In business to deliver
Figure 2.1-4
Project Overview
(Nebraska)


Keystone Pipeline Project
TransCanada
In business to deliver
Figure 2.1-5
Project Overview
(Kansas-Mainline)
Legend
States
Counties
Terminal
Densitometer
Pump station
Valve
Keystone Mainline Centerline
Cushing Extension Centerline
Powerline
Interstate Highway
Major Rivers
Reservations
Wilderness
Federal Land
National Wildlife Refuge
Municipality
N
E
S
W
0 10 20 40 Miles
0 10 20 40 Kilometers
Ontario
Manitoba
Saskatchewan
Michigan
Wisconsin
Minnesota
Iowa
Illinois
Missouri
North Dakota
South Dakota
Nebraska
Kansas
Missouri
Kansas
Nebraska
Kansas



Keystone Pipeline Project

TransCanada
In business to deliver

Figure 2.1-6

Project Overview
(Missouri)

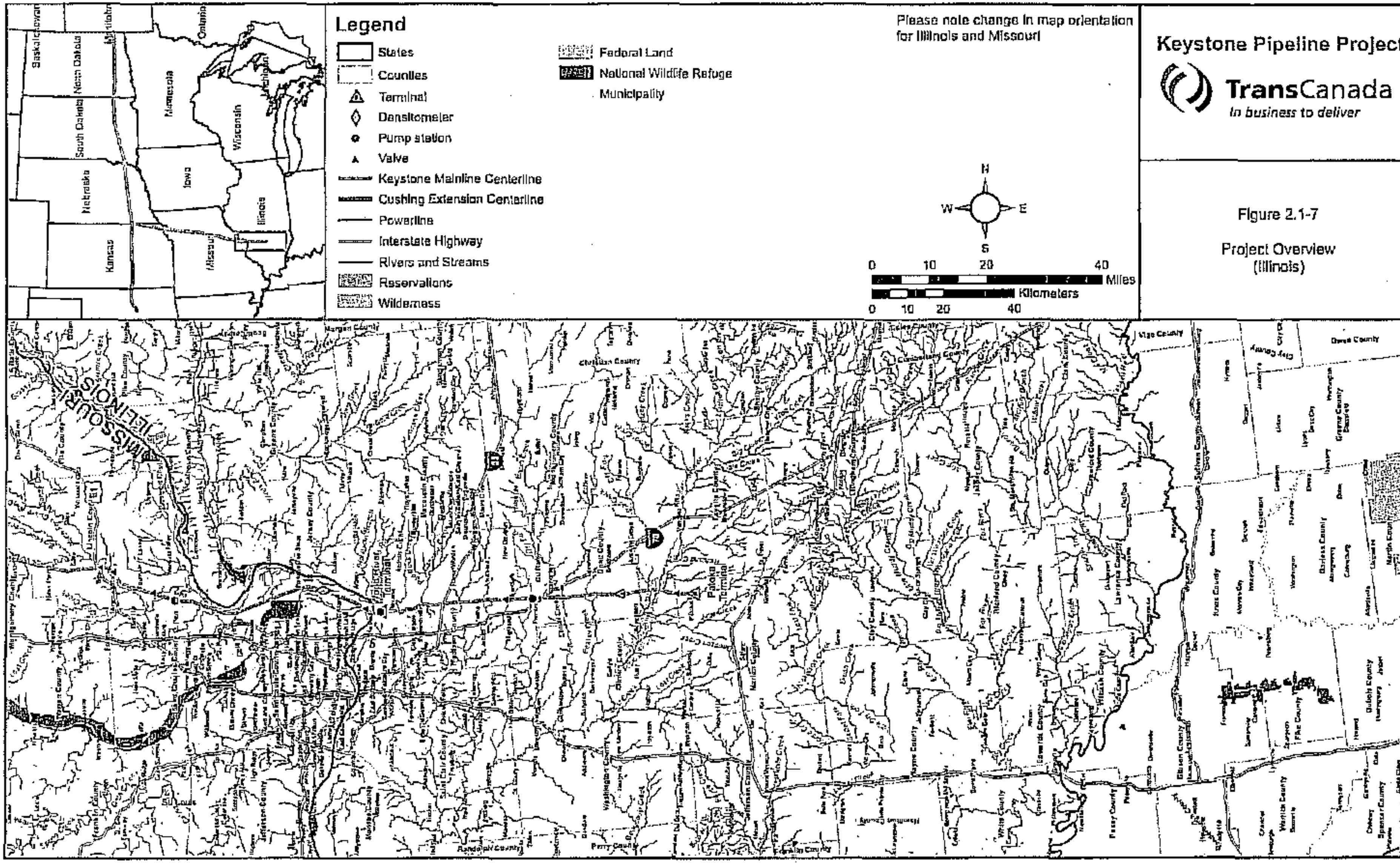


Figure 2.1-7

Project Overview (Illinois)

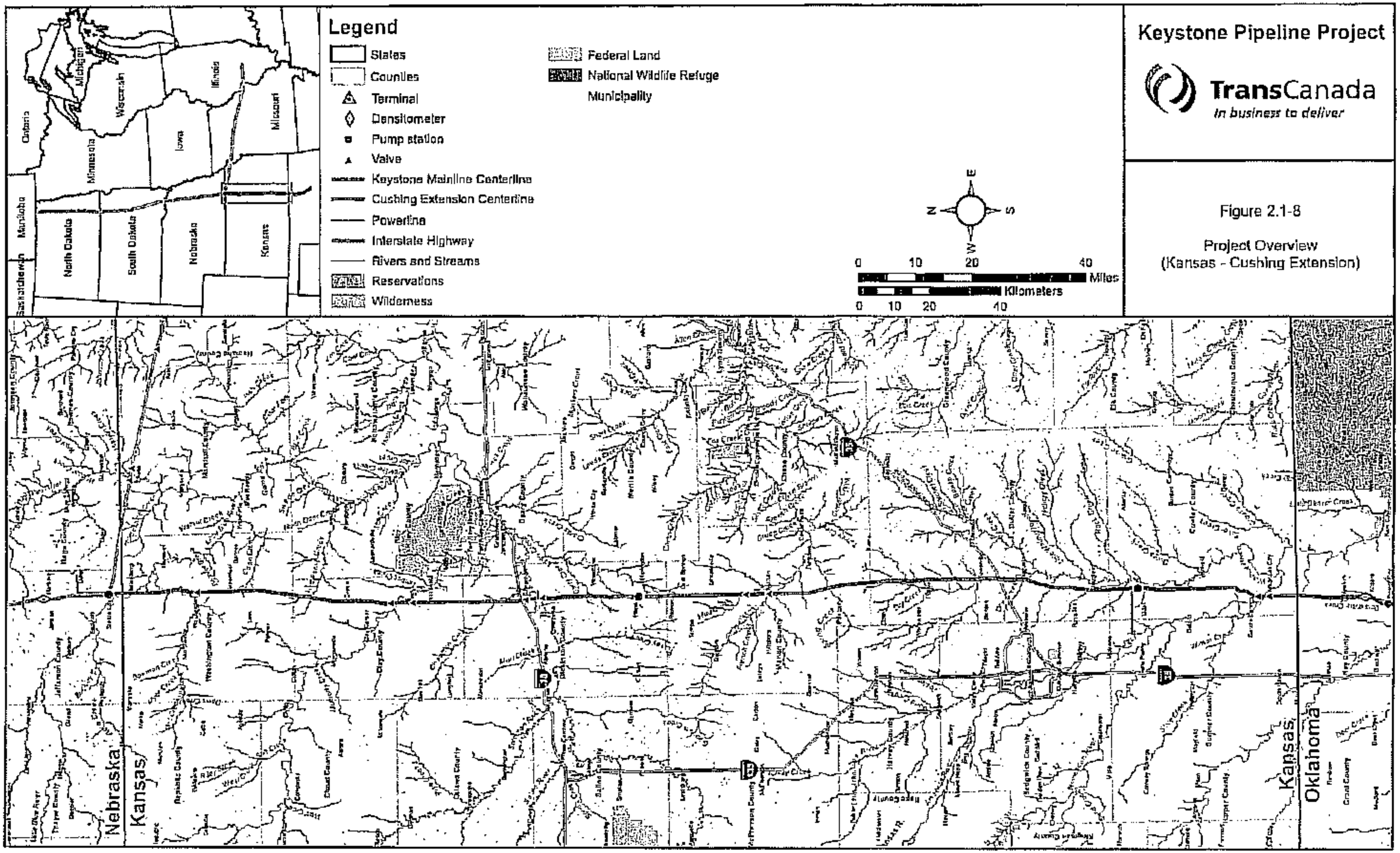


Figure 2.1-8

Project Overview
(Kansas - Cushing Extension)

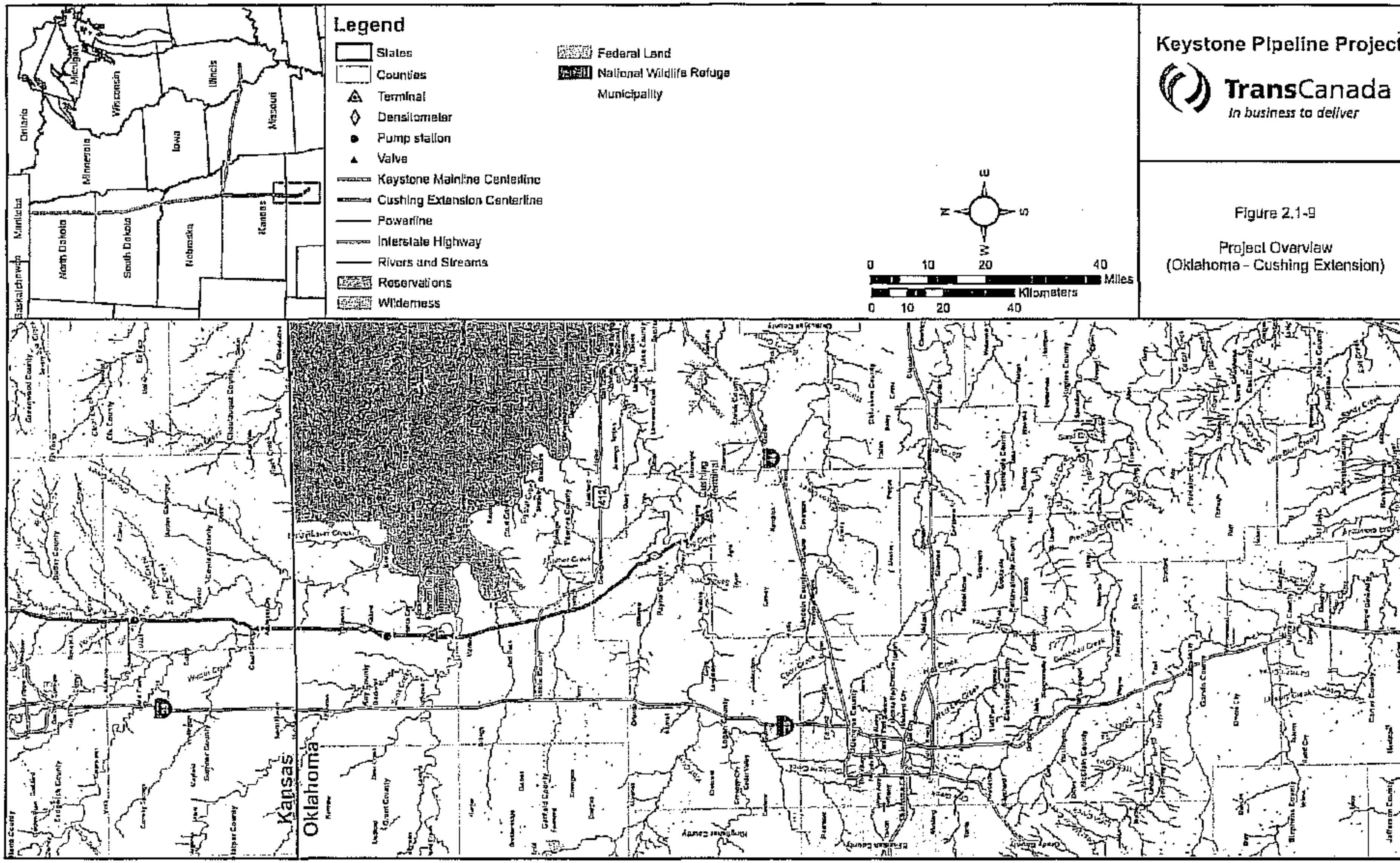
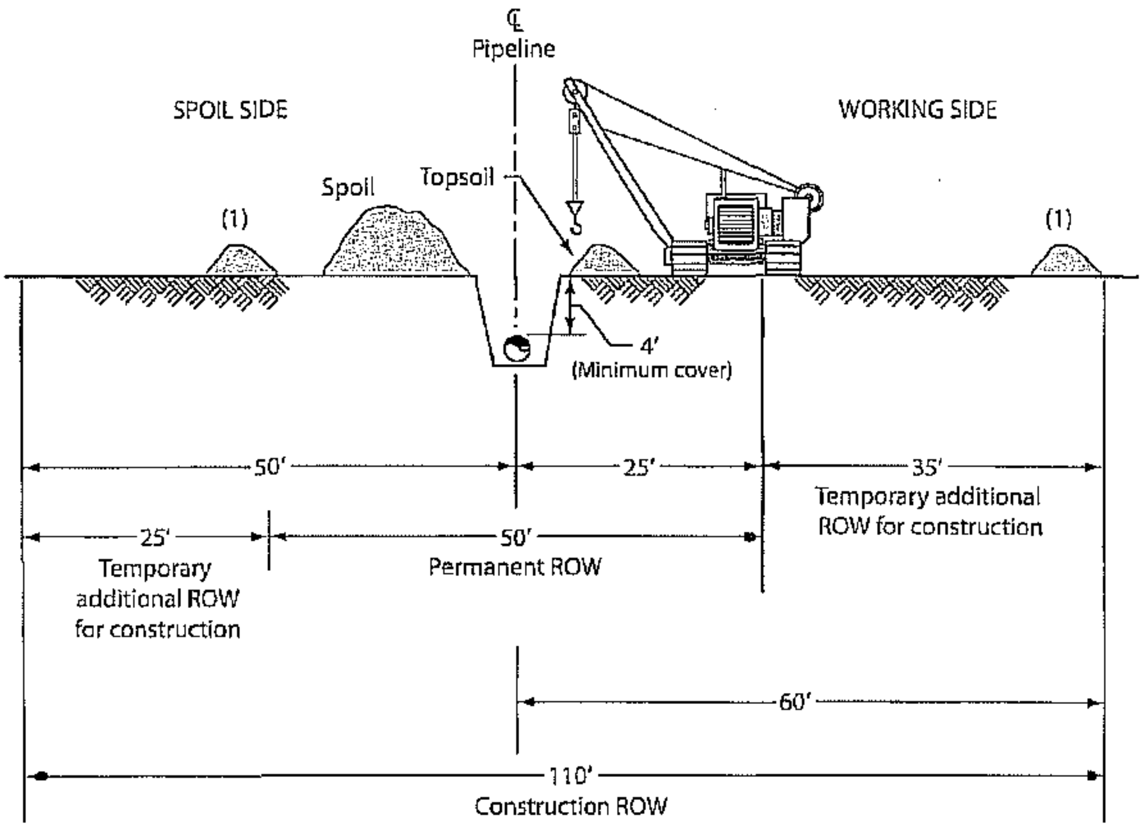


Figure 2.1-9

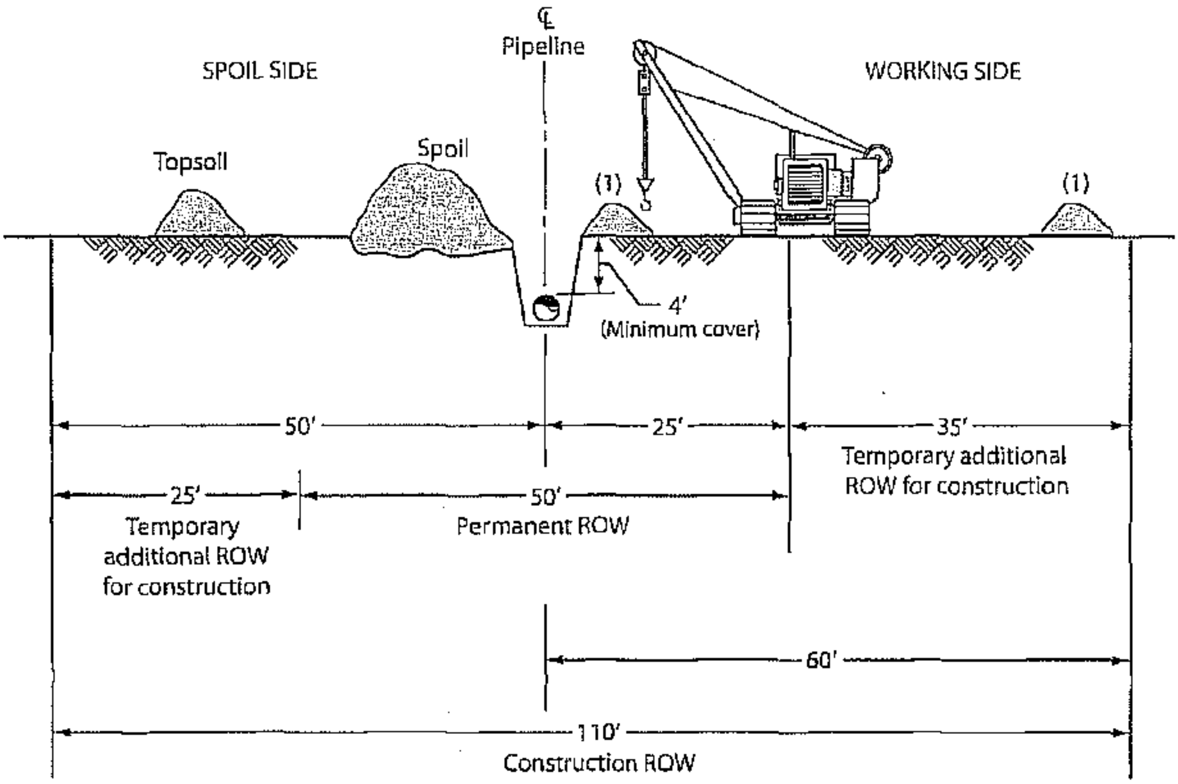
Project Overview
(Oklahoma - Cushing Extension)



(1) Alternate topsoil placement locations

KEYSTONE PIPELINE PROJECT

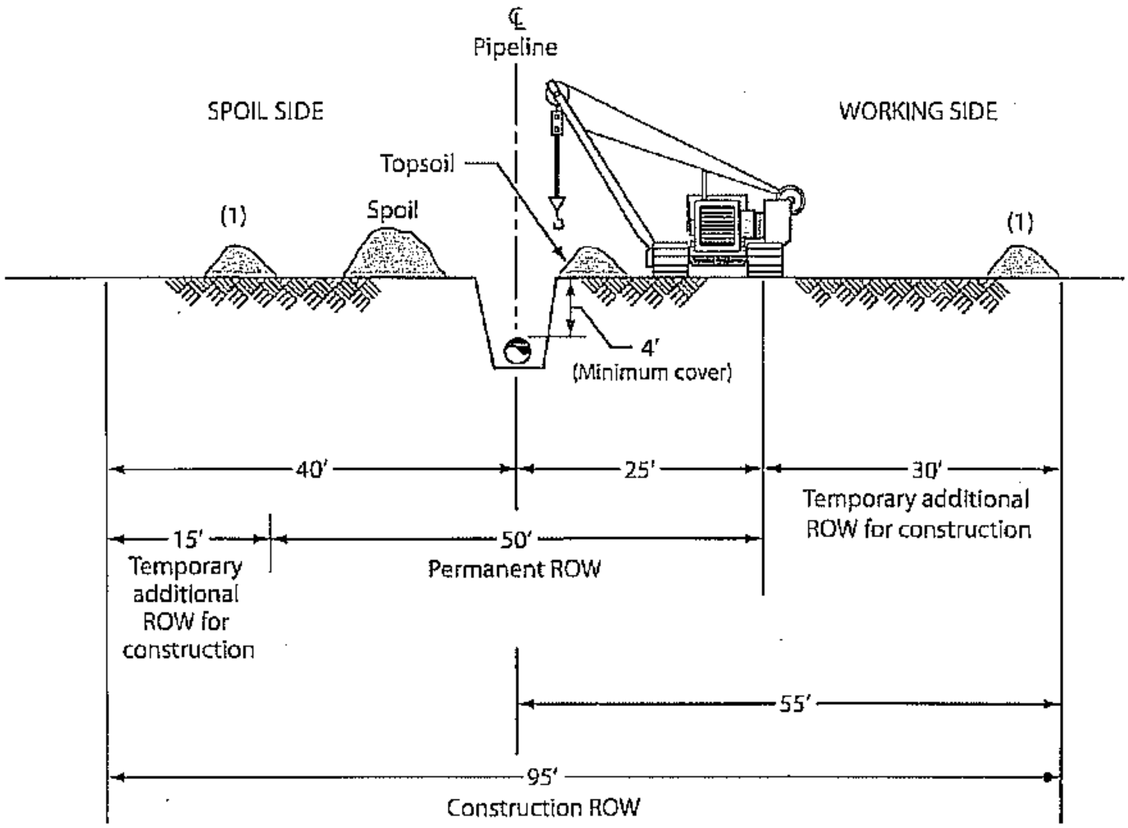
Figure 2.1-10
Typical 110′ Construction Right-of-Way
(30- or 36-inch Pipeline)
with Topsoil Removal Only over Trench Line



(1) Alternate topsoil placment locations

KEYSTONE PIPELINE PROJECT

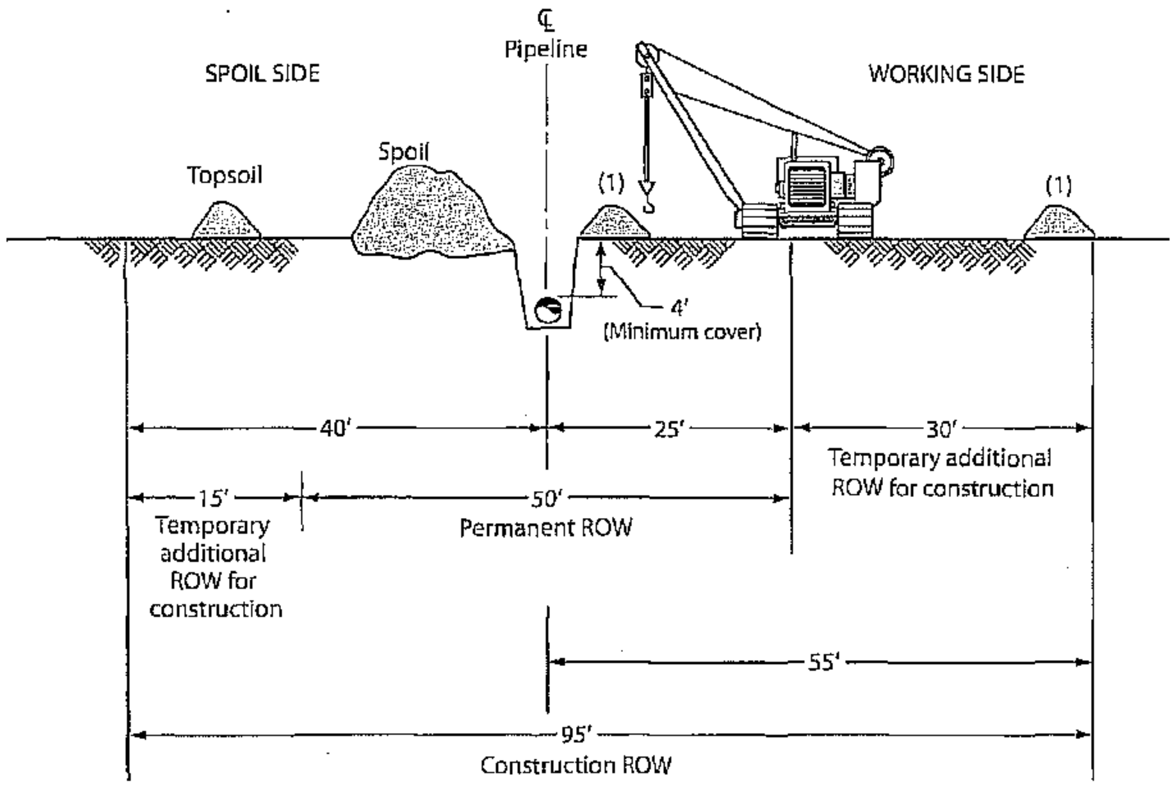
Figure 2.1-11
Typical 110' Construction Right-of-Way (30- or 36-inch Pipeline) with Topsoil Removal over Trench Line and Spoil Side



(1) Alternate topsoil placement locations

KEYSTONE PIPELINE PROJECT

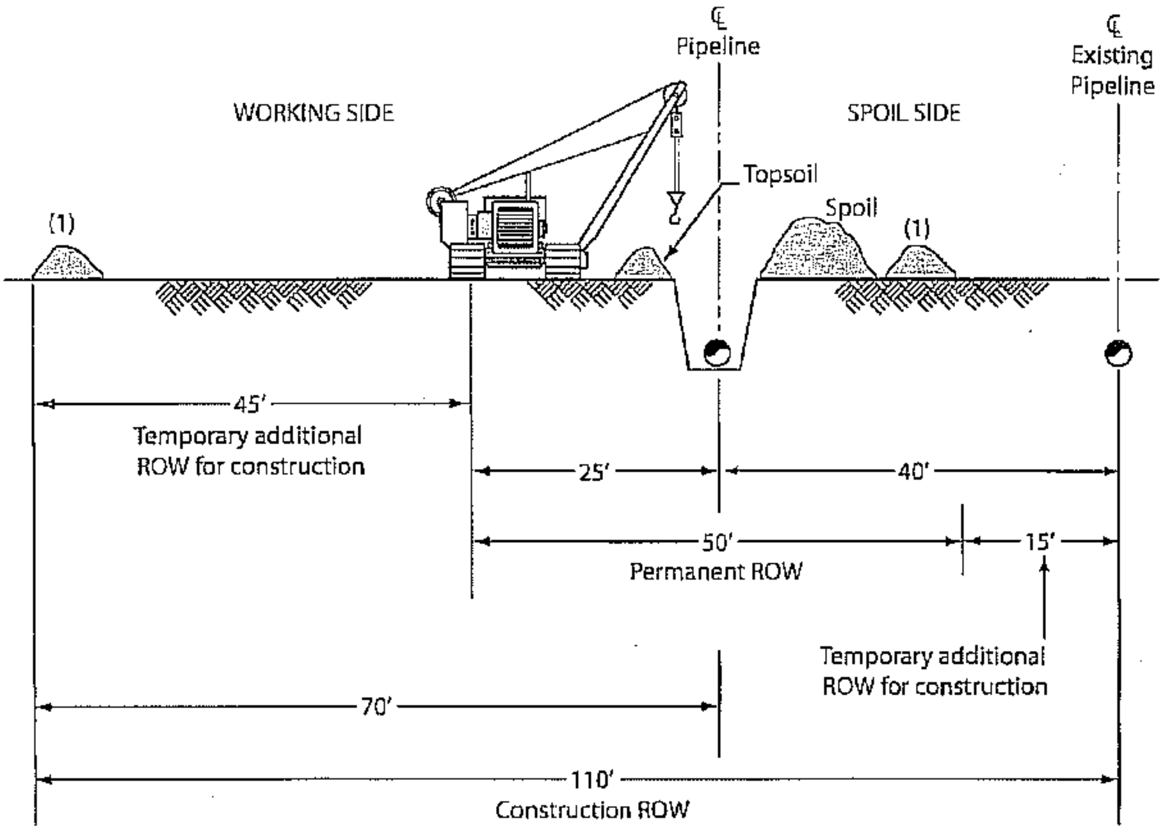
Figure 2.1-12
Typical 95′ Construction Right-of-Way (24-inch Pipeline) with Topsoil Removal Only over Trench Line



(1) Alternate topsoil placement locations

KEYSTONE PIPELINE PROJECT

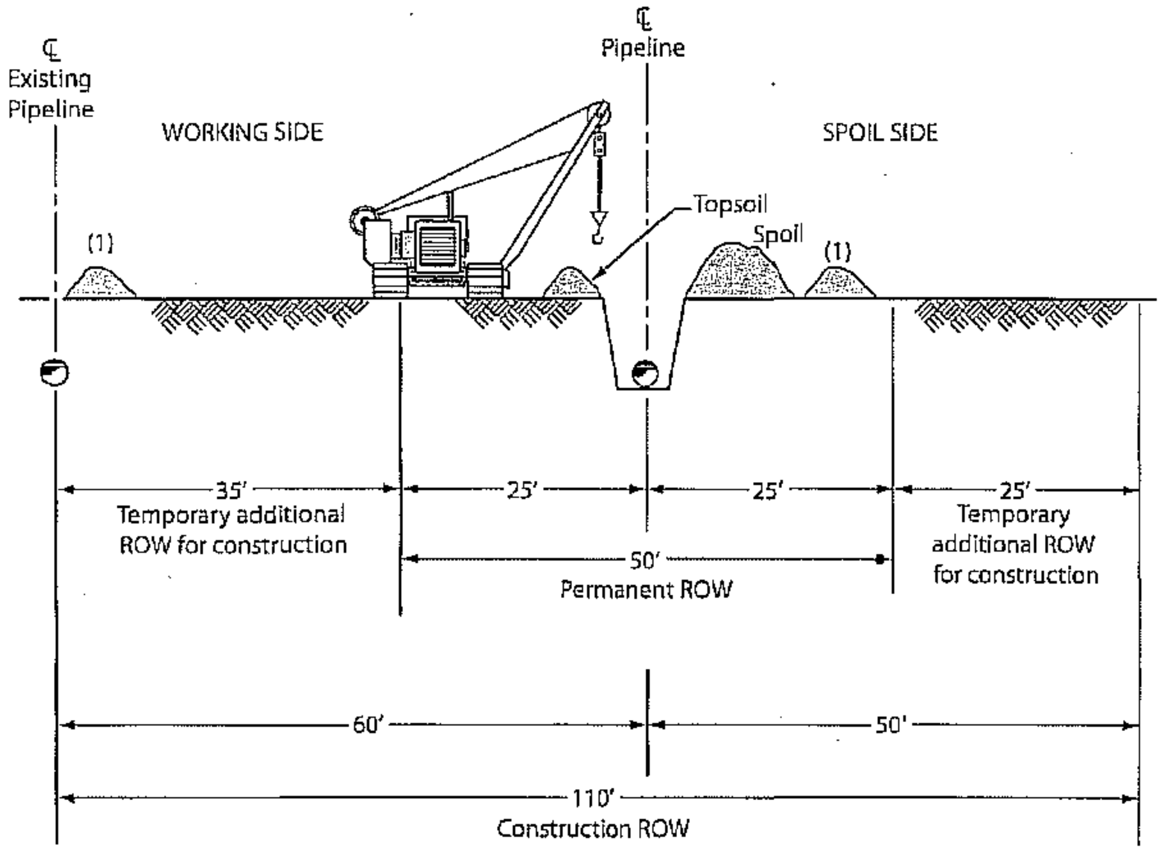
Figure 2.1-13
Typical 95' Construction Right-of-Way (24-inch Pipeline) with Topsoil Removal over Trench Line and Spoil Side



(1) Alternate topsoil placement locations

KEYSTONE PIPELINE PROJECT

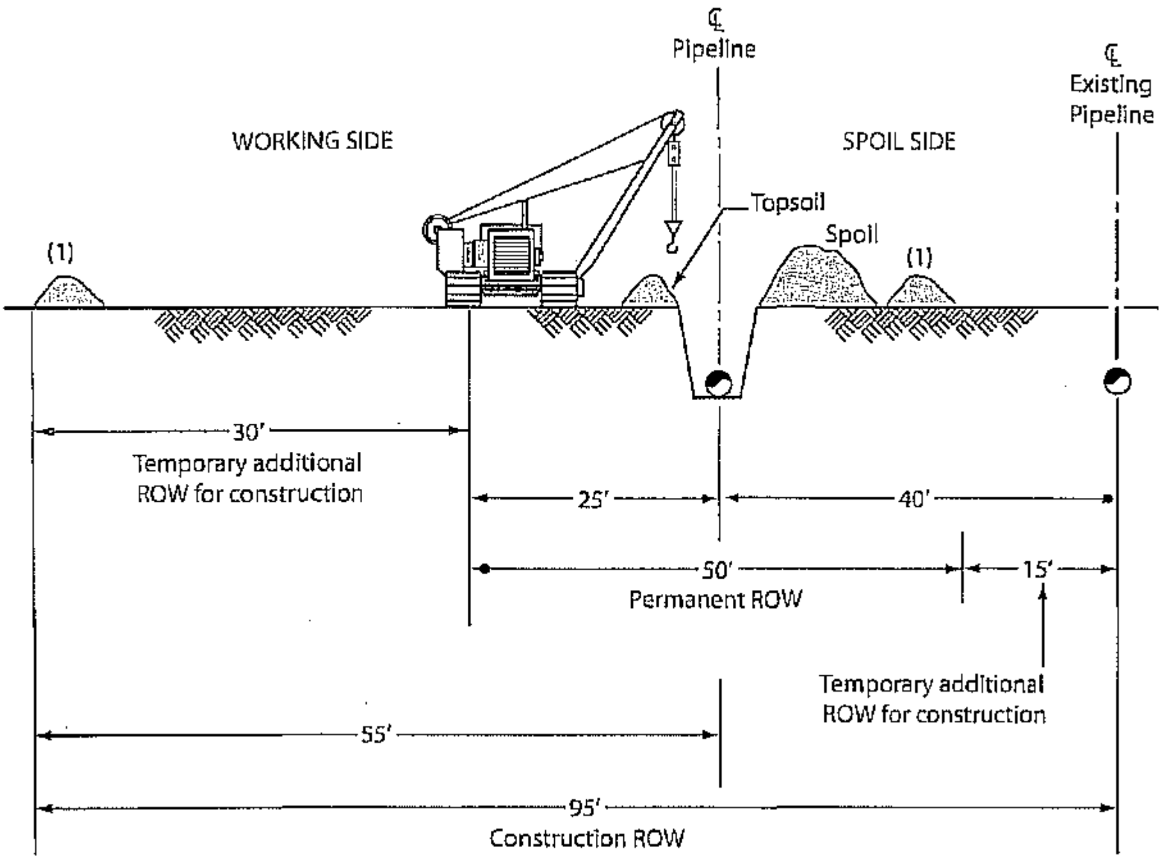
Figure 2.1-14
Typical 110' Construction Right-of-Way (30- or 36-inch Pipeline) - Spoil Side Adjacent and Parallel to Existing Pipeline



(1) Alternate topsoil placement locations

KEYSTONE PIPELINE PROJECT

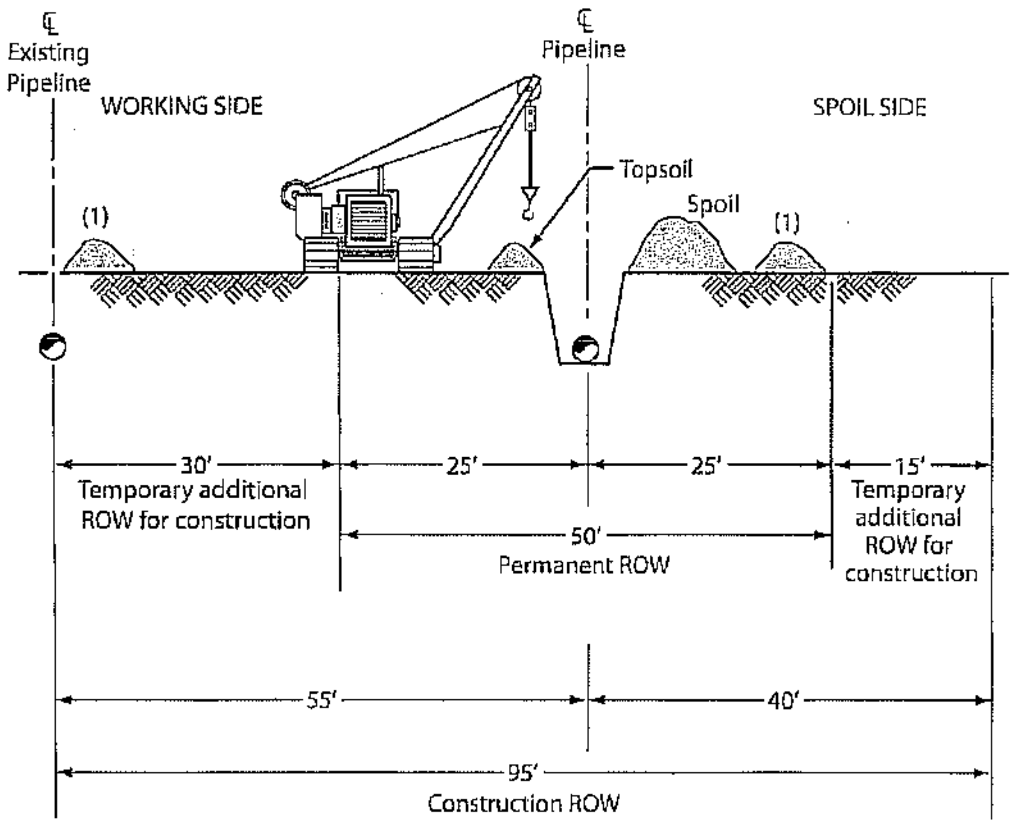
Figure 2.1-15
Typical 110′ Construction Right-of-Way (30- or 36-inch Pipeline) - Working Side Adjacent and Parallel to Existing Pipeline



(1) Alternate topsoil placement locations

KEYSTONE PIPELINE PROJECT

Figure 2.1-16
Typical 95' Construction Right-of-Way (24-Inch Pipeline) - Spoil Side Adjacent and Parallel to Existing Pipeline



(1) Alternate topsoil placement locations

KEYSTONE PIPELINE PROJECT

Figure 2.1-17
Typical 95' Construction Right-of-Way (24-inch Pipeline) - Working Side Adjacent and Parallel to Existing Pipeline

Table 2.1-2 Summary of Land Requirements Associated with the Keystone Pipeline Project

Facility	Land Affected During Construction [1] (acres)	Land Affected During Operation [2] (acres)
KEYSTONE MAINLINE		
NORTH DAKOTA		
Pipeline ROW	2,891	1,314
Lateral ROWs	0	0
Additional Temporary Workspace Areas	141	0
Pipe and Contractor Yards	310	0
Pump Stations/Delivery Facilities[3]	11	11
North Dakota Subtotal[4]	*3,353*	*1,325*
SOUTH DAKOTA		
Pipeline ROW	2,919	1,327
Lateral ROWs	0	0
Additional Temporary Workspace Areas	171	0
Pipe and Contractor Yards	400	0
Pump Stations/Delivery Facilities[3]	9	9
South Dakota Subtotal[4]	*3,499*	*1,336*
NEBRASKA		
Pipeline ROW	2,850	1,295
Lateral ROWs	0	0
Additional Temporary Workspace Areas	166	0
Pipe and Contractor Yards	235	0
Pump Stations/Delivery Facilities[3]	11	11
Nebraska Subtotal[4]	*3,262*	*1,306*
KANSAS		
Pipeline ROW	1,317	599
Lateral ROWs	0	0

Table 2.1-2 Summary of Land Requirements Associated with the Keystone Pipeline Project

Facility	Land Affected During Construction [1] (acres)	Land Affected During Operation[2] (acres)
Additional Temporary Workspace Areas	81	0
Pipe and Contractor Yards	95	0
Pump Stations/Delivery Facilities[3]	4	4
Kansas Subtotal[4]	*1,497*	*603*
MISSOURI		
Pipeline ROW	3,641	1,655
Lateral ROWs	0	0
Additional Temporary Workspace Areas	282	0
Pipe and Contractor Yards	275	0
Pump Stations/Delivery Facilities[3]	13	13
Missouri Subtotal[4]	*4,211*	*1,668*
ILLINOIS		
Pipeline ROW	653	343
Lateral ROWs	11	6
Additional Temporary Workspace Areas	64	0
Pipe and Contractor Yards	90	0
Pump Stations/Delivery Facilities[3]	8	8
Illinois Subtotal[4]	*826*	*357*
Keystone Mainline Subtotal[5]	16,648	6,595
	CUSHING EXTENSION	
NEBRASKA		
Pipeline ROW	31	14
Lateral ROWs	0	0
Additional Temporary Workspace Areas	4	0
Pipe and Contractor Yards	15	0

Table 2.1-2 Summary of Land Requirements Associated with the Keystone Pipeline Project

Facility	Land Affected During Construction [1] (acres)	Land Affected During Operation [2] (acres)
Pump Stations/Delivery Facilities[3]	0	0
Nebraska Subtotal[4]	50	14
KANSAS		
Pipeline ROW	2,796	1,271
Lateral ROWs	0	0
Additional Temporary Workspace Areas	168	0
Pipe and Contractor Yards	295	0
Pump Stations/Delivery Facilities[3]	4	4
Kansas Subtotal[4]	*3,263*	*1,275*
OKLAHOMA		
Pipeline ROW	1,063	483
Lateral ROWs	22	12
Additional Temporary Workspace Areas	65	0
Pipe and Contractor Yards	105	0
Pump Stations/Delivery Facilities[3]	5	5
Oklahoma Subtotal[4]	*1,260*	*500*
Cushing Extension Subtotal[4]	4,573	1,789
PROJECT TOTAL[4]	**21,221**	**8,384**

[1] Disturbance is based on a total of 110-foot-wide construction ROW for 30- and 36-inch pipe and a 95-foot-wide construction ROW for 24-inch pipe, except in certain wetlands, shelterbelts, and other forested areas, residential areas, and commercial/industrial areas where a 85-foot-wide construction ROW will be used, or in areas requiring extra width for workspace necessitated by site conditions. Disturbance also includes pipe storage and contractor yards.

[2] Operation acreage was estimated based on a 50-foot-wide permanently maintained ROW in all areas. All pigging facilities will be located within either pump stations or delivery facility sites. Mainline valves and densitometers will be constructed within the construction ROW and operated within a 50-foot x 50-foot area or 50-foot x 66-foot area, respectively, centered on the permanently maintained 50-foot-wide ROW. Other mainline valves will be located within the area associated with a pump station. Consequently, the acres of disturbance for these aboveground facilities are captured within the Pipeline ROW and Pump Station/Delivery Facilities categories within the table.

[3] The Wood River delivery facility will be constructed outside of the existing pipeline operational tank facilities. The delivery facility in Patoka will be located within the terminal. Delivery facilities along the Cushing Extension at Ponca City and Cushing will be located within existing tank storage terminals. Additional temporary workspace areas include temporary disturbance for the construction of pump stations and/or delivery facilities.

[4] Discrepancies in total acreages are due to rounding.

2.1.2 Pipeline ROW

Along the Keystone Mainline, approximately 467.5 miles (43.4 percent) of the 1,078 miles of the pipeline route will be located within about 300 feet of existing pipeline, utility, or road ROWs. Approximately 610.4 miles (56.6 percent) will be new ROW.

For the Cushing Extension, approximately 15.6 miles (5.3 percent) of the 292 miles of pipeline route will be within approximately 300 feet of existing pipeline, utility, or road ROWs. Approximately 276.2 miles (94.7 percent) of the route ROW will be new ROW.

In locations where the proposed pipeline route will parallel existing utilities, Keystone's new permanent ROW will be adjacent to the existing permanent ROW. Keystone's pipeline generally will be installed at a 40-foot offset from the nearest existing pipeline centerline (**Figures 2.1-14** and **2.1-16**) except in areas where the working side of the pipeline construction ROW is adjacent to the existing pipeline. In these areas, Keystone's pipeline will be installed at a 60-foot offset from the nearest existing pipeline centerline (**Figures 2.1-15** and **2.1-17**).

2.1.3 Laterals

A lateral will be constructed from the Keystone Mainline to deliver crude oil to the tank storage terminal in Wood River. The Wood River lateral will be approximately 5,213 feet in length. Additional laterals will be required to make deliveries to Ponca City (6,618 feet) and Cushing (3,544 feet) terminals.

Construction and operation of the laterals will be similar to the Keystone Mainline. The laterals will be constructed within a 110-foot-wide corridor, consisting of both a temporary 60-foot-wide temporary construction ROW and a 50-foot-wide permanent ROW. After construction the temporary and permanent ROW will be restored and returned to their previous use.

2.1.4 Additional Temporary Workspace Areas

In addition to the construction ROW, Keystone has identified the types of additional temporary workspace areas that will be required (**Table 2.1-3**) and where these sites will be located. These workspace requirements are indicated graphically on the route sheets provided in Appendix A and B. These preliminary spaces have been used to quantify impacts of the project. Temporary workspaces will be needed for areas requiring special construction techniques (e.g., river, wetland, and road crossings; horizontal directional drill entry and exit points; steep slopes; rocky soils) and construction staging areas.

The location of additional temporary workspaces will be modified as the project continues to be refined. This will involve the adjustment of workspaces as necessary with respect to actual wetland and waterbody locations. Keystone will adjust additional temporary workspace at the prescribed set back distance from waterbody and wetland features unless impractical as determined on a site-specific basis. As a result, wetland impact acreage presented is likely overstated.

2.1.5 Pipe Storage and Contractor Yards

Off-ROW extra workspace areas will be required during the construction phase of the project to serve as pipe storage yards and contractor yards. Keystone estimates that 42 pipe storage yards and 17 contractor yards will be required during construction of the Keystone Mainline and 13 pipe storage and six contractor yards will be required during construction of the Cushing Extension (**Table 2.1-4**). Contractor yards will reduce worker transportation requirements during construction and will occupy approximately 15 to 20 acres. Pipe staging yards will be used to stockpile pipe at approximately 30-mile intervals along the pipeline route and typically are located in proximity to railroad sidings facilities. Pipe yards will occupy approximately 25 acres. To the extent practical, Keystone proposes to use existing commercial/industrial sites or sites that previously have been used for construction. Existing public or private roads will be used to access each yard. Both pipe storage yards and contractor yards will be used on a temporary basis and will be restored upon completion of construction.

Table 2.1-3 Dimensions and Acreage of Typical Additional Temporary Workspace Areas

Feature	Dimensions (length by width in feet at each side of crossing)	Acreage
Directionally drilled waterbodies	350 x 140 plus the length of the drill x 25	1.1+
Waterbodies >50 feet wide	300 x 100	0.7
Waterbodies <50 feet wide	250 x 50	0.3
Bored highways and railroads	50 x length of crossing plus 50 feet	Varies
Open-cut or bored county or private roads	125 x 50	0.1
Foreign pipeline/utility/other buried feature crossings	125 x 50	0.1
Push-pull wetland crossings	50 feet x length of wetland	Varies
Construction spread mobilization and demobilization	300 x 150	1.0
Stringing truck turnaround areas	200 x 80	0.4

Table 2.1-4 Locations and Acreage of Potential Pipe Storage Yards and Contractor Yards

State / Type of Yard	Counties	Combined Acreage[1]
KEYSTONE MAINLINE		
North Dakota		
Contractor Yards	Emerado, Valley City, Lisbon	60
Pipe Storage Yards	Walhalla, Union, Michigan, Oakes, Fordville, Amherst, Sharon, Sibley, Kathryn, Crete	250
South Dakota		
Contractor Yards	Aberdeen, Mitchell, Yankton, Bath, Huron	100
Pipe Storage Yards	Hecla, Ferney, Doland, Iroquois, Fedora, Bridgewater, Utica, Claremont, Groton, Yale, Emery, Yankton	300
Nebraska		
Contractor Yards	Norfolk, Columbus, Seward	. 60
Pipe Storage Yards	Harington, Hoskins, Leigh, David City, Milford, Lanham	175
Kansas		
Contractor Yards	Hiawatha	20
Pipe Storage Yards	Baileyville, Fairview, Bendena	75

Table 2.1-4 Locations and Acreage of Potential Pipe Storage Yards and Contractor Yards

State / Type of Yard	Counties	Combined Acreage[1]
Missouri		
Contractor Yards	Carrolton, Columbus, Mexico, O'Fallon	75
Pipe Storage Yards	Turney, Braymer, Indian Grove, Salisbury, Clark, Wellsville, Hawk Point, St. Peters	200
Illinois		
Contractor Yards	Edwardsville	15
Pipe Storage Yards	Edwardsville, Tamalco, Patoka	75
	CUSHING EXTENSION	
Nebraska		
Contractor Yards	Fairburg	15
Pipe Storage Yards	None	0
Kansas		
Contractor Yards	Waterville, Lionville, Winfield	45
Pipe Storage Yards	Greenleaf, Claycenter, Chapman, Tampa, Peabody, Whitewater, Agusta, Udall, Winfield, Arkansas City	250
Oklahoma		
Contractor Yards	Blackwell, Cushing	30
Pipe Storage Yards	Ponca City, Perry, Cushing	75

[1]Acreages of contractor yards are based on 15 to 20 acres per site, while acreages of pipe storage yards are based on 25 acres per site.

2.1.6 Access Roads

Keystone will use public and preexisting private roads to provide access to most of the construction ROW. Keystone does not anticipate the need to improve and maintain many temporary roads needed to access the work areas. Paved roads are not likely to require improvement or maintenance prior to or during construction. Gravel roads and dirt roads may require maintenance during the construction period due to high use. Road improvements such as blading and filling will be restricted to the existing road footprint (i.e., the road will not be widened). Private roads and new temporary access roads will be used and maintained only with permission of the landowner or land management agency.

As a part of its permanent aboveground facilities, Keystone also will construct short, permanent access roads from public roads to the proposed pump stations, delivery facilities, and mainline valves. The estimated acres of disturbance associated with proposed permanent access roads are included in the Aboveground Facility discussion (Section 2.2.5). Prior to construction, Keystone will finalize the location of permanent access roads along with any additional temporary access roads. At a minimum, construction of new permanent access roads will require completion of cultural resources and biological surveys, along with the appropriate SHPO and USFWS consultations and approvals. Other state and local permits also may be required prior to construction. In the future, maintenance of newly created access roads will be the responsibility of Keystone.

2.1.7 Aboveground Facilities

Keystone will require a total of about 61 acres of land along the Keystone Mainline for the location of aboveground facilities, including pump stations, delivery facilities, densitometer sites, and mainline valves. Keystone will require 13 acres for similar facilities on the Cushing Extension.

Keystone will initially construct 23 new pump stations for the Mainline and three for the Cushing Extension, which are identified in **Table 2.1-1**. Expansion to 591,000 bpd will require one additional pump station along the Keystone Mainline. Each station will consist of two or three pumps driven by electric motors, an electrical building, electrical substation, two sump tanks, a small maintenance building, and parking area for station personnel. Stations will operate on locally purchased electric power for pumps, lights, and heating in the buildings and will be fully automated for unmanned operation. Remote start/stop, set point controls, unit monitoring equipment, and station information will be installed at each location. The pipe entering and exiting the pump station sites will be located below grade. The pipe within the pump station (after entering and prior to exiting the pump station facilities) will be aboveground.

Keystone will install two delivery facilities along the Keystone Mainline route at Wood River and Patoka and two along the Cushing Extension (Ponca City and Cushing) (**Table 2.1-1**). The delivery facilities will include pressure regulating, heating, sampling, chromatography, tube switching, and crude oil measurement equipment. At Patoka, delivery facilities will be located entirely within the tank storage terminal. At Wood River, a stand-alone property will be obtained for these facilities. Cushing Extension delivery facilities will be located within the Ponca City and Cushing tank storage terminals.

Keystone will construct 45 mainline valves along the Keystone Mainline and 12 mainline valves along the Cushing Extension. Mainline valves will be installed at each pump station and along the ROW. When not located at a pump station, mainline valves will be sectionalizing block valves constructed within a fenced 50-foot-wide by 50-foot-long site located within the pipeline construction ROW and centered on the 50-foot-wide permanently maintained ROW. Remotely activated valves are located at pump stations, upstream of major river crossings, and above sensitive waterbodies. These valves can be quickly activated to shutdown the pipeline in the event of an emergency to minimize environmental impacts in the unlikely event of a spill. Mainline valve intervals will be a maximum of approximately 50 miles, with an average spacing interval of approximately every 15 to 20 miles. The spacing intervals between the mainline valves along the ROW are based upon the location of the pump stations, waterbodies greater than 100 feet in width, high consequence areas, densely populated areas, and other topographic and environmental considerations.

The Keystone Pipeline Project will be designed to permit full pigging of the pipeline with a minimum interruption of service. Pig launchers and/or receivers will be constructed and operated completely within the boundaries of the pump stations or delivery facilities. Launchers and receivers will allow the pipeline to accommodate a high-resolution internal line inspection tool.

2.1.8 Construction Procedures

The proposed facilities will be designed, constructed, tested, and operated in accordance with all applicable requirements included in the USDOT regulations at 49 CFR Part 195, *Transportation of Hazardous Liquids by Pipeline*, and other applicable federal and state regulations. These regulations are intended to ensure adequate protection for the public and to prevent crude oil pipeline accidents and failures. Among other design standards, Part 195 specifies pipeline material and qualification, minimum design requirements, and protection from internal, external, and atmospheric corrosion.

To manage construction impacts, Keystone will implement Keystone's Construction Mitigation and Reclamation Plan (Keystone's Plan; Appendix E). This Plan contains construction and mitigation procedures that will be used throughout the project, with subsections to address specific environmental conditions.

Keystone will Implement its Spill Prevention, Control, and Countermeasure (SPCC) Plan to avoid or minimize the potential for harmful spills and leaks during construction. The plan describes spill prevention practices, emergency response procedures, emergency and personnel protection equipment, release notification procedures, and cleanup procedures. The SPCC Plan is discussed further in Sections 3.2, 3.3, and 3.5.

Keystone will implement its Emergency Response Plan (ERP) to identify its emergency personnel and the logical sequence of actions, which should be taken in the event of an emergency involving the Keystone system facilities during construction or operation. The ERP will meet federal safety requirements (49 CFR Parts 194 and 195). The ERP establishes written emergency shut down procedures, communication coordination, and clean-up responsibilities in the event of a crude oil pipeline emergency. A draft of Keystone's ERP was submitted to the Department of State on July 1, 2006.

Mitigation and other measures contained in this ER will constitute the basic construction design applicable to all lands disturbed by the Keystone Pipeline Project. This approach will enable construction to proceed with a single set of specifications, irrespective of the ownership status (federal versus non-federal) of the land being crossed. On private lands, this basic design may be modified slightly to accommodate specific landowner requests/preferences.

2.1.8.1 General Pipeline Construction Procedures

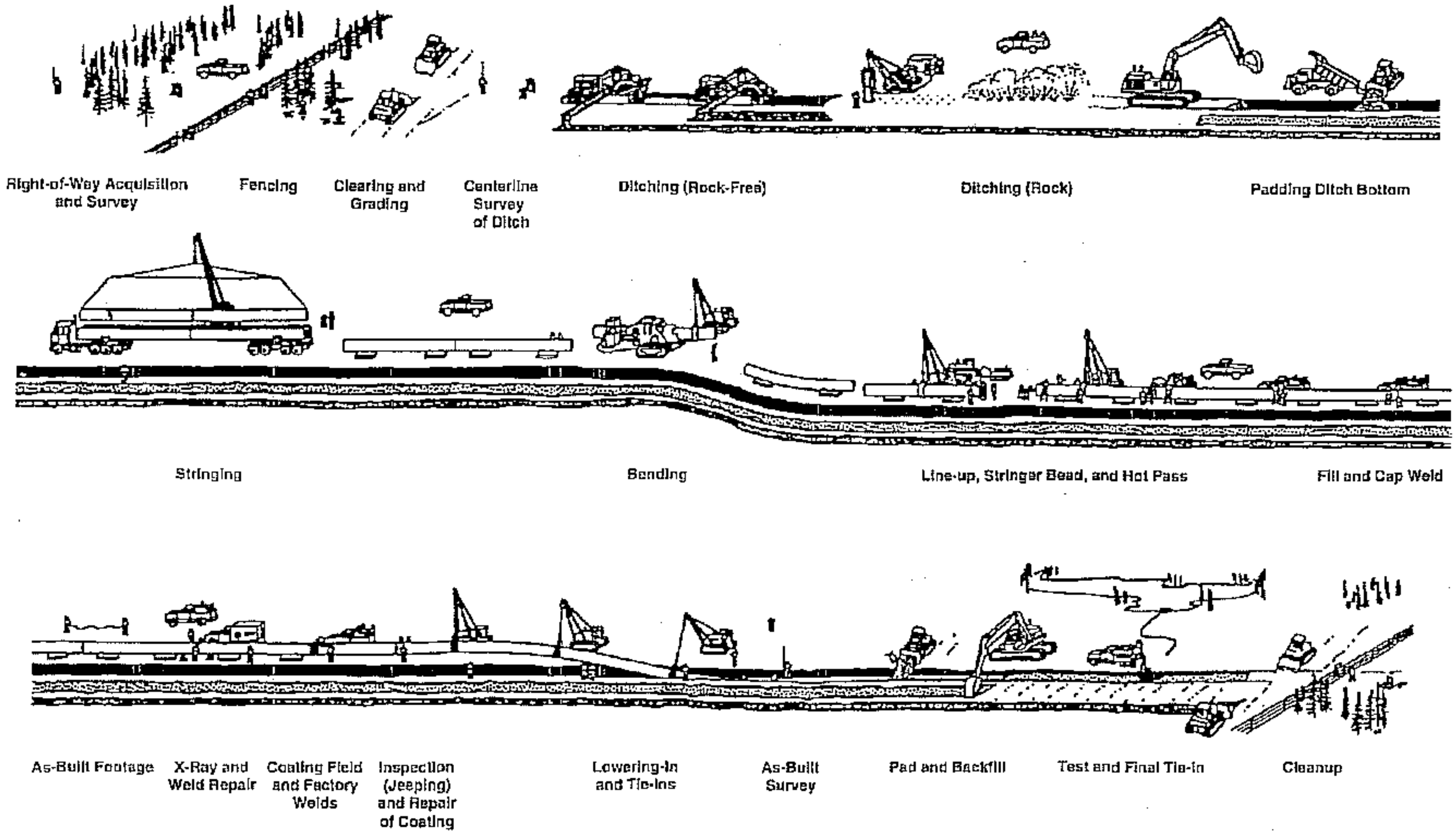
Before starting construction, Keystone will finalize engineering surveys of the ROW centerline and extra workspaces and substantially complete the acquisition of ROW easements and any necessary acquisitions of property in fee.

Overland pipeline construction generally proceeds as a moving assembly line as shown in **Figure 2.1-18** and as summarized below. Keystone currently plans to construct the pipeline in five to seven spreads; four to five spreads along the Keystone Mainline and one to two spreads along the Cushing Extension. Each of the pipeline spreads will consist of approximately 200 to 300 miles of pipeline on the mainline and 125 to 175 miles on the Cushing Extension. Separate crews will be used for construction of the aboveground facilities.

Standard pipeline construction is composed of specific activities including survey and staking of the ROW, clearing and grading, trenching, pipe stringing, bending, welding, lowering-in, backfilling, hydrostatic testing, and cleanup. In addition to standard pipeline construction methods, Keystone will use special construction techniques where warranted by site-specific conditions. These special techniques will be used when constructing across rugged terrain, waterbodies, wetlands, paved roads, highways, and railroads (Section 2.3.2).

<u>Survey and Staking</u>

The first step of construction involves marking the limits of the approved work area (i.e., the construction ROW boundaries and any additional temporary workspace areas) and flagging the location of approved access roads and foreign utility lines. Wetland boundaries and other environmentally sensitive areas also will be marked or fenced for protection at this time. Before the pipeline trench is excavated, a survey crew will stake the centerline of the proposed trench.



Not to Scale

KEYSTONE PIPELINE PROJECT

Figure 2.1-18

Typical Pipeline Construction Sequence

Clearing and Grading

Before clearing and grading activities are conducted, landowner fences will be braced and cut and temporary gates and fences will be installed to contain livestock, if present. A clearing crew will follow the fence crew and will clear the work area of vegetation (including crops) and obstacles (e.g., trees, logs, brush, rocks). Temporary erosion control measures such as silt fences or straw bales will be installed prior to vegetation removal down slopes into wetlands and riparian areas. Grading will be conducted where necessary to provide a reasonably level work surface. Where the ground is relatively flat and does not require grading, rootstock will be left in the ground. More extensive grading will be required in steep side-slopes or vertical areas and where necessary to prevent excessive bending of the pipeline.

Trenching

The trench will be excavated to a depth that provides sufficient cover over the pipeline after backfilling. Typically, the trench will be about seven to eight feet deep and about four to five feet wide in stable soils. In most areas, the USDOT requires a minimum of 36 inches of cover. In rocky areas the USDOT requires a minimum depth of cover of 18 inches. In most locations, the depth of cover for the Keystone pipeline will be a minimum of 48 inches (**Table 2.1-5**). Trenching may precede bending and welding or may follow based on several factors including soil characteristics, water table, existence of drain tiles, and weather conditions at the time of construction.

Table 2.1-5 Minimum Pipeline Cover

Location	Cover, Normal Excavation (inches)	For Rock Excavation (inches)
All waterbodies	60	36
Dry creeks, ditches, drains, washes, gullies, etc.	60	36
Drainage ditches at public roads and railroads	60	48
All other land	48	36

When rock or rocky formations are encountered, tractor-mounted mechanical rippers or rock trenchers will be used to fracture the rock prior to excavation. In areas where mechanical equipment can not break up or loosen the bedrock, blasting (use of explosives) will be required (Section 2.3.2). Excavated rock will be used to backfill the trench to the top of the existing bedrock profile.

Topsoil will be separated from subsoil over the trench or over the trench and spoil side. In areas of removal of topsoil only over the trench, separated topsoil will be stored on the near side of the trench and in a pile separate from subsoil (which will be stored on the far side of the trench) to allow for proper restoration of the soil during the backfilling process (see **Figures 2.1-10** through **2.1-17**). In areas where topsoil over the trench and spoil side is removed, separated topsoils will be stored on the edge of the spoil side of the construction ROW (or, optionally, on the edge of the working side of the construction ROW) and in a pile separate from subsoil (which will be stored on the spoil side of the trench) to allow for proper restoration of the soil during the backfilling process. In areas where the ROW will be graded to provide a level working surface and where there is a need to separate topsoil from subsoil, the ROW will be graded to collect topsoil before any subsoil is disturbed.

Topsoil will be piled such that the mixing of subsoil and topsoil will not occur. Gaps will be left between the spoil piles to prevent storm water runoff from backing up or flooding. Topsoil will be returned to its original horizon after subsoil is backfilled in the trench.

Pipe Stringing, Bending, and Welding

Prior to or following trenching, sections of externally coated pipe up to 80 feet long (also referred to as "joints") will be transported by truck over public road networks and along authorized private access roads to the ROW and placed or "strung" along the trench in a continuous line.

After the pipe sections are strung along the trench and before joints are welded together, individual sections of the pipe will be bent where necessary to allow for uniform fit of the pipeline with the varying contours of the bottom of the trench. A track-mounted, hydraulic pipe-bending machine will shape the pipe to conform to the contours of the terrain. Where multiple or complex bends are required in a section of pipe, that section of the pipeline will be bent at the factory.

After the pipe sections are bent, the joints will be welded together into long strings and placed on temporary supports. The pipeline joints will be lined up and held in position until securely joined by welding. Keystone will non-destructively inspect 100 percent of the welds using radiographic, ultrasonic, or other USDOT-approved method. Welds that do not meet established specifications will be repaired or removed. Once the welds are approved, a protective epoxy coating will be applied to the welded joints. The pipeline will then be electronically inspected or "jeeped" for faults or voids in the epoxy coating and visually inspected for any faults, scratches, or other coating defects. Damage to the coating will be repaired before the pipeline is lowered into the trench.

In rangeland areas used for grazing and livestock, construction activities potentially can hinder the movement of livestock if the livestock cannot be relocated temporarily by the owner. The movement of wildlife in search of food and water also can be hindered by construction activities. To minimize impact on livestock and wildlife movements during construction, Keystone will leave hard plugs (short lengths of unexcavated trench) or install soft plugs (areas where the trench is excavated and replaced with minimal compaction) to allow livestock and wildlife to cross the open trench safely. Soft plugs will be constructed with a ramp on each side to provide an avenue of escape for animals that fall into the trench.

Prior to lowering-in of the pipe into the trench, multiple sections of pipeline may be welded together above the trench. These welded lengths of pipe may be greater than one mile in length. Keystone will lower these sections of pipeline into the trench expeditiously to minimize impacts to landowners.

Lowering-in and Backfilling

Before the pipeline is lowered in, the trench will be inspected to be sure it is free of livestock or wildlife, as well as rocks and other debris that could damage the pipe or protective coating. In areas where water has accumulated, dewatering may be necessary to permit inspection of the bottom of the trench. The pipeline then will be lowered into the trench. On sloped terrain, trench breakers (stacked sand bags or foam) will be installed in the trench at specified intervals to prevent subsurface water movement along the pipeline. The trench will then be backfilled using the excavated material. In rocky areas, the pipeline will be protected with an abrasion-resistant coating or rock shield (fabric or screen that is wrapped around the pipe to protect the pipe and its coating from damage by rocks, stones, and roots). Alternatively, the trench bottom will be filled with padding material (e.g., finer grain sand, soil, or gravel) to protect the pipeline. No topsoil will be used as padding material.

Hydrostatic Testing

The pipeline will be hydrostatically tested in approximately 30-mile sections (maximum 50-mile sections) to ensure the system is capable of withstanding the operating pressure for which it is designed. This process involves isolating the pipe segment with test manifolds, filling the line with water, pressurizing the section to a pressure at least 1.25 times the maximum allowable operating pressure (MAOP), and maintain that pressure for a period of eight hours. The hydrostatic test will be conducted in accordance with 49 CFR Part 195. Keystone proposes to obtain water for hydrostatic testing from rivers and streams that the pipeline route crosses and in accordance with federal, state, and local regulations. The pipeline will be hydrostatically tested after backfilling and all construction work that will directly affect the pipe has been completed. If leaks are found, they will be repaired and the section of pipe retested until specifications are met. Water used for the testing will then be transferred to another pipe section for subsequent hydrostatic testing. Alternatively, the water will be tested to ensure compliance with the NPDES discharge permit requirements, treated if necessary, and discharged. Hydrostatic testing is discussed further in Sections 3.3.2, 3.5.1, and 3.6.3.

Pipe Geometry Inspection

The pipeline will be inspected prior to final tie-ins utilizing an electronic caliper (geometry) pig to ensure the pipeline does not have any dents or ovality that might be detrimental to the operations of the pipeline.

Final Tie-in

Following successful hydrostatic testing, test manifolds will be removed and the final pipeline tie-in welds will be made and inspected.

Commissioning

After final tie-ins are complete and inspected, the pipeline will be cleaned and dried. If the pipeline is not ready for commissioning after the drying phase, the pipeline will be filled with 10 pounds per square inch, gauge (psig) of dry air until ready for commissioning. Commissioning involves verifying that equipment has been properly installed and is working, the controls and communications systems are functional, and the pipeline is ready for service. In the final step, the pipeline is prepared for service by purging the line of air and filling the line with crude oil.

Cleanup and Restoration

During cleanup, construction debris on the ROW will be disposed of and work areas will be final graded. Preconstruction contours will be restored as closely as possible. Segregated topsoil will be spread over the surface of the ROW and permanent erosion controls will be installed. After backfilling, final cleanup will begin as soon as weather and site conditions permit. Every reasonable effort will be made to complete final cleanup (including final grading and installation of erosion control devices) within approximately 20 days after backfilling the trench (approximately 10 days in residential areas). Construction debris will be cleaned up and taken to a disposal facility.

After permanent erosion control devices are installed and final grading has occurred, all disturbed work areas except annually cultivated fields will be seeded as soon as possible. Seeding is intended to stabilize the soil, revegetate areas disturbed by construction, and, depending upon land use, restore native flora. Timing of the reseeding efforts will depend upon weather and soil conditions and will be subject to the prescribed dates and seed mixes specified by the landowner, land-managing agency, or Natural Resource Conservation Service (NRCS) recommendations. On agricultural lands, seeding will be conducted only as agreed upon with the landowner.

Keystone will restrict access along the ROW using gates, boulders, or other barriers to minimize unauthorized access by all-terrain vehicles in wooded areas if requested by the landowner. Pipeline markers will be installed at road and railroad crossings and other locations (as required by 49 CFR Part 195) to show the location of the pipeline. Markers will identify the owner of the pipeline and convey emergency information. Special markers providing information and guidance to aerial patrol pilots also will be installed.

2.1.8.2 Special Construction Procedures

In addition to standard pipeline construction methods, Keystone will use special construction techniques where warranted by site-specific conditions. These special techniques will be used when constructing across paved roads, highways, railroads, steep terrain, waterbodies, wetlands, and when blasting through rock. These special techniques are described below.

Road, Highway, and Railroad Crossings

Construction across paved roads, highways, and railroads will be in accordance with the requirements of the road and railroad crossing permits and approvals obtained by Keystone. In general, all major paved roads, all primary gravel roads, highways, and railroads will be crossed by boring beneath the road or railroad. **Figure 2.1-19** illustrates a typical bored road or railroad crossing. Boring requires the excavation of a pit on each side of the feature, the placement of boring equipment in the pit, and boring a hole under the road at least equal to the diameter of the pipe. Once the hole is bored, a prefabricated pipe section will be pulled through the borehole. For long crossings, sections can be welded onto the pipe string just before being pulled through the borehole. Boring will result in minimal or no disruption to traffic at road, highway, or railroad crossings. Each boring will be expected to take one to two days for most roads and railroads and up to 10 days for long crossings such as interstate or four-lane highways.

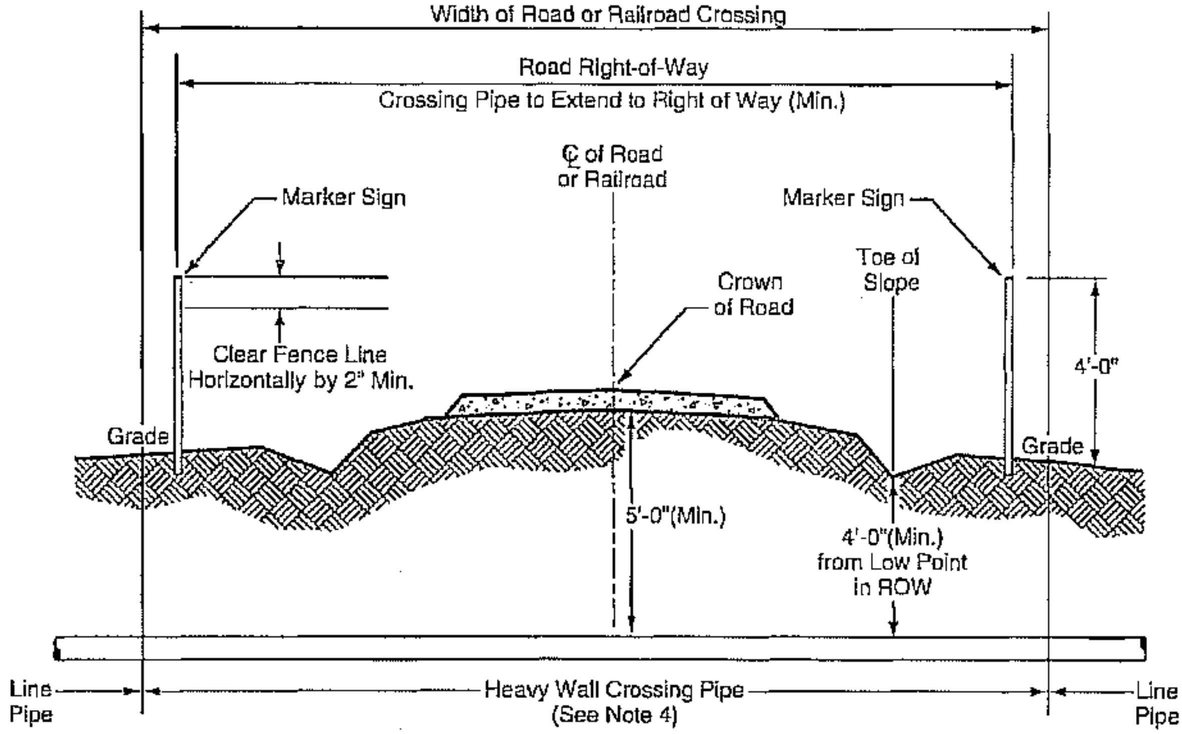
Most smaller, unpaved roads and driveways will be crossed using the open-cut method where permitted by local authorities or private owners. The open-cut method will require temporary closure of the road to traffic and establishment of detours. If no reasonable detour is feasible, at least one lane of traffic will be kept open, except during brief periods when it is essential to close the road to install the pipeline. Most open-cut road crossings will be completed and the road resurfaced in one or two days. Keystone will take measures, such as posting signs at open-cut road crossings, to ensure safety and minimize traffic disruptions.

Steep Terrain

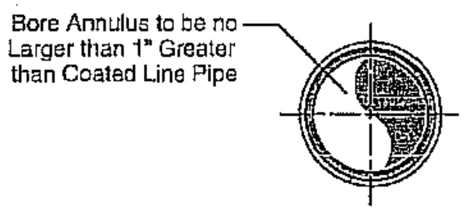
Additional grading may be required in areas where the proposed pipeline route will cross steep slopes. Steep slopes often need to be graded down to a gentler slope for safe operation of construction equipment and to accommodate pipe-bending limitations. In such areas, the slopes will be excavated prior to pipeline installation and reconstructed to their original contours during restoration.

In areas where the proposed pipeline route crosses laterally along the side of a slope, cut and fill grading may be required to obtain a safe, flat work terrace. Topsoil will be stripped from the entire ROW and stockpiled prior to cut and fill grading on steep terrain. Generally, on steep side-slopes, soil from the high side of the ROW will be excavated and moved to the low side of the ROW to create a safe and level work terrace. After the pipeline is installed, the soil from the low side of the ROW will be returned to the high side and the slope's original contours will be restored. Topsoil from the stockpile will be spread over the surface, erosion control features installed, and seeding implemented.

In steep terrain, temporary sediment barriers such as silt fence and straw bales will be installed during clearing to prevent the movement of disturbed soil into wetland, waterbody, or other environmentally sensitive areas. Temporary slope breakers consisting of mounded and compacted soil will be installed across the ROW during grading and permanent slope breakers will be installed during cleanup. Following construction, seed will be applied to steep slopes and the ROW will be mulched with hay or non-brittle straw or covered with erosion control fabric. Sediment barriers will be maintained across the ROW until permanent vegetation is established.



TYPICAL UNCASED ROAD CROSSING - BORED



Notes:

1. Crossings shall be in accordance with applicable permit.
2. Road crossing pipe shall extend at minimum to right-of-way line.
3. The type and minimum required length of pipe for crossings of roads shall be as specified on alignment sheets.
4. Pipe for bored crossings to include abrasion-resistant (ARB) coating.
5. Pipeline marker and test stations to be installed on ROW line next to fence if possible.
6. The crossing pipe shall be straight with no vertical or horizontal bends within the road right-of-way.

KEYSTONE PIPELINE PROJECT

Figure 2.1-19
Typical Uncased Road or Railroad Crossing - Bored

Waterbody Crossings

A total of 272 perennial streams and rivers will occur during the construction of the Keystone Mainline and 58 perennial waterbody crossings will occur on the Cushing Extension. Perennial waterbodies will be crossed using one of four techniques: the open-cut wet method (Keystone's preferred method), open-cut flume method, open-cut dam-and-pump method, or horizontal directional drill (HDD) method as described below.

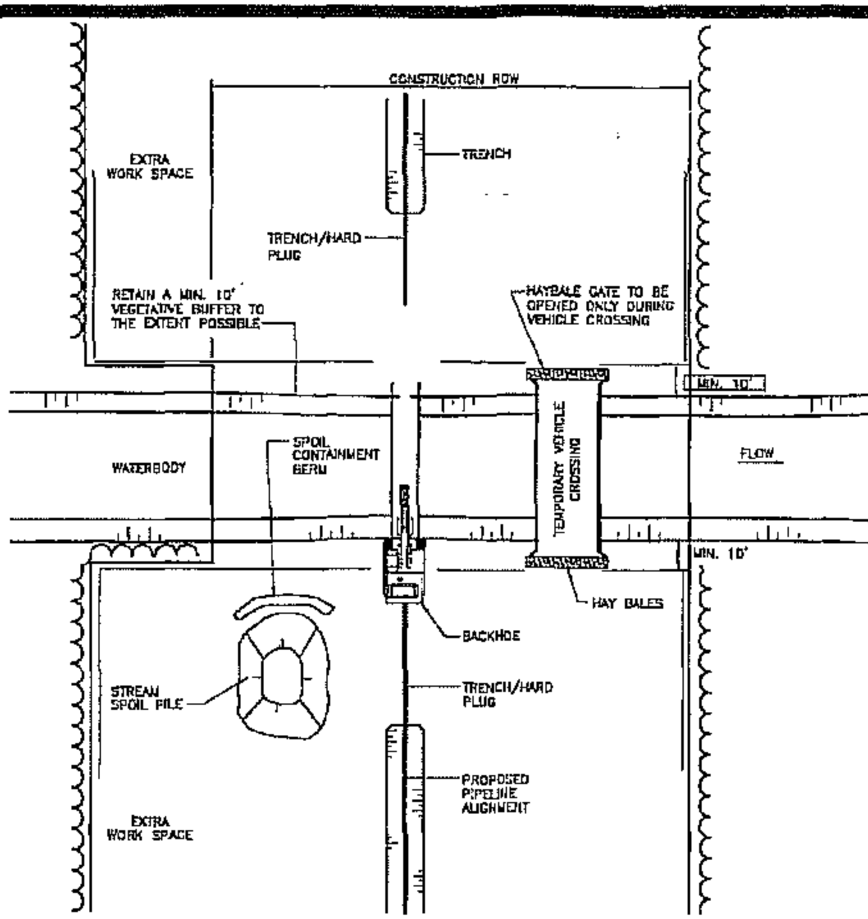
Keystone's preferred crossing method will be to use an open-cut wet crossing. The open-cut wet method involves trenching through the waterbody while water continues to flow through the construction work area (**Figure 2.1-20**). Pipe segments for the crossing will be fabricated adjacent to the waterbody. Generally, backhoes operating from one or both banks will excavate the trench within the streambed. In wider rivers, in-stream operation of equipment may be necessary. Trench plugs consisting of a hard or soft plug will be placed to prevent the flow of water into the upland portions of the trench. Trench spoil excavated from the streambed generally will be placed at least 10 feet away from the water's edge unless stream width is great enough to require placement in the stream bed. Sediment barriers will be installed where necessary to control sediment and to prevent excavated spoil from entering the water. After the trench is dug, the prefabricated pipeline segment will be carried, pushed, or pulled across the waterbody and positioned in the trench. When crossing saturated wetlands and flowing waterbodies using the open-cut method, the pipe coating will be covered with reinforced concrete or concrete weights to provide negative bouyancy. The trench will then be backfilled with native material or with imported material if required by applicable permits. Following backfilling, the banks will be restored and stabilized.

Keystone will utilize dam and pump or dry flume crossings where technically feasible on environmentally sensitive waterbodies as warranted by resource-specific sensitivities. The flume crossing method involves diverting the flow of water across the trenching area through one or more flume pipes placed in the waterbody. The dam-and-pump method is similar to the flume method except that pumps and hoses will be used instead of flumes to move water around the construction work area. In both methods, trenching, pipe installation, and backfilling are done in isolation from the live stream while water flow is maintained for all but a short reach of the waterbody at the actual crossing. Once backfilling is completed, the flume or pump hoses are removed and the streambanks restored and stabilized.

At the Missouri River (two crossings), Platte River, Chariton River, Cuivre River (two crossings), Mississippi River, Hurricane Creek, and Kaskaskia River, Keystone plans to use the HDD method of construction. The HDD method involves drilling a pilot hole under the waterbody and banks, then enlarging the hole through successive reamings until the hole is large enough to accommodate a prefabricated segment of pipe. Throughout the process of drilling and enlarging the hole, a slurry consisting mainly of water and bentonite clay will be circulated to power and lubricate the down-hole tools, remove drill cuttings, and hold the hole open. Pipe sections long enough to span the entire crossing will be staged and welded along the construction work area on the opposite side of the waterbody and then pulled through the drilled hole. Ideally, use of the HDD method results in no impact on the banks, bed, or water quality of the waterbody being crossed. **Figure 2.1-21** shows a conceptual HDD waterbody crossing.

Approximately 840 intermittent waterbody crossings will occur on the Keystone Mainline and about 133 intermittent waterbody crossings on the Cushing Extension. If these intermittent waterbodies are dry at the time of crossing, Keystone proposes to use conventional upland cross-country construction techniques. If an intermittent waterbody is flowing when crossed, Keystone will install the pipeline using the open cut wet crossing method discussed above. When crossing waterbodies, Keystone will adhere to the guidelines outlined in its Site-Specific Waterbody Crossing Plans (Appendix D), Keystone's Plan (Appendix E) and the requirements of its waterbody crossing permits.

Additional temporary workspace areas will be required on both sides of all waterbodies to stage construction, fabricate the pipeline, and store materials. These workspaces will be located at least 50 feet away from the water's edge, except where the adjacent upland consists of actively cultivated or rotated cropland or other



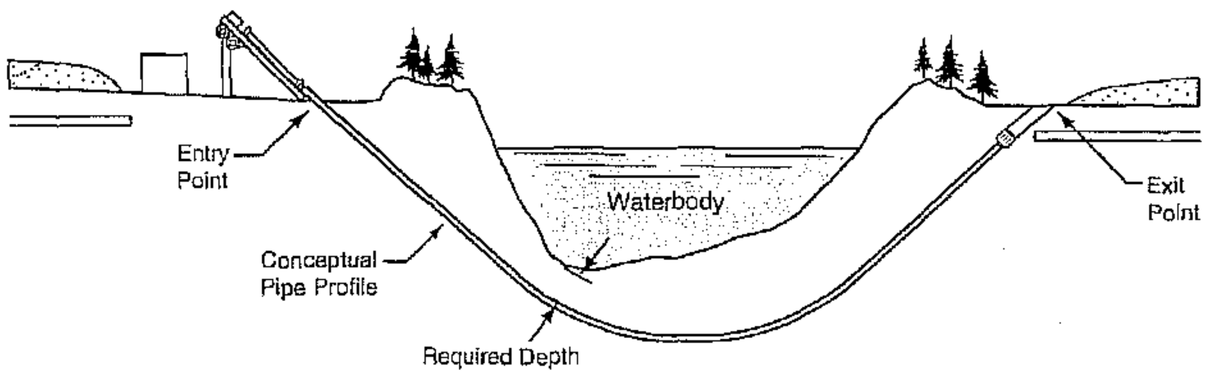
PLAN VIEW

CONSTRUCTION PROCEDURES:

1. RIGHT-OF-WAY BOUNDARIES AND WORK SPACE LIMITS SHALL BE CLEARLY DELINEATED. STAGING FOR MAKEUP SHALL BE LOCATED A MINIMUM OF 10 FEET FROM WATERBODY.
2. CLEARING LIMITS WILL BE CLEARLY DELINEATED AND A 10 FOOT VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREA AND THE WATERBODY SHALL BE MAINTAINED TO THE EXTENT POSSIBLE. ALL CLEARING SHALL BE MINIMIZED TO THE EXTENT POSSIBLE AND TO ONLY THAT NECESSARY FOR CONSTRUCTION. WOODY VEGETATION SHALL BE CUT AT GROUND LEVEL AND THE STUMPS/ROOTS LEFT IN PLACE TO THE EXTENT POSSIBLE.
3. TOPSOIL SHALL BE STRIPPED FROM THE DITCH LINE IN ALL WETLANDS RIPARIAN.
4. CONTRACTOR SHALL INSTALL SIGNS APPROXIMATELY 100 FEET MINIMUM FROM EACH WATERBODY AND WETLAND TO IDENTIFY THE HAZARDOUS MATERIALS EXCLUSION AREA.
5. EROSION AND SEDIMENT CONTROL
   A. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS WATERBODY OR WETLAND.
   B. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY OR INDIRECTLY INTO THE WATERBODY. ALL EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO SUIT ACTUAL SITE CONDITIONS. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION.
   C. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA, INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED CONSTRUCTION RIGHT OF WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.
   D. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE WATERBODY CROSSING UNTIL THE WATER CROSSING IS INSTALLED AND BACKFILLED.
   E. TRENCH BREAKERS ARE TO BE INSTALLED AT THE SAME SPACING AND IMMEDIATELY UPSLOPE OF PERMANENT SLOPE BREAKERS, OR AS DIRECTED BY THE COMPANY.
6. CONTRACTOR SHALL MAINTAIN HARD PLUGS IN THE DITCH AT THE WATERBODY UNTIL JUST PRIOR TO PIPE INSTALLATION. CONTRACTOR SHALL EXCAVATE TRENCH AND INSTALL PIPE AS EXPEDIENTLY AS PRACTICAL TO REDUCE THE DURATION OF WORK ACTIVITIES IN THE WATERBODY BED.
7. CONTRACTOR SHALL PLACE TRENCH SPOIL ONLY IN CERTIFICATED WORK SPACE AND A MINIMUM OF 10 FEET FROM THE WATERBODY BANKS TO PREVENT ENTRY OF SPOIL INTO THE WATERBODY. SPOIL SHALL BE CONTAINED AS NECESSARY USING EITHER A STRAW BALE BARRIER OR AN EARTH/ROCK BERM.
8. CONTRACTOR SHALL RESTORE THE WATERBODY AND BANKS TO APPROXIMATE PRECONSTRUCTION CONTOURS, UNLESS OTHERWISE APPROVED BY THE COMPANY. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED. ANY MATERIALS PLACED IN THE WATERBODY TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATERBODY AND WETLAND BOUNDARIES UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.
9. VEHICLE CROSSING CAN BE CONSTRUCTED USING EITHER A FLUME CROSSING OR A TEMPORARY BRIDGE. VEHICLE CROSSING ONLY REQUIRED IF STREAM SUPPORTS A STATE DESIGNATED FISHERY.

KEYSTONE PIPELINE PROJECT

Figure 2.1-20
Typical Waterbody Crossing
Open Cut Trench



PROFILE

Notes:

1. Set up drilling equipment a minimum of 100 feet from the edge of the watercourse. Limit clearing between drill entry and exit point to brush clearing of a 10-foot wide strip as necessary to monitor drilling activities and obtain water for hydrostatic testing and drilling mud.
2. Ensure that only bentonite-based drilling mud is used.
3. Install suitable drilling mud tanks or sumps to prevent contamination of watercourse.
4. Install berms downslope from the drill entry and anticipated exit points to contain any release of drilling mud.
5. Dispose of drilling mud in accordance with the appropriate regulatory authority requirements.

	KEYSTONE PIPELINE PROJECT
	Figure 2.1-21 Waterbody Crossing Typical Horizontal Directional Drill

disturbed land. Before construction, temporary bridges (e.g., subsoil fill over culverts, timber mats supported by flumes, railcar flatbeds, flexi-float apparatus) will be installed across all perennial waterbodies to allow construction equipment to cross. Construction equipment will be required to use the bridges, except the clearing crew, which will be allowed one pass through the waterbodies before the bridges are installed.

During clearing, sediment barriers such as silt fence and staked straw bales will be installed and maintained on drainages across the ROW adjacent to waterbodies and within additional temporary workspace areas to minimize the potential for sediment runoff. Silt fence and/or straw bales located across the working side of the ROW will be removed during the day when vehicle traffic is present and will be replaced each night. Alternatively, drivable berms could be installed and maintained across the ROW in lieu of silt fence and/or straw bales.

In general, equipment refueling and lubricating at waterbodies will take place in upland areas that are 100 feet or more from the edges of the water. When circumstances dictate that equipment refueling and lubricating will be necessary in or near waterbodies, Keystone will follow its SPCC Plan to address the handling of fuel and other hazardous materials.

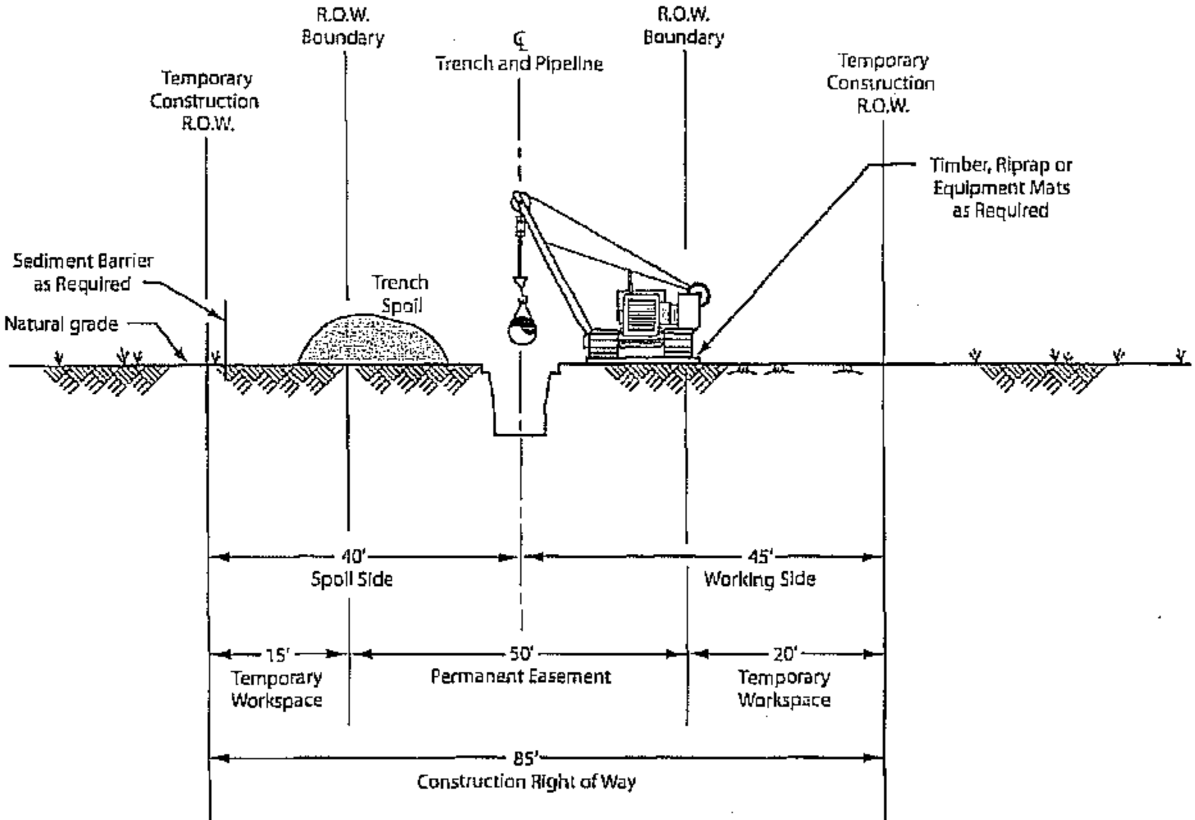
After the pipeline is installed beneath the waterbody, restoration will begin. Waterbody banks will be restored to preconstruction contours or to a stable configuration. Appropriate erosion control measures such as rock riprap or gabion baskets (rock enclosed in wire bins), log walls, vegetated geogrids, willow cuttings, etc.) will be installed as necessary on steep waterbody banks in accordance with permit requirements. More stable banks will be seeded with native grasses and mulched or covered with erosion control fabric. Waterbody banks will be temporarily stabilized within 24 hours of completing in-stream construction. Sediment barriers, such as silt fence and/or straw bales or drivable berms will be maintained across the ROW at all waterbody approaches until permanent vegetation is established. Temporary equipment bridges will be removed following construction.

Wetland Crossings

Data from wetland delineation field surveys, aerial photography, and National Wetland Inventory (NWI) map data were used to identify wetlands crossed by the proposed Keystone Mainline and Cushing Extension. Pipeline construction across wetlands will be similar to typical conventional upland cross-country construction procedures, with several modifications where necessary to reduce the potential for pipeline construction to affect wetland hydrology and soil structure.

The wetland crossing method used will depend largely on the stability of the soils at the time of construction. If wetland soils are not excessively saturated at the time of construction and can support construction equipment without equipment mats, construction will occur in a manner similar to conventional upland cross-country construction techniques (**Figure 2.1-22**). Topsoil will be salvaged over the trenchline. In saturated soils, topsoil segregation generally will not be possible. Keystone typically will use an 85-foot-wide construction ROW through saturated wetlands unless non-cohesive soils are present that will require a wider construction ROW. Additional temporary workspace areas will be required on both sides of particularly wide saturated wetlands to stage construction, fabricate the pipeline, and store materials. These additional temporary workspace areas will be located in upland areas a minimum of 10 feet from the wetland edge.

Construction equipment working in saturated wetlands will be limited to that area essential for ROW clearing, excavating the trench, fabricating and installing the pipeline, backfilling the trench, and restoring the ROW. In areas where there is no reasonable access to the ROW except through wetlands, non-essential equipment will be allowed to travel through wetlands only if the ground is firm enough or has been stabilized to avoid rutting.



PROFILE

Notes:

1. Flag wetland boundaries prior to clearing.
2. No refueling of mobile equipment is allowed within 100 feet of wetland. Place "No Fueling" sign posts 100 feet back from wetland boundary. Refuel stationary equipment as per Keystone's spill prevention procedures.
3. Install temporary slope breaker upslope within 100 feet of wetland boundary if directed by Keystone.
4. Install timber mats/riprap through entire wetland area. Equipment necessary for right-of-way clearing may make one (1) pass through the wetland before mats are installed.
5. Aviod adjacent wetlands. Install sediment barriers (straw bales and/or silt fence) at downslope edge of right-of-way and along wetland edge as required.
6. Restrict root grubbing to only that area over the ditchline and ditch spoil areas and remove from wetland for disposal.
7. Topsoil stripping shall not be required in saturated soil conditions
8. Leave hard plugs at edge of wetland until just prior to trenching.
9. Pipe section may be fabricated within the wetland and adjacent to alignment, or in staging area outside the wetland and walked in.
10. Trench through wetland.
11. Lower-in pipe, install trench plugs at wetland edges as required and backfill immediately.
12. Remove timber mats or prefabricated mats from wetland upon completion.
13. Restore grade to near pre-construction topography, replace topsoil, and install permanent erosion control.

KEYSTONE PIPELINE PROJECT

Figure 2.1-22
Typical Standard
Wetland Crossing

Clearing of vegetation in wetlands will be limited to trees and shrubs, which will be cut flush with the surface of the ground and removed from the wetland. To avoid excessive disruption of wetland soils and the native seed and rootstock within the wetland soils, stump removal, grading, topsoil segregation, and excavation will be limited to the area immediately over the trenchline. During clearing, sediment barriers, such as silt fence and staked straw bales, will be installed and maintained on downslopes adjacent to saturated wetlands and within additional temporary workspace areas as necessary to minimize the potential for sediment runoff.

Where wetland soils are saturated and/or inundated, the pipeline can be installed using the push-pull technique. The push-pull technique will involve stringing and welding the pipeline outside of the wetland and excavating and backfilling the trench using a backhoe supported by equipment mats or timber riprap. The prefabricated pipeline is installed in the wetland by equipping it with buoys and pushing or pulling it across the water-filled trench. After the pipeline is floated into place, the floats are removed and the pipeline sinks into place. Most pipe installed in saturated wetlands will be coated with concrete or equipped with set-on weights to provide negative buoyancy. Because little or no grading will occur in wetlands, restoration of contours will be accomplished during backfilling. Prior to backfilling, trench breakers will be installed where necessary to prevent the subsurface drainage of water from wetlands. Where topsoil has been segregated from subsoil, the subsoil will be backfilled first, followed by the topsoil. Topsoil will be replaced to the original ground level leaving no crown over the trenchline. In some areas where wetlands overlie rocky soils, the pipe will be padded with rock-free soil or sand before backfilling with native bedrock and soil. Equipment mats, timber riprap, gravel fill, geotextile fabric, and/or straw mats will be removed from wetlands following backfilling.

Where wetlands are located at the base of slopes, permanent slope breakers will be constructed across the ROW in upland areas adjacent to the wetland boundary. Temporary sediment barriers will be installed where necessary until revegetation of adjacent upland areas is successful. Once revegetation is successful, sediment barriers will be removed from the ROW and disposed of properly.

In wetlands where no standing water is present, the construction ROW will be seeded in accordance with the recommendations of the local soil conservation authorities or land management agency.

Blasting

Blasting (use of explosives to fracture rock) may be required in areas where consolidated shallow bedrock or boulders are encountered, which cannot be removed by conventional excavation methods. If blasting is required to clear the ROW and to fracture the ditch, strict safety precautions will be followed. Keystone will exercise extreme care to avoid damage to underground structures, cables, conduits, pipelines, and underground watercourses or springs. To protect property or livestock, Keystone will provide adequate notice to adjacent landowners or tenants in advance of blasting. Blasting activity will be performed during daylight hours and in compliance with federal, state, and local codes and ordinances and manufacturers' prescribed safety procedures and industry practices.

Residential and Commercial Construction

Keystone used 2005 aerial photography to identify areas containing buildings within 25 feet of the construction ROW. These areas are summarized in **Table 2.1-6**. Prior to construction, Keystone will verify the proximity of buildings to the pipeline and determine if the structures are occupied residences or commercial businesses. Keystone will develop site-specific construction plans to mitigate the impacts of construction on residential and commercial structures.

Fences and Grazing

Fences will be crossed or paralleled by the construction ROW. Before cutting any fences for pipeline construction, each fence crossed by the ROW will be braced and secured to prevent the slacking of the fence.

Table 2.1-6 Areas with Buildings Located Within 25 Feet of the Construction ROW

	County	MP	Structures
KEYSTONE MAINLINE			
North Dakota	Barnes	126.8	single
	Sargent	204.9	single
South Dakota	Marshall	240.3	single
	Hanson	377.9	single
	Hutchinson	403.7	single
	Yankton	429.3	single
	Yankton	433.8	single
Nebraska	Seward	570.9	single
	Seward	585.3	single
	Jefferson	627.1	single
	Gage	647.0	single
Kansas	Nemaha	684.8	several
	Nemaha	687.1	single
	Nemaha	693.8	single
	Brown	703.6	single
	Brown	708.7	single
	Doniphan	728.1	several
	Doniphan	733.7	development
	Doniphan	734.4	several
Missouri	Buchanan	753.4	several
	Buchanan	754.4	several
	Buchanan	756.4	development
	Buchanan	757.2	single
	Clinton	771.8	single
	Clinton	773.3	single
	Clinton	777.1	several
	Clinton	785.6	several
	Clinton	789.2	single
	Caldwell	794.0	single
	Caldwell	796.4	single
	Caldwell	802.9	single
	Caldwell	807.7	single
	Caldwell	810.5	single
	Carroll	823.3	single
	Carroll	823.9	single
	Carroll	824.6	several
	Carroll	827.8	single

Table 2.1-6 Areas with Buildings Located Within 25 Feet of the Construction ROW

	County	MP	Structures
	Carroll	830.8	several
	Carroll	832.9	single
	Chariton	842.7	single
	Chariton	848.5	several
	Chariton	858.4	single
	Chariton	859.5	several
	Chariton	859.7	single
	Chariton	867.4	several
	Chariton	871.9	single
	Randolph	877.6	several
	Randolph	881.2	single
	Audrain	905.1	development
	Audrain	908.8	single
	Audrain	914.4	several
	Audrain	926.4	single
	Montgomery	943.7	single
	Montgomery	945.8	single
	Montgomery	947.6	single
	Montgomery	948.6	several
	Montgomery	950.9	development
	Montgomery	952.3	several
	Lincoln	956.1	single
	Lincoln	956.7	single
	Lincoln	961.3	several
	Lincoln	965.9	several
	Lincoln	968.4	development
	Lincoln	972.2	several
	Lincoln	975.8	single
	Lincoln	978.7	several
	St. Charles	982.3	several
	St. Charles	983.3	single
	St. Charles	1007.9	single
	St. Charles	1013.6	single
Illinois	Madison	1024.5	single
CUSHING EXTENSION			
Nebraska	N/A	N/A	None
Kansas	Marion	124.6	single
	Butler	156.4	development

Table 2.1-6 Areas with Buildings Located Within 25 Feet of the Construction ROW

	County	MP	Structures
	Cowley	180.3	single
	Cowley	188.2	single
	Cowley	200.5	several
	Cowley	208.1	several
	Cowley	209.1	several
Oklahoma	Kay	233.2	development
	Kay	234.3	several
	Kay	235.3	single
	Noble	254.1	single
	Noble	258.7	single
	Payne	269.7	several
	Payne	270.5	single
	Payne	274.5	development
	Payne	279.4	single
	Payne	289.6	single
	Payne	291.7	single

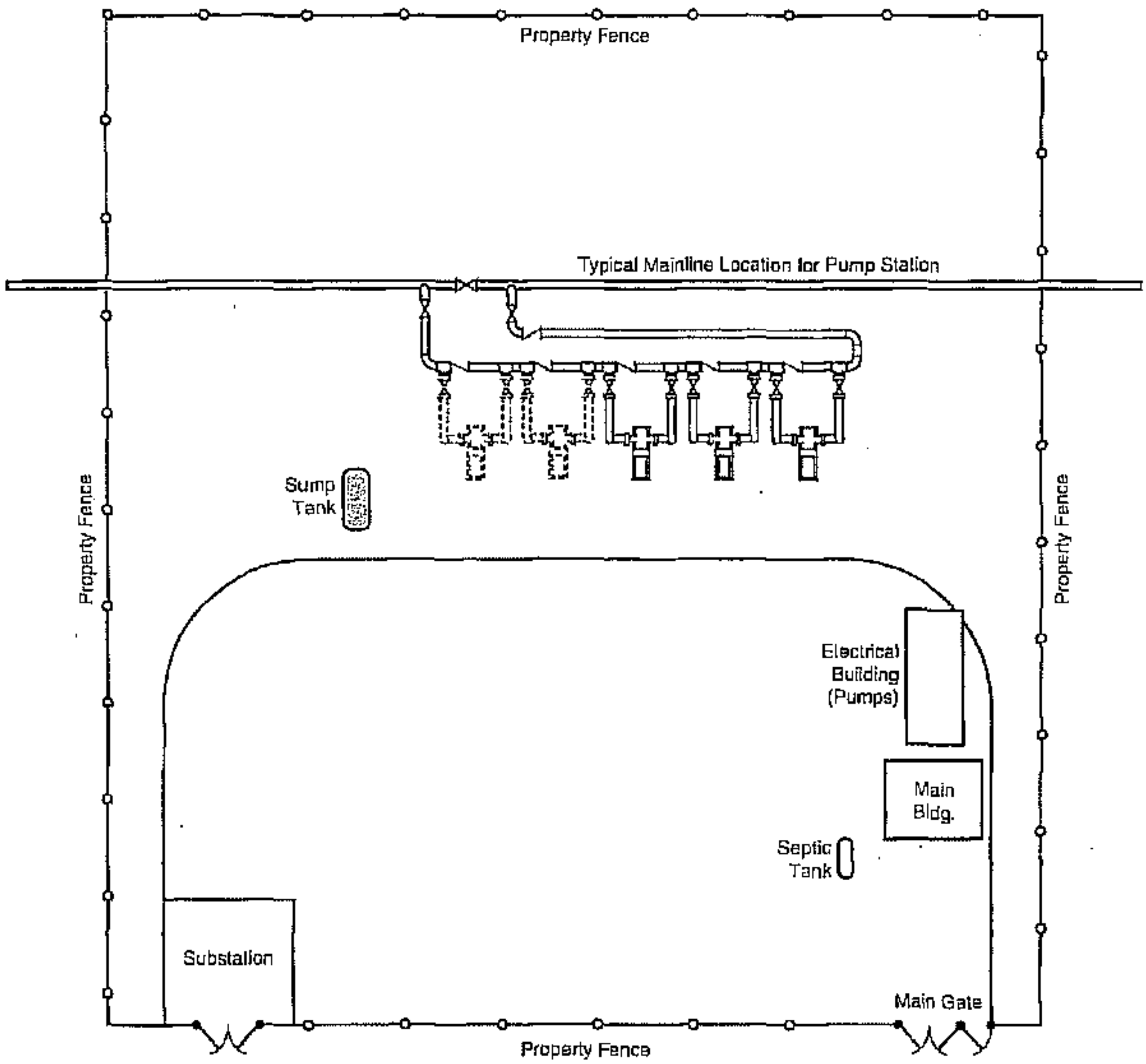
To prevent the passage of livestock, the opening in the fenceline will be temporarily closed when construction crews leave the area. If gaps in natural barriers used for livestock control are created by the pipeline construction, the gaps will be fenced according to the landowner's requirements. All existing improvements, such as fences, gates, irrigation ditches, cattle guards, and reservoirs will be maintained during construction and repaired to pre-construction conditions or better.

2.1.8.3 Aboveground Facility Construction Procedures

Construction activities at each of the pump stations will follow a standard sequence of activities: clearing and grading, installing foundations for the electrical building and support buildings, and erecting the structures to support the pumps and associated facilities. A block valve is installed in the mainline with two side block valves, one to the suction piping of the pumps and one from the discharge piping of the pumps. Construction activities and the storage of building materials will be confined to the pump station construction sites. **Figures 2.1-23** and **2.1-24** illustrates a typical plot plan for a pump station.

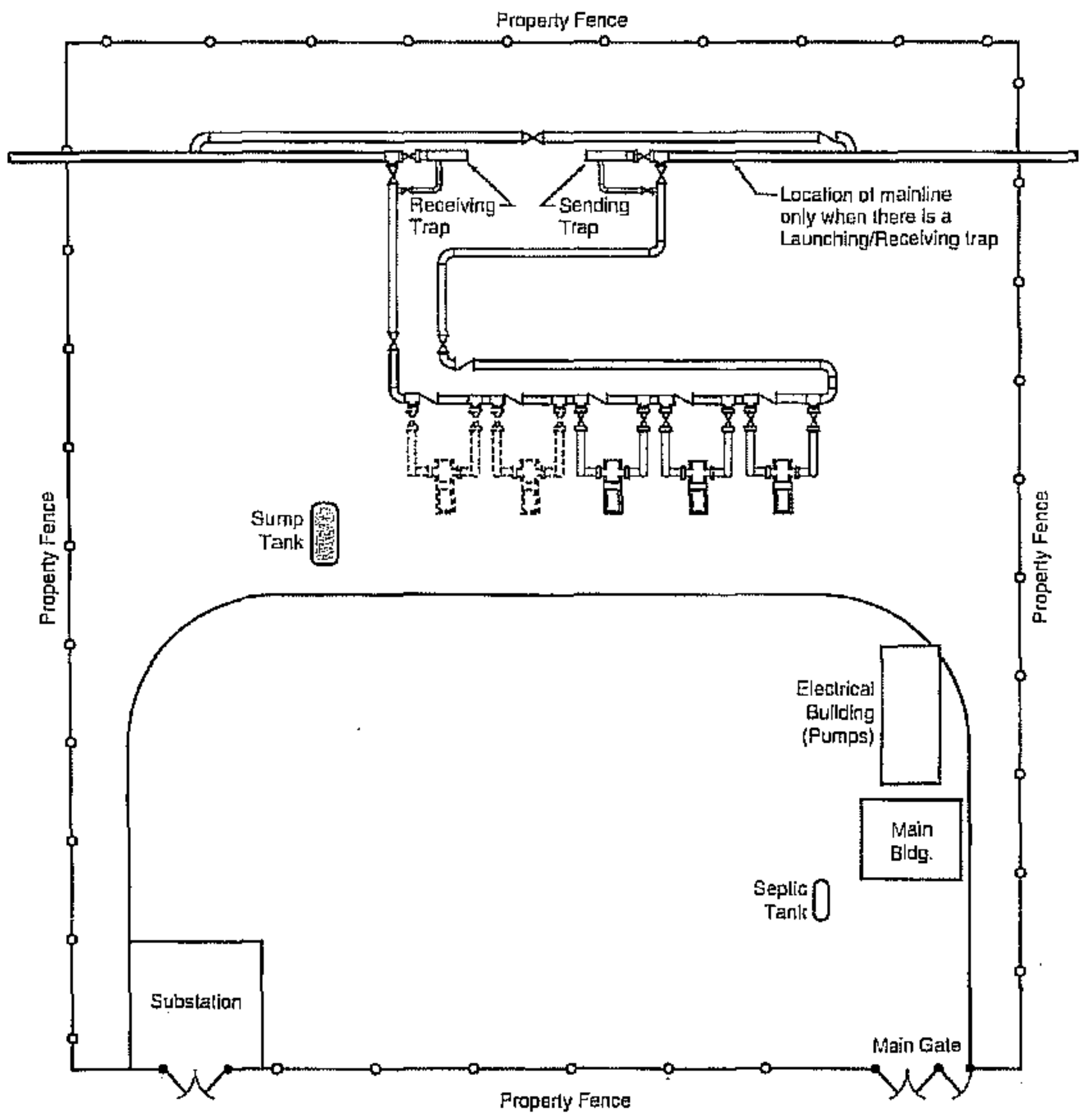
The sites for the pump stations will be cleared of vegetation and graded as necessary to create a level surface for the movement of construction vehicles and to prepare the area for the building foundations. Foundations will be constructed for the pumps and buildings and soil will be stripped from the area of the building foundations.

Each pump station will include one electrical building and one support building. The electrical building will include electrical systems, communications, and control equipment. The second building houses a small office and washroom. The crude oil piping, both aboveground and belowground, will be installed and pressure-tested



KEYSTONE PIPELINE PROJECT

Figure 2.1-23
Typical Pump Station without Pigging Facilities



KEYSTONE PIPELINE PROJECT

Figure 2.1-24
Typical Pump Station with Pigging Facilities

using methods similar to those used for the main pipeline. After testing is successfully completed, the piping will be tied in to the main pipeline. Piping installed below grade will be coated for corrosion protection prior to backfilling. In addition, all below grade facilities will be protected by a cathodic protection system. Before being put into service, pumps, controls, and safety devices will be checked and tested to ensure proper system operation and activation of safety mechanisms.

Each pump station will require electricity and telephone facilities, which will be obtained from local utilities. **Table 2.1-7** summarizes electrical power and distribution lines requirements.

Table 2.1-7 Summary of Electrical Power Supply Requirements for Pump Stations

Station	Local Utility	Service Description
		KEYSTONE MAINLINE
North Dakota		
Pump Station ML#15	NODAK Electric Cooperative	Approximately 8 miles of new 69-kilovolt (kV) transmission line from existing 69-kV line to main substation at pump station site. Approximately 25 miles of existing 69-kV line upgrades. Main pump station substation with 15 million volt-amps (MVA) 69/4.16-kV transformer.
Pump Station ML#16	NODAK Electric Cooperative	Approximately 1 mile of 69-kV transmission line from existing 69-kV line to main substation at pump station site. Main pump station substation with 15 MVA 69/4.16-kV transformer.
Pump Station ML#17	NODAK Electric Cooperative	Approximately 11.5 miles of 69-kV transmission line from existing 69-kV line to main substation at pump station site. Approximately 17 miles of existing 69-kV line upgrades. Main pump station substation with 15 MVA 69/4.16-kV transformer.
Pump Station ML#18	Ottertail Power Company	Approximately 18 miles of 115-kV transmission line to main substation at pump station site. Remote end upgrades. Main pump station substation with 15 MVA 115/4.16-kV transformer.
Pump Station ML#19	Dakota Valley Electric Cooperative	Approximately 29 miles of 115-kV transmission line from Foreman substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 12/16 MVA 115/4.16-kV transformer.
South Dakota		
Pump Station ML#20	Lake Region Electric Association, Inc.	Approximately 13 miles of 115-kV transmission line from Groten substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 15 MVA 115/4.16-kV transformer.
Pump Station ML#21	Dakota Energy Cooperative Inc.	Approximately 3 miles of 69-kV transmission line from a new 230/69-kV substation to main substation at pump station site. Main pump station substation with a 15 MVA 69/4.16-kV transformer.
Pump Station ML#22	Central Electric Cooperative Inc.	Approximately 12 miles of 115-kV transmission line from a new 230/115-kV substation to main substation at pump station site. Main pump station substation with 15 MVA 115/4.16-kV transformer.

Table 2.1-7 Summary of Electrical Power Supply Requirements for Pump Stations

Station	Local Utility	Service Description
Pump Station ML#23	Southeastern Electric Service Cooperative Inc.	Approximately 19 miles of 115-kV transmission line from a new 230/115-kV substation to main substation at pump station site. Main pump station substation with 15 MVA 115/4.16-kV transformer.
Nebraska		
Pump Station ML#24	Nebraska Public Power District	Approximately 5 miles of 69-kV transmission line from a new 115/69-kV substation to main substation at pump station site. Main pump station substation with a 15 MVA 69/4.16-kV transformer.
Pump Station ML#25	Nebraska Public Power District	Approximately 3 miles of new 34.5-kV transmission line from a new 115/34.5-kV substation to main substation at pump station site. Main pump station substation with 15 MVA 34.5/4.16-kV transformer.
Pump Station ML#26	Nebraska Public Power District	Approximately 4 miles of new 34.5-kV transmission line tapping an existing 34.5-kV line to main substation at pump station site. Main pump station substation with 10 MVA 34.5/4.16-kV transformer.
Pump Station ML#27	Nebraska Public Power District	Approximately 2 miles of 115-kV transmission line tapping an existing 115-kV line to main substation at pump station site. Remote end upgrades. Main pump station substation with 15 MVA 115/4.16-kV transformer.
Pump Station ML#28	Nebraska Public Power District	Approximately 9 miles of 69-kV transmission line from local substation to main substation at pump station site. New 115/69-kV substation and rebuilding 4 miles of 34.5-kV line to 69 kV. Main pump station substation with 15 MVA 69/4.16-kV transformer.
Kansas		
Pump Station ML#29	Westar Energy	Approximately 4.5 miles of 115-kV transmission line tapping an existing line to main substation at pump station site. Remote end upgrades. Main pump station substation with 10 MVA 115/4.16-kV transformer.
Pump Station ML#30	Doniphan Electric Cooperative	Approximately 2 miles of 34.5-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 15 MVA 34.5/4.16-kV transformer.
Missouri		
Pump Station ML#31	Platte-Clay Electric Cooperative	Approximately 2 miles of 161-kV line from an existing substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 15 MVA 161/4.16-kV transformer.
Pump Station ML#32	Kansas City Power & Light	Approximately 6 miles of 34.5-kV line from an existing substation to main substation at pump station site. Remote end upgrades. Main pump station substation with 7.5 MVA 34.5/4.16-kV transformer.
Pump Station ML#33	Kansas City Power & Light	Approximately 0.5 mile of 34.5-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 7.5 MVA 34.5/4.16-kV transformer.
Pump Station ML#34	Ameren UE	Approximately 0.5 mile of 69-kV transmission line tapping an existing 69-kV line to main substation at pump station site. Tap point switches and remote end upgrades. Main pump station substation with 15 MVA 69/4.16-kV transformer.

Table 2.1-7 Summary of Electrical Power Supply Requirements for Pump Stations

Station	Local Utility	Service Description
Pump Station ML#35	Central Electric Power Cooperative	Approximately 3.5 miles of 69-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 15 MVA 69/4.16-kV transformer.
Pump Station ML#36	Ameren UE	Approximately 0.5 mile of 34.5-kV transmission line tapping an existing line to main substation at pump station site. Main pump station substation with 15 MVA 34.5/4.16-kV transformer.
Illinois		
Pump Station ML#37	Ameren IP	Less than 0.5 mile of 34.5-kV transmission line from nearby utility line to main substation at pump station site. Remote end upgrades. Main pump station substation with 5 MVA 34.5/4.16-kV transformer.
Pump Station ML#38	To Be Determined	Assuming 4.3 miles of 115-kV line to a 115/4.16-kV substation. This pump station will be installed if the project meets the 591,000 bpd capacity.
		CUSHING EXTENSION
Kansas		
Pump Station CE#30	To be determined by utility contacts	Approximately 2.5 miles of 230-kV transmission line tapped off an existing 230-kV line. Main pump station substation with a 15 MVA transformer. Remote end upgrades as required.
Pump Station CE#32	To be determined by utility contacts	Approximately 9 miles of 138-kV transmission line tapped off an existing 138-kV line. Main pump station substation with a 10 MVA transformer. Remote end upgrades as required.
OKLAHOMA		
Pump Station CE#33	To be determined by utility contacts	Approximately 0.8 mile of 138-kV transmission line tapped off an existing 138-kV line. Main pump station substation with a 12 MVA transformer. Remote end upgrades as required.

After the completion of startup and testing, the pump station sites will be graded. A permanent security fence will be installed around each pump station site.

Where delivery and pigging facilities are co-located with pump stations, the delivery and pigging facilities will be located entirely within the pump station sites. Construction activities will include clearing, grading, trenching, installing piping, erecting buildings, fencing the facilities, cleanup, and restoration. The delivery facilities will operate on locally provided power (**Table 2.1-7**).

Mainline valve construction will be carried out concurrent with the construction of the pipeline. Where practical, mainline valves typically will be located near public roads to allow year-round access. If necessary, permanent access roads or approaches will be constructed within the permanent ROW to each mainline valve site.

The construction of pig launchers and receivers will be carried out concurrent with the construction of the pump stations and delivery facilities. Activities such as clearing, grading, trenching, and clean-up will occur simultaneously with construction activities associated with the pump stations and delivery facilities.

2.1.8.4 Construction Workforce and Schedule

Keystone proposes to begin construction in early 2008. Construction is expected to last 18 months, ending in September 2009. Keystone proposes to commence service by November 30, 2009. Work on the Cushing Extension will begin in late 2009 or early 2010, with an in-service date for the Cushing Extension of 2010. Keystone anticipates a peak workforce of approximately 2,500 to 3,000 construction personnel. Construction personnel will consist of Keystone employees, contractor employees, construction inspection staff, and environmental inspection staff.

Keystone is planning to build the Keystone Mainline in four or five spreads and the Cushing Extension in one or two spreads (**Table 2.1-8**). Construction activity will occur simultaneously on the four or five Keystone Mainline spreads.

Table 2.1-8 Construction Spreads Associated with the Keystone Pipeline Project

Spread Number	Location	Approximate Distance within Construction Spread (miles)
	KEYSTONE MAINLINE	
Spread 1	Cavalier, ND to Spink, SD	300 miles
Spread 2	Beadle, SD to Gage, NE	330 miles
Spread 3	Marshall, NE to Chariton, MO	215 miles
Spread 4	Chariton, MO to Patoka, IL	220 miles
	CUSHING EXTENSION	
Spread 5	Jefferson, NE to Cushing, OK	300 miles

Keystone anticipates 500 to 600 construction and inspection personnel associated with each spread. Each spread will require 15 months to complete. All construction work is expected to be completed by the end of September 2009. Currently, Keystone proposes construction of the aboveground facilities in the spring of 2008. Construction of each pump station will require approximately 20 to 30 additional workers. Construction of pump stations will be completed in 18 months.

Keystone, through its construction contractors and subcontractors, will attempt to hire temporary construction staff from the local population. At peak workforce, Keystone anticipates that an average of 10 to 15 percent of the total construction workforce may be hired locally, with the remaining portion of the workforce (85 to 90 percent or more) consisting of non-local personnel.

Only work vehicles will be allowed on the construction ROW or additional temporary workspace areas during construction.

2.1.8.5 Future Plans and Abandonment

<u>Future Plans</u>

As discussed in Chapter 1.0, the Keystone Pipeline system initially will be capable of transporting 435,000 bpd and is expandable up to a capacity of approximately 591,000 bpd. While there is no certainty that the project will reach its full potential, all of the additional pumps and one additional pump station that will be required to achieve maximum capacity have been addressed in this ER.

Keystone is evaluating the potential construction of the Cushing Extension. In November of 2005, TransCanada conducted an Expression of Interest for the Cushing Extension during the Keystone Pipeline Project's Open Season. Sufficient interest was received to warrant further development of the Cushing Extension project. A subsequent Open Season is necessary to solicit binding contract commitments to support the project. TransCanada anticipates conducting an Open Season for the Cushing Extension in late 2006 to early 2007. If sufficient shipper support is received during the Open Season, Keystone would likely proceed with construction activities necessary to meet an estimated in-service timeframe of late 2010.

If Keystone receives the additional contractual commitments required to support construction of the Cushing Extension, additional pumping units at pump stations upstream of Mainline MP 632 will be required. Additional upstream stations and additional upstream pipeline construction will not be required.

Abandonment

The proposed Keystone pipeline is expected to operate for 50 or more years. Keystone has not identified plans for abandonment of these facilities at this time. If abandonment of any facilities is proposed in the future, the abandonment will be subject to approvals by state and/or federal agencies having jurisdiction. Abandonment will be implemented in accordance with then-applicable permits, approvals, codes, and regulations.

2.1.9 Operation and Maintenance

Keystone will operate and maintain the project facilities in accordance with the USDOT regulations in 49 CFR Parts 194 and 195 and other applicable federal and state regulations. Operation and maintenance of the pipeline system in most cases will be accomplished by Keystone personnel. Keystone estimates that operation of the pipeline will require approximately 20 employees in the U.S.

2.1.9.1 Normal Operations and Routine Maintenance

The pipeline will be inspected periodically from the air and on foot as operating conditions permit but no less frequently than as required by 49 CFR Part 195. These surveillance activities will provide information on possible encroachments and nearby construction activities, erosion, exposed pipe, and other potential concerns that may affect the safety and operation of the pipeline. Evidence of population changes will be monitored and High Consequence Areas identified as necessary. Mainline valves also will be inspected annually and the results documented.

In order to maintain accessibility of the ROW and to accommodate pipeline integrity surveys, woody vegetation along the pipeline ROW periodically will be cleared over the pipeline. Cultivated croplands (such as wheat and corn) will be allowed to grow in the permanent ROW. Large trees will be removed from the permanent ROW. Keystone will use mechanical mowing or cutting along its ROW for normal vegetation maintenance.

During operations, Keystone will monitor the pipeline and conduct pipeline integrity surveys to identify any potential integrity concerns. Plans related to waterbodies, wetlands, and upland areas are discussed in Keystone's Plan (Appendix E). Operation and maintenance procedures, including record keeping, will be performed in accordance with the USDOT requirements. Keystone will survey the ROW to identify areas where permanent erosion control devices require repair or additional erosion control devices are necessary to prevent future degradation.

Keystone will further monitor the ROW to identify any areas where soil productivity has been degraded as a result of pipeline construction and reclamation measures will be implemented to rectify any such concerns. Applicable reclamation measures are outlined in the Plan (Appendix E).

Supervisory Control and Data Acquisition (SCADA) facilities will be located at all pump stations and delivery facilities. The pipeline SCADA system will be capable of the following functions:

- Mainline valve position remote indication;
- Mainline valve remote closing and opening control from a control center;
- Remote indication of line pressure and temperature; and
- Remote indication of delivery flow and total flow.

The Keystone pipeline will have a control center manned by an experienced and highly trained crew 24 hours per day for 365 days per year. A backup control center also will be constructed.

Communications systems will provide up-to-date information from the pump stations to the control center plus the capability to contact field personnel. A backup communications system will be included within the system design and installation. The control center has state-of-the-art pipeline monitoring systems including a leak detection system that will indicate out-of-normal conditions (see Section 2.1.8.2, Abnormal Operations) and initiate visual and audible alarms if they detect an operating condition that warrant operator investigation. Serious abnormal situations that are not investigated will initiate automatic pipeline shutdown systems.

Crude oil moves along the pipeline at approximately three miles per hour, similar to the pace of an individual walking. The movement of crude oil within a pipeline results in friction between the crude oil and the pipe, so pump stations are installed to generate pressure, up to 1,440 pounds per square inch (psi), to push the crude oil down the pipeline.

2.1.9.2 Abnormal Operations

Abnormal operating procedures will be implemented whenever appropriate in accordance with 49 CFR Section 195.402(d). In the event of any unusual situation, the operations manager on duty will alter the pipeline's operation. In the event pressure indications show a change, higher or lower, the pipeline controller will immediately make an evaluation. If a leak is suspected, Keystone will initiate its Emergency Response Plan (ERP) (submitted to the Department of State on July 1, 2006).

If a leak is suspected and the pipe is shutdown, the operation of the segment will not be resumed until the cause of the alarm (e.g., false alarm by instrumentation) or the leak is identified and repaired. If a reportable leak were to occur, USDOT approval will be required to resume operation of the affected segment.

Keystone will perform aerial surveillance of the pipeline ROW at least 26 times a year, in accordance with 49 CFR Part 195. In addition to visual surveillance and operator diligence, Keystone will employ two technology-based leak detection systems to facilitate the early detection of pipeline leaks. These systems include:

- Leak detection software associated with the SCADA monitoring system; and
- Volumetric balancing.

As described above, Keystone's SCADA system will constantly monitor pipeline operation to quickly detect abnormal operation, including the detection of leaks. The SCADA system and leak detection software will fully comply with industry standards (API 1149). Using real-time dynamic flow modeling software, line-pack compensated volumetric balancing, and a hydraulic gradient model, the SCADA system will check pipeline conditions (e.g., flow rates, pressure, temperature, and fluid density) every three to five seconds while the pipeline is actively transporting crude oil. Pressure transducers and other monitoring equipment will be located at pump stations and data from these locations will be transmitted via satellite to the centralized SCADA location. The SCADA system will acquire and accumulate these data, which will then be fed into a leak detection model for analysis and trending. Real-time measurements will be analyzed against predetermined thresholds; if a predetermined threshold is exceeded, the information will be sent to the SCADA system, and the operator will be informed to take corrective actions. Compared to older leak detection programs, line-pack compensated volume-balancing represents an improved method for volume accounting that calculates changes in fluid volume within the pipeline.

When the Keystone pipeline is not actively transporting oil, the pipeline will enter a "static" mode. Since crude oil will not be moving, the pressures between pressure transducers should remain relatively constant after accounting for temperature changes and other minor pressure changes.

Emergency Response Procedures

Potential system emergencies include leaks or fires located near or directly involving a pipeline or pipeline facility and pipeline or pipeline facility damage from natural and human causes. If an emergency were to occur, pipeline flow will be stopped and will not resume until the cause of the problem (e.g., instrumentation failure or leak) is detected and repaired.

Keystone will be required to prepare site-specific ERPs for the system, which will be submitted to and approved by the OPS prior to operation. A preliminary draft ERP has been submitted to the Department of State (July 1, 2006). The ERP will: 1) establish guidelines and procedures to be followed in emergencies and to minimize hazards resulting from pipeline emergencies, 2) establish procedures for training Keystone's employees on emergency procedures, and 3) establish guidelines for continuing educational programs designed to inform the public of the procedures to follow in recognizing and reporting an emergency condition in compliance with the recommended practice of API 1162.

If a spill were to occur, Keystone will be required to immediately notify the National Response Center (NRC) in the event of a release of crude oil that: 1) violates water quality standards, 2) creates a sheen on water, or 3) causes a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines (40 CFR Part 112). In addition to the NRC, Keystone will make timely notifications to other agencies, including the appropriate Local Emergency Planning Committees (LEPCs), sheriff's departments, the applicable state's DEQ, USEPA, and affected landowners.

In many cases, oil spill responses could be handled by Keystone. However, some spills may require assistance from local, state, or federal agencies. Under the National Contingency Plan, USEPA is the lead federal response agency for oil spills occurring on land and in inland waters. USEPA will evaluate the size and nature of a spill, its potential hazards, the resources needed to contain and clean it up, and the ability of the responsible party or local authorities to handle the incident. The USEPA will monitor all activities to ensure that the spill is being contained and cleaned up appropriately. All spills meeting legally defined criteria (see criteria above per 40 CFR Part 112) must be monitored by the USEPA, even though most spills may be small and cleaned up by the responsible party. In the unlikely event of a large spill, Keystone and its contractors will be expected to take the lead in recovery and cleanup. The role of local emergency responders is typically to notify community members, direct people away from the hazard area, and address potential impacts to the community such as temporary road closings.

A fire associated with a spill is relatively rare. According to historical data (OPS 2005), only about four percent of reportable liquid spills are ignited. In the event of a fire, local emergency responders will execute the roles listed above and firefighters will take actions to prevent the crude oil fire from spreading to adjacent foliage or structures. Fire departments might choose to extinguish a small- or moderate-sized crude oil fire, but in many cases the best course of action may be to let the fire burn itself out. Local emergency responders typically are trained and able to execute the roles described above without any additional training or specialized equipment. Keystone also will work with emergency response agencies to provide pipeline awareness education and other support.

Remediation

Corrective remedial actions will be dictated by federal regulations and enforced by the USEPA and OPS. Required remedial actions may range from the excavation and removal of contaminated soil to allowing the contaminated soil to recover through natural environmental fate processes (e.g., evaporation, biodegradation). Decisions concerning remedial methods and extent of the cleanup will consider state-mandated remedial cleanup levels, potential effects to sensitive receptors, volume and extent of the contamination, exceedences of water quality standards, and the magnitude of adverse impacts that will be caused by remedial activities.

In the event of a spill, several federal regulatory programs define the notification requirements and required response actions, including the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300), the CWA, and the Oil Pollution Act. At the most fundamental level, these interlocking programs mandate notification and initiation of response actions in a timeframe and on a scale commensurate with the threats posed. They also establish a required endpoint for response actions: the mitigation of any unacceptable threat to human health or the environment. The cumulative result of these regulatory constraints is that the adverse impacts of a release event will be temporary and baseline conditions ultimately will be restored.

2.2 No Action Alternative

If the No Action Alternative were selected, the Department of State would not issue a Presidential Permit to Keystone. The Keystone Pipeline Project would not provide needed pipeline capacity to transport WCSB crude oil supplies. The Keystone Pipeline Project would not provide the U.S. with a source of relatively stable and secure North American crude oil supplies to the Midwest and Gulf Coast markets, thereby continuing the U.S. dependence of foreign offshore oil supply.

While the No Action Alternative would eliminate the environmental impacts directly associated with the Keystone Pipeline Project, it will not necessarily result in an overall reduction in impacts to the public because crude oil likely will continue to be transported to these markets by other pipeline routes or alternative transportation methods (see System Alternatives).

2.3 System Alternatives

Two alternatives could potentially provide most of the proposed crude transportation services to Midwest U.S. markets.

Enbridge's Alberta Clipper, Southern Access Expansion, Southern Access Extension and Hypothetical Spearhead Expansion Projects

In 2006, Enbridge announced a proposal to develop the Alberta Clipper project. Alberta Clipper, and previously announced Southern Access Expansion (the "Enbridge Projects") are proposals to construct new pipelines that would parallel Enbridge's mainline oil pipeline between Alberta, Canada and northern Illinois. The Southern Access Extension proposal is new pipeline construction extending Enbridge's pipeline system from Flanagan, Illinois to Patoka, Illinois and the Spearhead expansion proposal is a hypothetical looping of the existing Spearhead pipeline from Chicago to Cushing.

Enbridge proposes that the pipelines would provide additional capacity of approximately 400,000 bpd and could be in operation by the end of the decade. If constructed, the Enbridge Projects could represent a $2.4-billion expansion (U.S. portion only) of Enbridge's mainline.

Enbridge's mainline oil pipeline follows a south-east route from Edmonton, Alberta, Canada across the Canada-United States border near Neche, North Dakota and continues through Minnesota to Superior, Wisconsin and then south to Chicago, Illinois.

Enbridge's Alberta Clipper project proposes construction of a new oil pipeline commencing in Alberta, Canada terminating at their Superior, Wisconsin terminal.

Enbridge's Southern Access Expansion project proposes construction of a new oil pipeline from Superior, Wisconsin to Flanagan, Illinois.

Enbridge's Southern Access Extension project proposes construction of new oil pipeline from Flanagan, Illinois south to Patoka, Illinois.

In total, the Enbridge Projects would require construction of approximately 955 miles of new pipeline, consisting of 501 miles of 36-inch pipe and 454 miles of 42-inch pipe.

Enbridge's Spearhead oil pipeline follows a route south-west from Chicago, Illinois through Missouri to Cushing, Oklahoma, and currently has a capacity of approximately 125,000 bpd. Keystone evaluated the existing Spearhead system and determined that additional facilities, in the order of an estimated 655 miles of new 30-inch pipeline, would be needed in order for Spearhead to provide a volume of crude oil delivery to Cushing, Oklahoma equivalent to that proposed by Keystone.

The hypothetical "Spearhead-Cushing Expansion" pipeline would likely be constructed adjacent to the existing Spearhead pipeline at an estimated capital cost of approximately $900 million.

Hypothetical Kinder Morgan Express – Platte Pipeline System Expansion and Cushing Extension

The Express Pipeline (existing 24-inch pipe) interconnects with the Platte Pipeline (existing 20-inch pipe) at Casper, Wyoming. This 1,700-mile pipeline system transports oil sands crude oil from Alberta's oil sands in Hardisty, Alberta to refineries in the U.S. Rocky Mountain and Midwest regions. In the U.S., the pipeline crosses Montana, Wyoming, Nebraska, Kansas, Missouri, and terminates in Wood River, Illinois.

Kinder Morgan has not announced any proposals to expand this system. Nevertheless, the construction of a parallel pipeline is evaluated by Keystone as a system alternative in this ER.

The hypothetical construction of a new pipeline that would parallel the Express-Platte Pipeline system would consist of 1,282 miles pipeline in the U.S. To transport a volume of crude oil similar to Keystone, the pipeline likely would consist of a 30-inch-diameter pipeline and would require 27 pump stations. Keystone evaluated the Express-Platte Pipeline system to determine the additional facilities needed in order to provide an equivalent level of crude oil delivery to Cushing, Oklahoma, as that proposed by Keystone. It is estimated that an additional 292 miles of new 30-inch pipeline would be required. This pipeline mileage requirement would be same as that required for Keystone (an extension could be constructed from the existing Platte Pipeline to Cushing along the same route proposed by Keystone). Keystone estimated capital cost for 1,574 miles of new 30-inch pipeline and pumping facilities would be approximately $2.1 billion.

System Alternatives Comparisons

Table 2.3-1 compares the Keystone Pipeline Project with the Enbridge Projects and hypothetical Spearhead-Cushing Expansion, and with the hypothetical Express-Platte to Cushing Extension. The U.S. portion of the proposed Keystone Mainline is similar in length to the Enbridge Projects, but is substantially shorter than the Express-Platte Pipeline System (not including the additional miles of hypothetical pipeline necessary for each to deliver equivalent volumes of crude to Cushing, Oklahoma) (**Table 2.3-1**). The Enbridge Projects propose to deliver crude oil directly to Midwestern markets, but will provide a less direct route to provide crude oil deliveries to the Cushing refineries compared with the Cushing Extension portion of the Keystone Pipeline Project and cannot meet the market need proposed to be met by the Keystone Project.

Table 2.3-1 Comparison of the Keystone Pipeline System with Two Other System Alternatives

	Keystone Pipeline Project	Enbridge Projects and Spearhead-Cushing Expansion	Hypothetical Kinder Morgan Express-Platte Pipeline System Expansion and Cushing Extension
Delivery Points	Midwestern, U.S. and Cushing, Oklahoma	Midwestern, U.S. and Cushing, Oklahoma	Midwestern, U.S. and Cushing, Oklahoma
Miles of Pipe to Midwestern markets (Canada and U.S.)	1,078	955	1,282
Additional Miles of Pipe to Cushing	292	655	292
Total Miles	1,370	1,610	1,574
Project Cost (U.S. portion only)	$2.0 billion	$3.3 billion	$2.1 billion
Project Status	• Regulatory application submitted – April 2006 • Secured contracts for 340,000 bpd	• Southern Access-approved • Southern Access Extension – proposed • Alberta Clipper-proposed • Spearhead Loop – not proposed	Not Proposed
In-Service Date	November 2009	Unknown	N/A

The Keystone Pipeline Project is proposed to transport incremental crude oil production from the WCSB to meet growing demand by refineries and markets in the U.S. for stable, secure, on-shore crude oil supplies. Demand in the U.S. is forecast to grow by 17 percent, or 3 million bpd by 2015 (Section 1.2, Purpose and Need of Project). According to forecasts of crude production based on approved and planned projects, crude production volume in Alberta will exceed pipeline export capacity by 2009 if major expansion or new pipeline systems are not built. Keystone's analysis of this same date supports this conclusion and has led Keystone to target completion of the pipeline by 2009. This conclusion has been confirmed by the fact that shipper commitments to utilize the pipeline have indicated that service on the Mainline is required by 2009.

Keystone is the only identified system alternative in a position to meet the increased demand for crude oil within the timeframe required. At this time, no expansion of the Express-Platte System has been proposed. Also at this time, the proposed expansions and extension of the Enbridge mainline will not meet the market need for deliveries to Cushing proposed to be met by Keystone. Keystone is the only identified alternative that has secured contractual commitments from customers to ship crude oil on the Keystone Pipeline. Keystone has secured long-term transportation contracts with customers totalling 340,000 bpd with an average term of 18 years.

Keystone proposes the least cost and most direct route to deliver to Cushing, OK and proposes an in-service date for deliveries to the Midwestern U.S. that meets the forecast increased demand for crude oil. All identified alternatives involve the construction of substantial lengths of new pipelines, all with sections of new pipeline construction located to some degree adjacent to existing pipelines and other previously-disturbed linear right of ways, and all involving attendant environmental impacts and disturbance.

In the end, Keystone is the only identified system alternative in a position to meet the increased demand for crude oil within the timeframe required.

The No Action Alternative for the Keystone Pipeline Project will likely result in the implementation of Enbridge's Projects, the hypothetical Kinder Morgan Express-Platte Pipeline System Expansion and Cushing Extension, and/or other pipeline system alternatives to transport the increasing WCSB crude oil supply. These system alternatives also will have environmental impacts specific to their routes, which could be less than or greater than the Keystone Pipeline Project.

2.4 Alternatives

2.4.1 Pipeline Route Alternatives

2.4.1.1 General

The proposed route for the Keystone Pipeline 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.

The process followed by Keystone is shown graphically shown in **Figure 2.4-1** and is described in the following text.

2.4.1.2 Phase I Route Selection and Alternatives Analysis

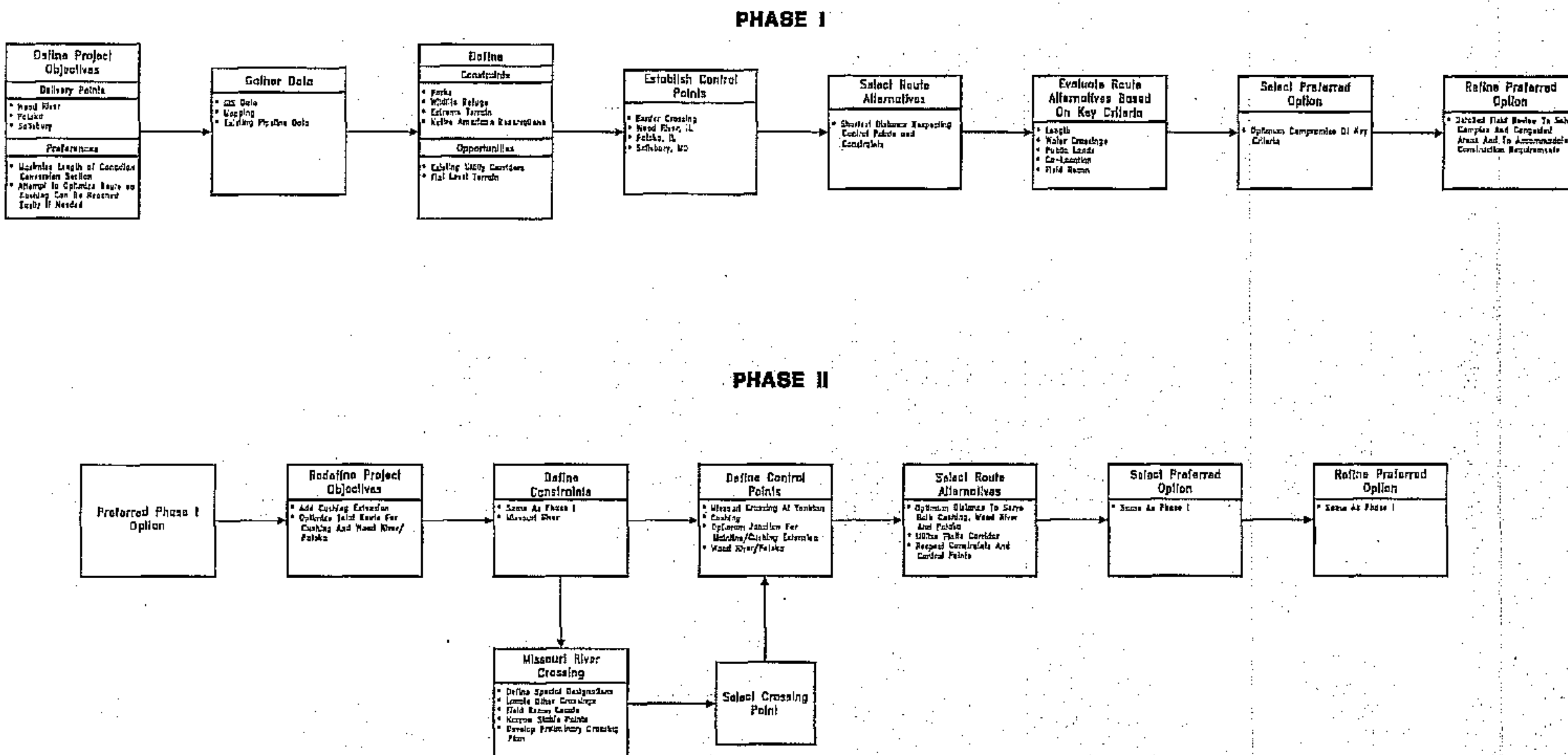
Objectives

Several high level objectives were established for the Keystone Pipeline Project which serve to define the project. These include the following:

1. Gas Pipeline Conversion: Converting an underutilized natural gas pipeline in Canada to crude oil service will result in Keystone pipeline crossing into U.S. generally in the vicinity of Gretna, Manitoba at the Manitoba/North Dakota border. **Figure 2.4-2** illustrates the Keystone natural gas pipeline segment in Canada between Alberta and Ontario that would be converted.

2. Market endpoints: Based on shipper requests, the primary market endpoints are: 1) Salisbury, Missouri (an interconnection point with other crude oil pipelines as well as tank storage); 2) the Conoco Phillips refinery at Wood River, Illinois; and 3) Patoka, Illinois (an interconnection point with other crude oil pipelines as well as tank storage).

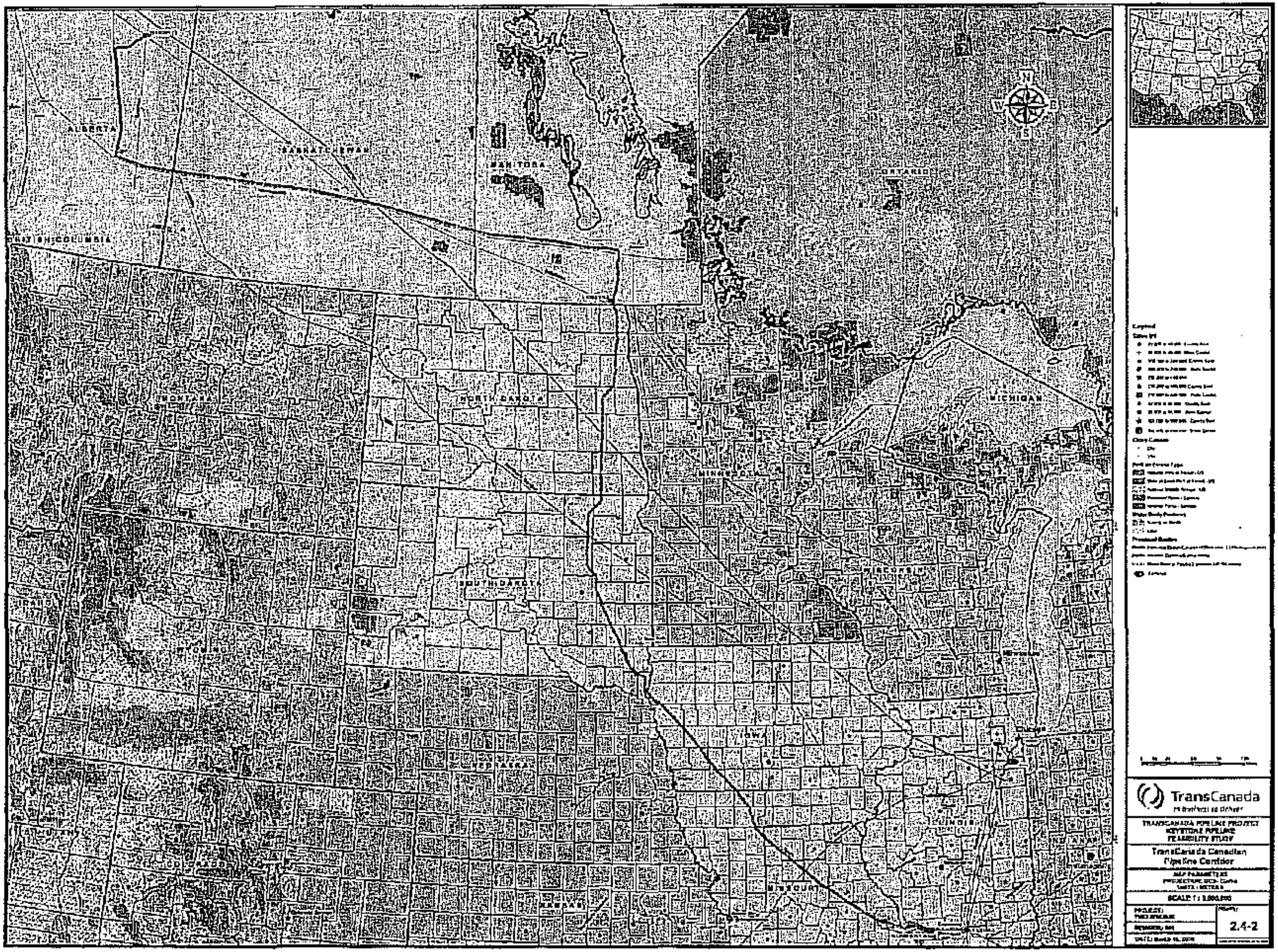
3. Cushing and Gulf Coast Refineries: While not considered an initial market point, the ability to economically access Cushing, Oklahoma, and, therefore, Gulf Coast refineries, was a desired objective of the system.



TransCanada

KEYSTONE PIPELINE PROJECT ROUTE ALTERNATIVES ANALYSIS PROCESS

FIGURE 2.4-1


ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
MICHIGAN
NEBRASKA
IOWA
MISSOURI
KANSAS
TransCanada
TRANSCANADA PIPELINE PROJECT
KEYSTONE PIPELINE
FEASIBILITY STUDY
TransCanada Canadian
Pipeline Corridor
2.4-2

Data Gathering

Based on these basic objectives, a general geographic region of interest was established. Data was then gathered for this region. These data included the following:

- Topographic Quadrangle Maps (1:250,000 Scale)
- Topographic Quadrangle Maps (1:24,000 Scale)
- Delorme State Atlas Gazetteer Data
- Aerial Photography from various sources
- Geographic Information System (GIS) layers containing federal and state environmental and land use data

All these data were compiled into a GIS-based constraint data set of the area to support the identification and evaluation of route options.

Constraints and Opportunities

A number of primary and secondary constraints were identified to guide the route selection process. With respect to Primary constraints it is the general objective to avoid these features. Where this is not possible, the objective is to minimize them to the extent possible. With respect to Secondary constraints, the objective generally is to avoid, if possible, or otherwise minimize. These include:

Primary

- Federal and State lands
- Large waterbodies
- Native American and military lands
- Extreme terrain
- Large wetland complexes
- Urban areas
- Wildlife refuges

Secondary

- Water crossings
- Wetland crossings
- Waterfowl production areas
- Irrigated croplands
- Bedrock
- Rural communities
- Aquifers

- Extensive forested areas
- Residences and associated features such as driveways, outbuildings and wind breaks

Opportunities refer to those features which are favorable features for pipeline routing and generally serve to simplify construction and decrease disturbance. These include:

- Existing linear features such as pipelines, power lines and roadways. Pipelines are typically preferred.
- Flat or gently rolling terrain
- Soils which can be readily excavated
- Non-forested areas

Definition of Control Points

The following control points served to define the route:

- U.S./Canada border crossing near Gretna, Manitoba
- Desire to pass near Salisbury, Missouri
- Delivery point at Wood River, Illinois
- Delivery point at Patoka, Illinois
- Desire to remain competitive to serve Cushing, Oklahoma

Route Alternatives Identification

Based on the above information and objectives, a number of route alternatives and alternative route segments were developed. These routes and route segments met the basic project objectives. These routes and route segments respected the constraints and opportunities to varying degrees.

The following paragraphs provide an overview of the characteristics of each of the major route alternatives and alternative route segments. These alternatives are illustrated on **Figure 2.4-3.**

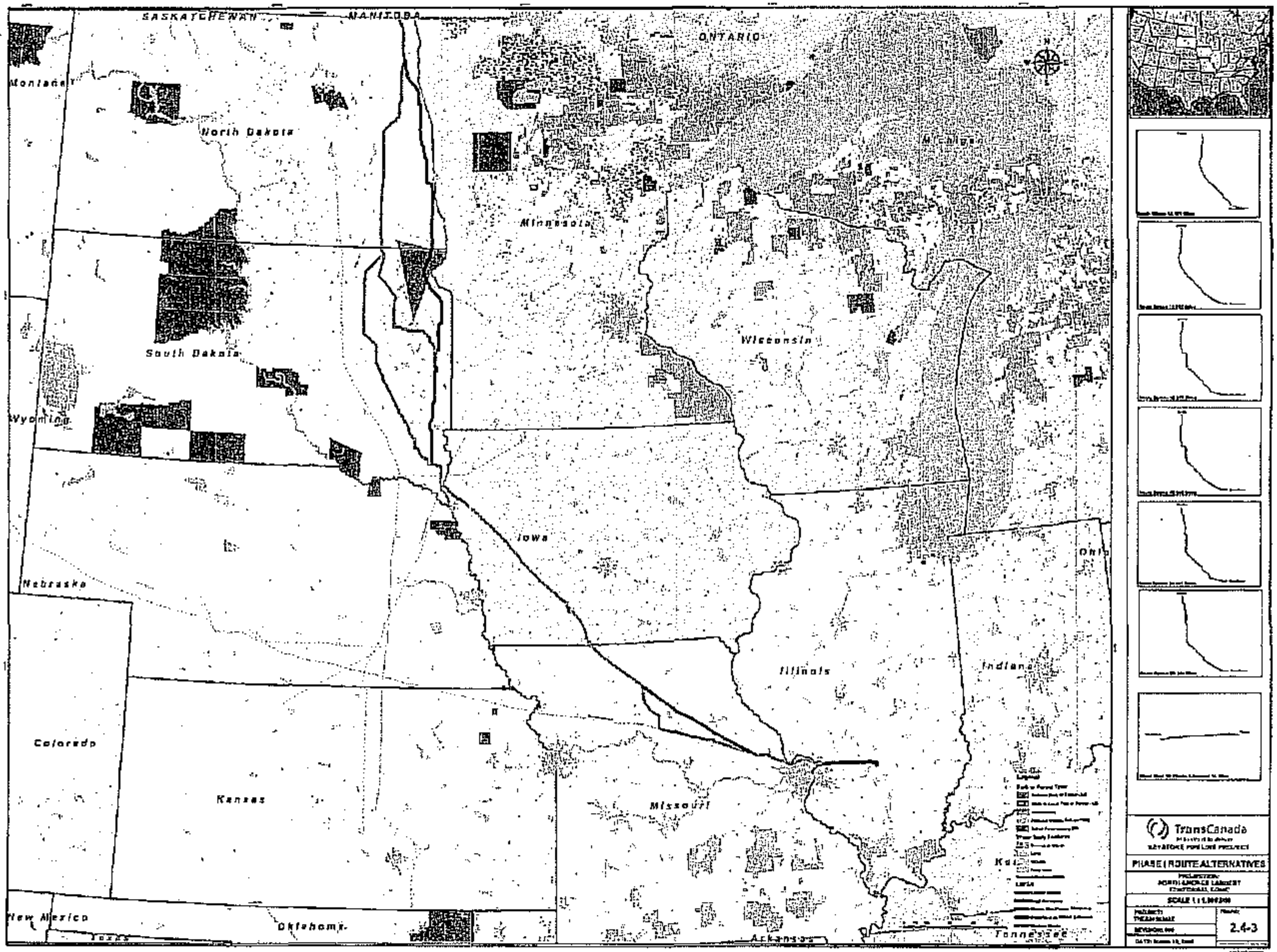
Western Alternative

The Western Alternative (Route 1A) begins at the Canada/North Dakota border due south of Gretna, Manitoba and runs along a westerly route to the Conoco Phillips refinery in Wood River, Illinois. The Lake Traverse Indian Reservation in South Dakota is avoided. The Western Alternative maximizes co-location with railroads, highways and roads and utility corridors. The total length of Western Alternative is approximately 971 miles.

From the Canada/North Dakota border, the Western Alternative runs due south, co-locating along the Burlington Northern Railroad and the Northern Pacific Railroad through northern North Dakota. The line then co-locates along a utility corridor, veering just to the north of Golden Lake State WMA, and continuing along Highway 32 through southern North Dakota.

In South Dakota, the line extends to the southwest along the Burlington Northern Railroad, avoiding the Lake Traverse Indian Reservation and then due south along Highway 27. South of Doland, the line turns towards the southeast and follows an old railroad corridor to Iowa.

Entering Iowa just north of Sioux City, South Dakota, the line co-locates along a utility corridor to the southeast. North of Creston, Iowa, the line turns to the south around Creston and co-locates along county roads to Missouri.



SASKATCHEWAN
MANITOBA
ONTARIO
Montana
North Dakota
South Dakota
Wyoming
Minnesota
Wisconsin
Iowa
Nebraska
Colorado
Kansas
Missouri
Illinois
Indiana
New Mexico
Texas
Oklahoma
Arkansas
Tennessee
TransCanada
PHASE I ROUTE ALTERNATIVES
2.4-3

In Missouri, the line co-locates with the Koch petroleum pipeline to just north of Brookfield, Missouri. The line co-locates with Highway 11 and utility corridors to the south through Salisbury, Missouri, a possible delivery point. From Salisbury, the line co-locates with the Platte petroleum pipeline system. West of Troy, Missouri, the line runs north following a power line corridor around Troy, avoiding anticipated commercial and residential expansion from the city. The line then turns to the south crossing the Cuivre River and co-locates with the Platte pipeline. Then the line co-locates with the Platte pipeline to the Mississippi River.

The line then crosses the Mississippi River into Illinois and continues into Wood River, Illinois. The segment between Wood River and Patoka, Illinois, will parallel the existing Buckeye Pipeline.

Eastern Alternative Segment

The Eastern Alternative provides an alternative to part of the Western Alternative. The Eastern Alternative parallels the North Dakota-Minnesota border, on the North Dakota side. The Eastern Alternative reduces the pipeline length by approximately nine miles relative to the Western Alternative.

The Eastern Alternative deviation from the Western Alternative begins north of Grafton, North Dakota, and co-locates with Interstate 29 south to South Dakota. In South Dakota, the line crosses into the Lake Traverse Indian Reservation. The line then co-locates with the Northern Pacific Railroad. This routing minimizes the route through the reservation and avoids the Coteau des Praires wetlands. Outside Milbank, South Dakota, the line turns south along Highway 15 to Interstate 29. The line then co-locates along Interstate 29 south to south of Beresford, South Dakota, where it then follows the Western Option to Wood River.

Coteau des Praires Alternative Segment

The Coteau des Praires Alternative provides an alternative to part of the Eastern Alternative in South Dakota. This segment deviates from the Western Option just south of the North Dakota-South Dakota border and merges with the Eastern Option east of Lake Poinsett at the intersection of Highway 28 and Interstate 29 in South Dakota. The Coteau des Praires Alternative runs through the Coteau des Praires of South Dakota and is approximately 126 miles. The line then co-locates with Interstate 29, continuing southeast for 20 miles, where it joins the Eastern Alternative.

Koch Alternative Segment

The Koch Alternative deviates from the Western Alternative after the line crosses into Missouri from Iowa. The Koch Alternative co-locates with the Koch petroleum pipeline for approximately 136 miles to the southeast through the state of Missouri to the Western Alternative along the Platte pipeline system west of St Louis, Missouri. The Koch alternative does not pass through Salisbury, Missouri.

Combined Route Alternatives

The above routes and route segments can be combined to form a matrix of complete route alternatives. The combined route alternatives are illustrated on **Figure 2.4-3**. The relative lengths of the different alternatives are presented in **Table 2.4-1**.

<u>Route Alternative Evaluation</u>

Each route alternative was evaluated with respect to the key criteria noted below:

- Length
- Percentage of co-location with existing linear facilities
- Waterbody crossings

- Road crossings
- Rail crossings
- Utility crossings
- National parks
- Conservation areas
- Wildlife areas
- Native American and Military Lands

Table 2.4-1 Lengths of Keystone Route Options (Canadian Border to Wood River/Patoka)

Route Option	Route and the Corresponding Alternative	Total Mileage (to Wood River, IL)	Total Mileage (to Patoka, IL)
1A	Western Alternative	971	1,026
1B	Western + Koch Alternative	953	1,009
1C	Western + Coteau des Praires Alternative	977	1,033
1D	Western + Coteau des Praires + Koch Alternative	960	1,016
2A	Western + Eastern Option	961	1,017
2B	Western + Eastern + Koch Alternative	944	1,000

The evaluation of each route alterative with respect to these features is provided in **Table 2.4-2** below.

The following sections provide a summary of the conditions and potential issues associated with each route alternative.

Route 1A

- Nearly the entire route crosses privately owned cropland. As a consequence, the primary land use issue will be obtaining private land easements and establishing appropriate construction practices for these lands. Considerations for construction on croplands will be: duration of construction, topsoil stripping and segregation, drain tile repair, depth of soil cover, soil replacement and de-compaction, and rehabilitation of surface features (farm access roads, windbreaks, fences, and terraces on slopes, floodway berms in drainages, erosion control plantings in waterways. Livestock management is not a common land use, so issues such as fence management for livestock, grazing deferment, dairy operations and confined pig and chicken operations are not expected to be as relevant as those associated with cultivated lands.
- The route avoids developed water features (flood control dams, reservoirs) and there is no apparent interference with significant pivot irrigation systems. Small farm ponds may be avoided with future alignment adjustments. Small berms and levees on the smaller Missouri River tributaries will require repairs. Crossings of the large levees at the Mississippi-Missouri River confluences will be crossed with a method acceptable to the COE.
- This route avoids cities and towns, unincorporated rural communities and farmsteads. A reroute may be required near Troy, Missouri, where recent new residential and commercial development has encroached on the Koch Pipeline ROW. Route 1A parallels the Platte Pipeline between Troy and Wood River. A favorable characteristic is the lack of substantial residential or commercial development near the Mississippi River crossing.

Table 2.4-2 Phase I Route Alternatives – Length, Utility Co-location, and Crossing Comparisons

Route Option	Co-Location Percentage						Waterbody		Road Crossings				Land Use Crossings				
	Length (miles)	Railroad (%)	Powerline (%)	Road (%)	Pipeline (%)	Total (%)	Minor	Major	Minor	Major	Rail Crossings	Utility Crossings	National State Parks	National Forest Lands	Conservation Areas	Wildlife Areas	Indian/ Military Reserves
1A	1,024	15.5	17.6	22.1	7.1	62.3	1,038	90	1,351	18	115	91	2	0	0	6	0
1B	1,008	15.7	16.1	22.5	7.6	61.9	970	92	1,275	14	97	76	2	0	0	6	0
1C	1,031	8.9	17.5	29.8	7.3	63.5	1,135	110	1,304	20	113	94	2	0	0	6	0
1D	1,015	9.0	16.0	30.4	7.8	63.2	1,067	112	1,228	16	95	79	2	0	0	6	0
2A	1,016	9.8	18.1	35.1	7.4	70.4	1,139	69	1,272	25	105	101	2	0	0	5	1
2B	999	10.0	16.6	35.8	7.9	70.3	1,071	71	1,196	21	87	86	2	0	0	5	1

Notes:

Waterbody Crossing Classifications: Minor < 100 feet > Major width.

"Road Crossing Classifications: Minor = unpaved and paved local streets and two lane highways.

Major = four lane highways and interstates"

All of the route options above include the Wood River to Patoka Extension.

This crossing list was completed in greater detail than the assessment table illustrated in the respective routing report.

- Many utility crossings (roadways, railroads, and other pipelines) will be required for this project. The rural road network is well developed across all the states.
- Federal special management areas are avoided by this route. The route intersects two state wildlife management areas and one state park. WMAs could be avoided by minor reroutes.
- The primary environmental issue is related to agricultural fields and will involve soil management and productivity maintenance, erosion and sedimentation control during construction, and cropland rehabilitation. Because the land is farmed right up to stream channels that usually lack riparian woodland buffers, there is a potential for soil erosion and increased sedimentation into stream channels during high precipitation events.
- Throughout the length of the route, the perennial stream channels and adjacent floodplains have been highly modified by adjacent agricultural practices. As a consequence, the quality of any fisheries in these streams is anticipated to be very low and none of the stream crossings are located within public access areas designated for recreational use.
- The route avoids large wetland complexes, particularly in North and South Dakota. This routing reduces the need for extensive application of wetland crossing methods (i.e., mats and pipe pull-ins) and reduces potential issues with disturbance of nesting or resting waterfowl. The route does cross many small linear wetland features (primarily stream channels) that will require delineation.
- The entire route has been highly modified by agricultural land uses, and nearly the entire length has been plowed for crops since settlement. A few small areas (some pastureland in North Dakota, the Missouri River bluffs southeast of Sioux Falls, and small patches of forest on steep slopes in Missouri) may contain a high percentage of native vegetation.

Route 1B

- Route 1B is shorter than Route 1A. Route 1B follows an existing pipeline, which results in reduced new construction impact. It appears that Route 1B crosses a greater length of forest than Route 1A, but the forests are along existing ROW, which will minimize the amount of tree clearing. Residential and commercial areas exist near Troy, which may require rerouting. The environmental issues are substantially the same as Route 1A.

Route 1C

- Compared to Route 1A, Route 1C crosses a greater length of water and wetland crossings west of Watertown, South Dakota. Route 1C co-locates with Interstate 29 from Watertown to the Western Route near the Iowa state line. Impacts to croplands may be reduced by co-locating in the highway ROW, depending on the offsets required by USDOT.
- This route alternative will require open-water construction work in pothole ponds and lakes in South Dakota. The route also will require more wetland crossings than the equivalent segment of Route 1A. The level of disturbance to cropland soils will depend on where the USDOT will allow the pipeline to be constructed near the interstate highway. No wildlife management areas will be crossed by the alternative route segment.

Route 1D

- Route 1D consists of the Western Alternative and the Koch Pipeline Alternative (see Route 1B above) and includes the Coteau des Pierres Alternative. See the discussion for these two alternatives above.

Route 2A

- Route 2A parallels Interstate 29 in North and South Dakota from near the Canadian border to where it reconnects with the Western Route near the Iowa border. Adjacent land uses are cropland. Wet areas (pothole lakes and emergent wetlands) are the least extensive in North and South Dakota. Impacts to croplands may be reduced by co-locating in the existing highway ROWs, depending on the offsets required by USDOT. Co-location with the Interstate will require route deviations at interchanges and possible conflicts with commercial developments located adjacent to the interchanges. Route 2A crosses about 35 miles of the Traverse Lake Indian Reservation, parallel to Interstate 29. Land uses on the Reservation (cropland, pastureland, and residential) are comparable to those adjacent to the Reservation.

Route 2B

- Route 2B is the same as Route 2A except for the inclusion of the Koch Pipeline Alternative in Missouri. See the discussion of Route 2A and 1B above.

Wood River to Patoka

- Except the Carlyle Lake State Wildlife Management Area (CLSWMA), nearly the entire route crosses privately owned cropland and residential land. As a consequence, the land use issues include the need for private land easements and determining the construction practices for these lands. Major elements of the construction plans on croplands will be similar to that in Section Route 1A.
- The primary environmental issues will be agricultural soil management and productivity maintenance, erosion and sedimentation control during construction, and cropland rehabilitation. Because some of this land is farmed in close proximity to stream channels, there is high potential for soils to erode and for accelerated sedimentation to occur into stream channels during high precipitation events. Trench dewatering will require considerable planning and attention during construction.
- Throughout Illinois, perennial stream channels and adjacent floodplains have been highly modified by adjacent agricultural practices. As a consequence, the quality of any fisheries in these agricultural streams is anticipated to be very low. However, state-designated Wildlife Areas are likely to contain higher quality streams and organisms.
- The entire route has been highly modified by agricultural land uses and nearly the entire length has been plowed for crops since settlement.

Preferred Route Selection

After consideration of pipeline length, land use and other environmental factors, the Western Alternative (1A) was selected as the preferred initial pipeline route. The primary factors in this decision were:

1. Avoids the Traverse Lake Indian reservation.
2. Preserves a market desire to pass through Salisbury due to pipeline interconnection possibilities and the presence of tank storage.
3. Minimizes the number of waterbody, railroad and roadway crossings while preserving the above attributes.

2.4.1.3 Phase 2 Addition of Cushing Extension

Objectives

Because of shipper interest in delivering crude oil to storage terminals and pipeline interconnections at Cushing, Oklahoma, a pipeline routing exercise was undertaken to meet the original project objective of delivering crude oil to Wood River and Patoka, as well as delivering oil to Cushing. To accomplish this goal, the Phase I pipeline route was shifted westward to provide the opportunity to develop the shortest route possible between the Canadian border and Cushing. A route that will parallel the existing Platte Pipeline from southern Nebraska to Wood River was established as the best overall option to deliver oil to Wood River and Patoka.

Data Gathering

Data gathered for Phase II was as described for Phase I.

Constraints and Opportunities

Constraints and opportunities were as described for Phase I.

Definition of Control Points

Several key control points were considered in the assessment which affected the overall routing options for the project as follows:

- Canada/U.S. Border – the pipeline entry into the U.S. was as described for Phase I.
- Delivery Point at Cushing, Oklahoma, as well as the delivery and interconnect points required for Phase I.
- Missouri River: In order to economically serve Cushing, the primary route alternatives shift westward and now involve a crossing of the Missouri river in South Dakota/Nebraska. Much of the Missouri River in this area possesses special designation under the Wild and Scenic Rivers act. Additionally, a number of technical issues severely restrict where a crossing can be effectively installed. A technically appropriate and permittable crossing location heavily influenced the overall routing process.

Route Alternatives

Based on the above objectives, constraints, opportunities, and control points, a number of route alternatives and alternative segments were developed.

The following paragraphs provide an overview of the characteristics of each of the major route alternatives. These route alternatives and alternative segments are illustrated on **Figure 2.4-4**.

Missouri River Alternative Segments

Since the Missouri River crossing is a major control point, crossing location options serve to define key route alternatives.

The proposed pipeline will cross the Missouri River within a segment designated as a recreational river under the WSRA. A gap in this designation is located at Lewis and Clark Lake near Yankton, South Dakota. The Recreational River Segment extends approximately 53 miles downstream of Yankton to Ponca State Park, Nebraska.

Three options exist for crossing the Missouri River:

- Cross at the existing Kaneb Pipeline crossing within the special designation area.
- Cross at the gap between the two special areas at the Lewis and Clark Lake.
- Cross at an area outside of the special designated areas (downstream of the end of the Recreational River segment.

The crossing of the pipeline at the gap between the two special areas at the Lewis and Clark Lake was not pursued because the distance across the lake is too far for the preferred HDD method and the approaches to the lake involve considerable relief in the form of high ridges and steep slopes.

Accordingly, the remaining two options entail a crossing within the special designation near Yankton, South Dakota, and a crossing downstream of the designation which terminates at Ponca State Park.

The crossing at Yankton, South Dakota, is co-located with two existing pipeline crossings and is near a highway bridge. The crossing occurs at a relatively stable portion of the Missouri River where lateral migration is not expected to be significant.

The crossing downstream of the designated portion of the river occurs in a reach of the Missouri which is less laterally constrained but still possible technically.

Based on these two Missouri River crossing locations, two main route alternatives were selected and designated as the Western Alternative and the Eastern Alternative. These alternative routes are shown on **Figure 2.4-4.**

Western Route Alternative

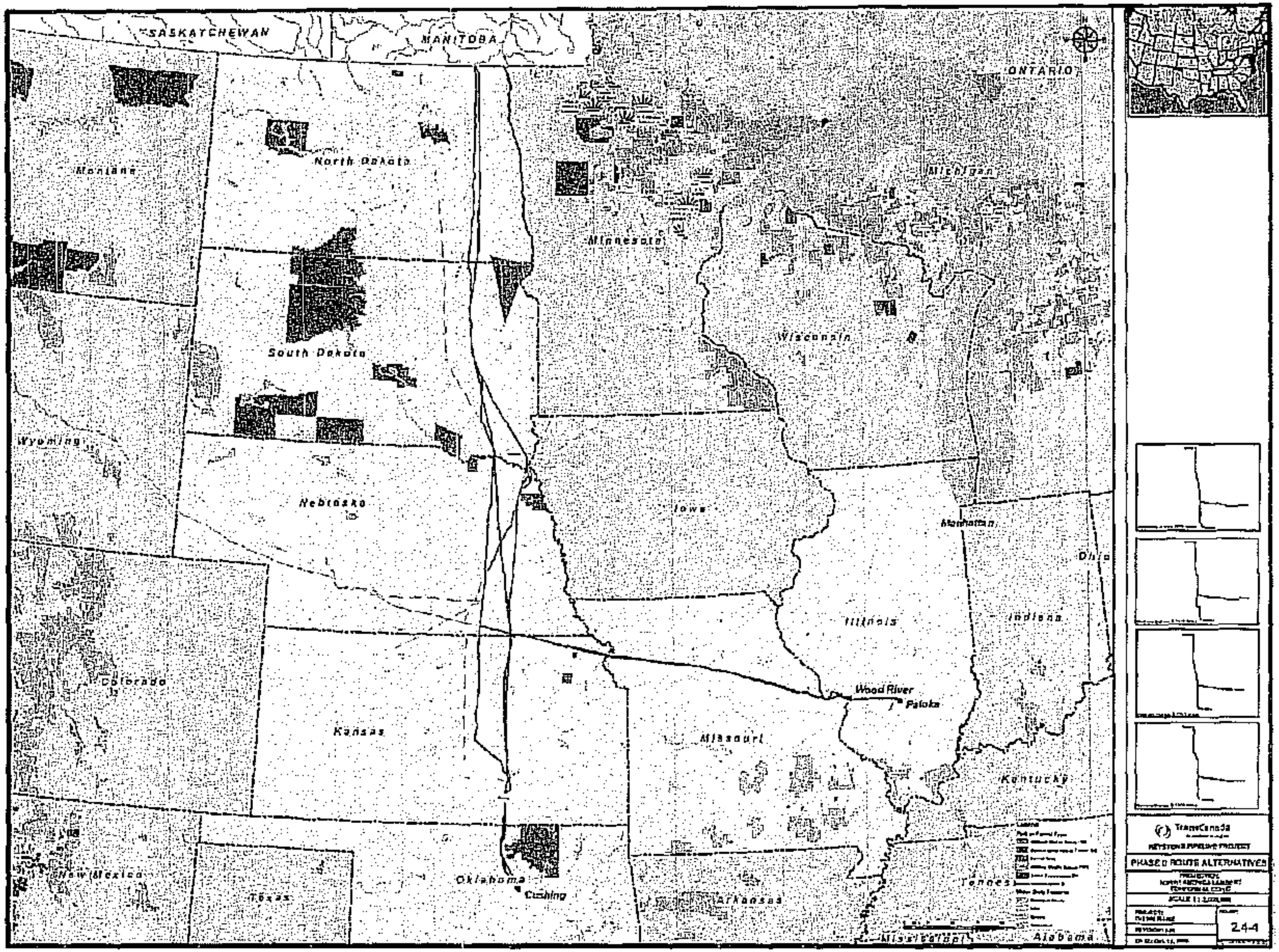
The Western Alternative consists of two sub alternatives, A and B.

Western Route Alternative A

Western Alternative A follows the Phase I Keystone Pipeline routing to a point just south of Carthage, South Dakota. From there, the route heads south along State Road 25 and begins its co-location with the existing Kaneb pipeline system. The pipeline will cross the Missouri River parallel to the existing Kaneb pipeline in an area managed by the NPS and designated as a Recreational River segment under the WSRA. The pipeline will be installed as a horizontal directional drill to minimize surface impacts. The route continues south into Kansas where the Kaneb pipeline terminates. From this point the route continues southeasterly along a new route segment that is not parallel to an existing pipeline into Cushing, Oklahoma. South of Hebron, Nebraska, the Platte pipeline crosses the Kaneb pipeline. It is at this point where the mainline will branch off and continue in a southeasterly direction to Salisbury, Missouri. From Salisbury, the mainline will continue along the Phase I Keystone route into Wood River and Patoka, Illinois.

Western Route Alternative B

Western route Alternative B will be the same as the Western Alternative A route from the U.S./Canada border to Yankton, South Dakota. At Yankton, the pipeline will be installed via a HDD across the Missouri River. The pipeline route will then diverge from western route Alternative B and extend directly south to Ponca City, Oklahoma, and turn southeasterly to the terminus at Cushing. The route between the Missouri River and Cushing will be in new ROW that is not co-located with an existing pipeline or other utility.


SASKATCHEWAN
MANITOBA
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North Dakota
South Dakota
Minnesota
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Indiana
Ohio
Colorado
Kansas
Missouri
Kentucky
New Mexico
Texas
Oklahoma
Arkansas
Tennes
Mississippi
Alabama
Wood River
Patoka
Cushing
TransCanada
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2.4-4

Eastern Route Alternative

The Eastern Alternative follows the Phase I Keystone Pipeline routing from the U.S./Canada border to the vicinity of the South Dakota/Iowa border. The route then crosses the Missouri River at the downstream end of the designated Recreational River at Ponca State Park, Nebraska. From Ponca State Park, the route extends directly south across Nebraska and Kansas to Ponca City, Oklahoma. From Ponca City to Cushing, the route will be the same as the Western Alternatives.

The lengths of the route alternatives are shown in **Table 2.4-3**. The mileages shown for each option begin at the Canada/U.S. border and include the routing to Cushing, Oklahoma, and to Wood River and Patoka, Illinois.

Table 2.4-3 Route Alternative Length Comparisons

Route	Mileage
Western Alternative A	1,414
Western Alternative B	1,363
Eastern Alternative	1,373

Route Alternative Evaluation

Each route alternative was evaluated with respect to the key criteria noted below:

- Length
- Percentage of co-location with existing linear facilities
- Waterbody crossings
- Road crossings
- Rail crossings
- Utility crossings
- National parks
- Conservation areas
- Wildlife areas
- Native American and Military Lands

The evaluation of each route alterative with respect to these features is provided in **Table 2.4-4 below.**

The following sections provide a summary of the environmental conditions and potential issues associated with each route option. The following are the primary land use and environmental issues identified, and relative similarities/differences among route options.

Western Alternative A

- As seen in **Table 2.4-3**, Western Alternative A is the longest of the three alternatives (1,414 miles), requiring the greatest surface disturbance.
- This Alternative crosses the Missouri River in the special designated area (Recreational River). This crossing will be an HDD, which will avoid channel disturbance within the river. This crossing method

will have to be technically feasible (underlying geologic conditions must be suitable for such a crossing method) and a crossing agreement will have to be reached with the NPS.

- The crossing location appears to be highly stable since the crossing is located approximately five miles downstream of the Gavins Point dam, which regulates river flows. The river also is directly adjacent to the City of Yankton and is near a highway bridge across the river.
- This alternative will parallel the existing Kaneb pipeline over the majority of its length.
- Approximately 30 more miles of pipe will be required to construct the Keystone Mainline pipeline to Wood River and Patoka than either Western Alternative B or the Eastern Alternative.

Western Alternative B

- As seen in **Table 2.4-3**, Western Alternative B is the shortest of the three alternatives (1,363 miles), requiring the least surface disturbance.
- This alternative will be constructed across the Missouri River at the same location as Western Alternative A, with the same construction and permitting issues.
- The segment between the Missouri River and Cushing will be new ROW, resulting in the establishment of a new utility corridor.
- Approximately 30 fewer miles of pipe will be required to construct the Keystone Mainline pipeline to Wood River and Patoka, as compared to Western Alternative A.

Eastern Alternative

- As seen in **Table 2.4-3** the Eastern Alternative is the second shortest of the three alternatives (1,373 miles), requiring the second least surface disturbance.
- This Alternative crosses the Missouri River outside the special designated area (Recreational River). This crossing will be a HDD, which will avoid channel disturbance within the river. This crossing method will have to be technically feasible (underlying geologic conditions must be suitable for such a crossing method).
- The crossing location channel cross section appears to be in a more active floodplain than the Yankton crossing, because the crossing is located approximately 58 miles downstream of the Gavins Point dam, which regulates river flows. At least one major tributary (James River) discharges into the Missouri River upstream of the alternative crossing. Greater seasonal flood volumes will increase the likelihood of lateral channel migration. This potential extent of lateral migration may be too extensive to be accommodated by a single HDD. There are extensive riparian woodlands at this crossing location, which also will require a longer HDD crossing than the Yankton crossing location.

The segment between the Missouri River and Cushing will be new ROW, resulting in the establishment of a new utility corridor.

- Approximately 30 fewer miles of pipe will be required to construct the Mainline pipeline to Wood River and Patoka, as compared to Western Alternative A.

<u>Preferred Route Selection</u>

After consideration of pipeline length, land use and other environmental factors, the Western Alternative B was selected as the preferred initial pipeline route. The primary factors in this decision were:

1. There is a high potential that an HDD could be approved and completed at the relatively stable Yankton Missouri River channel crossing location.

Table 2.4-4 Phase 2 Route Alternatives – Length, Utility Co-location, and Crossing Comparisons

Phase II Route Alternatives																	
		Co-location Percentage				Waterbody Crossings		Road Crossings				Land Use Crossings				
Route Option	Length (miles)	Railroad (%)	Powerline (%)	Road (%)	Pipeline (%)	minor	major	minor	major	Rail Crossings	Utility Crossings	National/ State Parks	National Forest Lands	Conservation Areas	Wildlife Areas	Indian/Military Reserves
Western A	1414	1.2	0.6	11.7	14.1	1600	96	1729	21	131	109	1	0	0	1	0
Western B	1363	1.3	0.7	8.1	9.9	1474	81	1635	18	122	102	1	0	0	1	0
Eastern	1373	2.8	0.6	4.3	7.9	1560	73	1710	20	137	85	0	0	0	1	0

Notes: Waterbody Crossing Classifications: Minor < 100ft > Major width.

Road Crossing Classifications: *Minor* = unpaved and paved local streets and two lane highways.

Major = four lane highways and interstates

This crossing list was completed in greater detail than the assessment table illustrated in the respective routing report

2. This alternative is the shortest of the three alternatives and represents less overall disturbance.

3. Other types of crossings (e.g., waterbody, railroad, and road crossings) generally will be fewer than the other alternatives (Table 2.4-4).

2.4.1.4 Previous Route Refinements

North Dakota Aquifer Reroute

During open house meetings and subsequent meetings and through correspondence from multiple North Dakota agencies, including the North Dakota Department of Health, Walsh Rural Water District, and the City of Park River, Keystone was advised that its proposed pipeline route would cross surficial drinking water aquifers in Pembina and Walsh counties, North Dakota.

To avoid the surficial drinking water aquifers, the pipeline route was shifted at its maximum deviation approximately 10.5 miles to the west of the original pipeline route. This reroute was incorporated into the original route filed with the Department of State in the April 2006 ER. No major modification to this reroute has occurred since that time.

Edwardsville Reroute

During open house meetings, landowners requested that Keystone's proposed pipeline route be relocated to follow the existing Two Rivers Pipeline to avoid pipeline construction through residential development areas just north and northwest of the city of Edwardsville, Illinois

After meeting with the landowners, Keystone agreed to reroute the pipeline. This reroute was incorporated into the original route filed with the Department of State in the April 2006 ER. No major modification to this reroute has occurred since that time.

2.4.1.5 Additional Route Refinement

Since the April submittal of the ER, Keystone has continued to refine its pipeline alignment based on agency, landowner, environmental, and engineering considerations. To date, Keystone has conducted 32 open house meetings with the public, conducted numerous meetings with the key federal and state agencies, initiated cultural resource and environmental surveys, and initiated engineering and construction assessments along the proposed pipeline route in the spring and summer of 2006. This work resulted in identification of landowner, environmental, engineering, and construction issues at various locations along the proposed pipeline route. These issues have resulted in 111 route adjustments and refinements (47 Keystone Mainline and 64 Cushing Extension), resulting in an increase of 5.0 miles to the length of the proposed pipeline. It also resulted in the relocation of 11 pump stations and 38 mainline valves.

The majority of route adjustments and refinements were minor in nature. However, 13 reroutes shifted portions of the proposed route substantially and are described as follows:

Pembina/Cavalier County Reroute (MP 0.4 to MP 6.9)

Field route engineering identified construction issues related to the proposed Keystone pipeline route in Cavalier County, North Dakota that are eliminated by rerouting the proposed pipeline as follows:

- Avoid a north-south drainage ditch between MP 3.7 and MP 4.0
- Avoid a "wood lot" between MP 4.9 and MP 5.3
- Avoid a "shelter belt" between MP 6.2 to MP 6.7

- Avoid three grain bins at MP 6.2
- Minimize the length of wetlands crossed

The Cavalier County reroute is approximately 6.5 miles in length and approximately 0.25 mile west of the originally proposed pipeline route as depicted on **Figure 2.4-5**. This reroute reduces the length of the proposed pipeline route by approximately 0.1 mile.

Tongue River Reroute (MP 16.2 to MP 19.6)

Field route engineering identified construction issues related to the proposed Keystone pipeline route that are eliminated by rerouting the proposed pipeline at the Tongue River in North Dakota as follows:

- Avoid pond at MP 16.7
- Reduce the number of Tongue River branches or tributaries that are crossed from 2 to 1
- Avoid "shelter belt" and drainage from MP 18.8 to MP 19.2

The Tongue River reroute is approximately 3.4 miles in length and approximately 0.4 mile west of the originally proposed pipeline route (**Figure 2.4-6**). This reroute reduces the length of the proposed pipeline route by approximately 0.1 mile.

USFWS Nelson and Steele County Wetlands Reroute (MP 69.3 to MP 121.5)

In a letter dated June 8, 2006, the USFWS requested Keystone minimize impacts to certain wetlands in Nelson and Steele counties, North Dakota. This is an area with numerous wetland easements held by the USFWS.

To minimize impacts to these USFWS wetland easements and their associated wetlands, the proposed pipeline route was shifted in many locations to avoid wetlands and wetland easements. The Nelson and Steele County reroute is approximately 52.2 miles in length and approximately 0.4 mile west of the originally proposed pipeline route (**Figure 2.4-7**). This reroute increases the length of the proposed pipeline route by approximately 0.6 mile.

USFWS Hecla Sandhills Reroute (MP 190.0 to MP 225.2)

In a letter dated June 8, 2006, the USFWS requested Keystone minimize impacts to the Hecla Sandhills in North Dakota, an area characterized by sand dunes with numerous USFWS wetland and grassland easements.

To minimize impacts to the Hecla Sandhills and their associated USFWS easements, the proposed pipeline route was rerouted approximately 2.6 miles west of the originally proposed pipeline route (**Figure 2.4-8**). The Hecla Sandhills reroute is approximately 35.2 miles in length and increases the length of the proposed pipeline route by approximately 1.2 miles. Keystone continues to assess the route in this area through field reconnaissance and consultation with agencies and landowners.

USFWS Day County Grasslands Reroute (MP 262.5 to MP 271.1)

In a letter dated June 8, 2006, the USFWS requested Keystone minimize impacts to Day County Grassland Easements, an area of native prairie protected by USFWS grassland easements.

To minimize impacts to these grassland easements, the route was shifted to a maximum deviation of approximately 0.5 mile to the west of the original pipeline route (**Figure 2.4-9**). The reroute is approximately 8.6 miles in length and increases the length of the original pipeline route by approximately 0.2 mile.

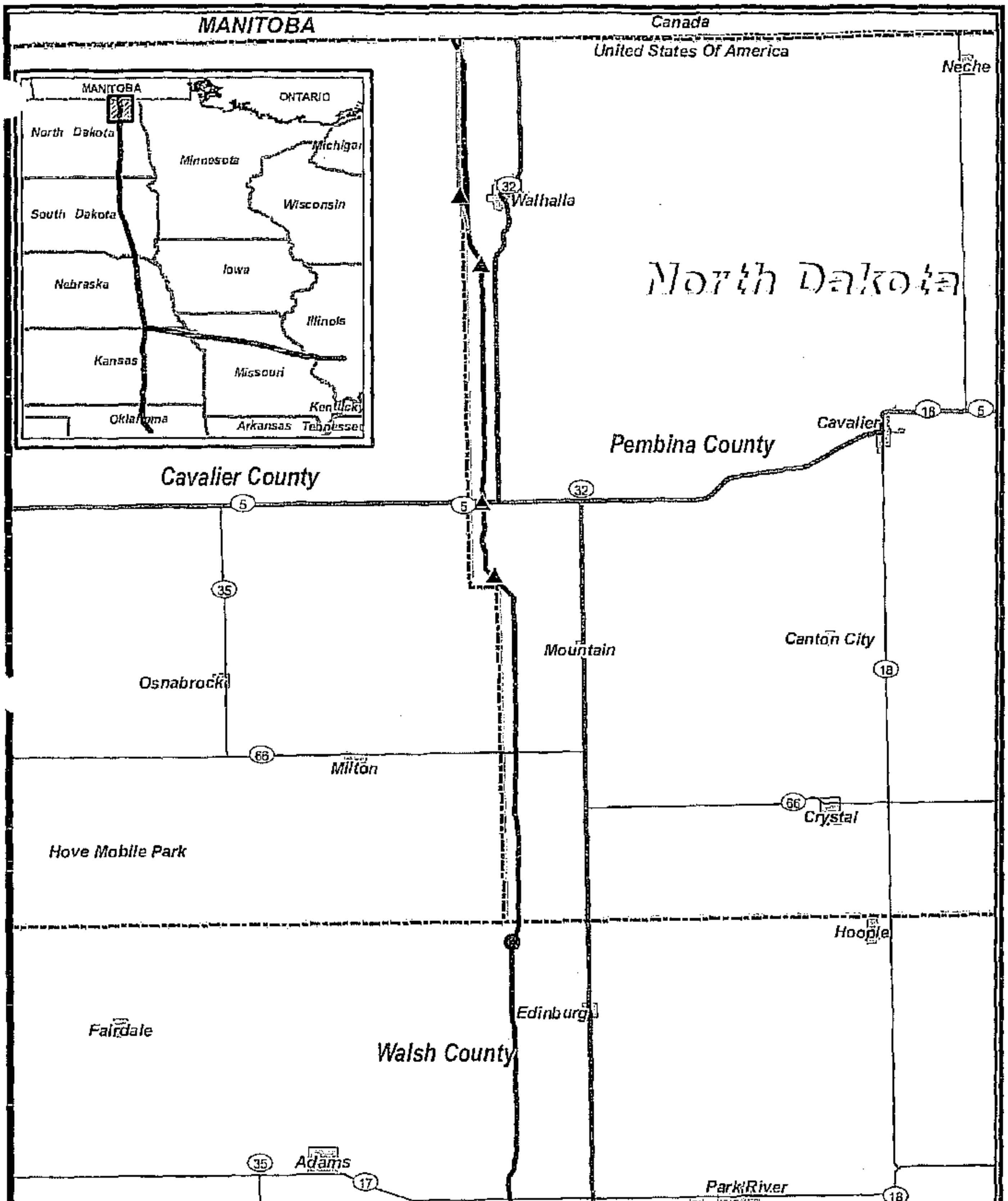

FIGURE 2.4-5
PEMBINA/CAVALIER COUNTY
REROUTE

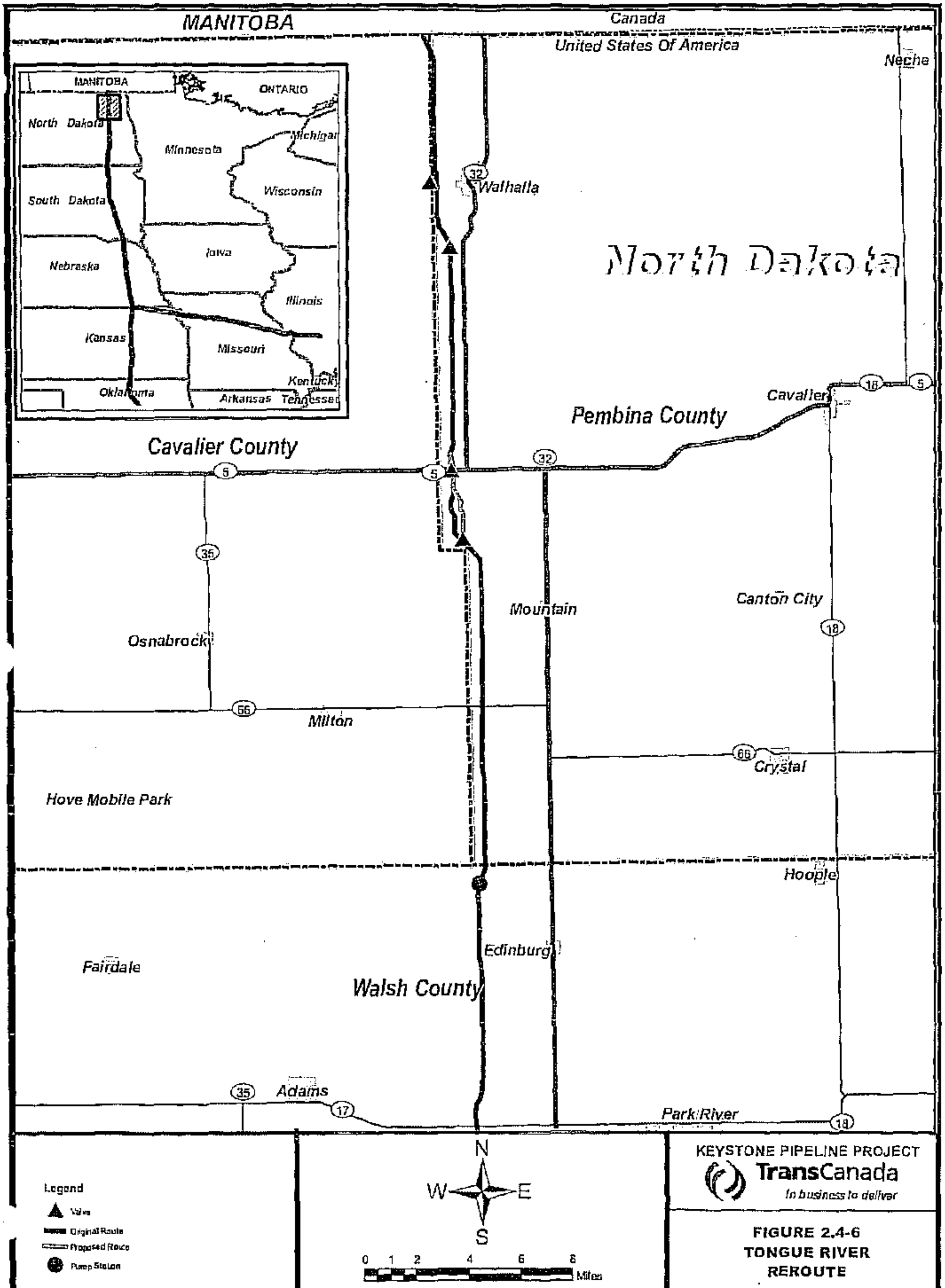

FIGURE 2.4-6
TONGUE RIVER REROUTE

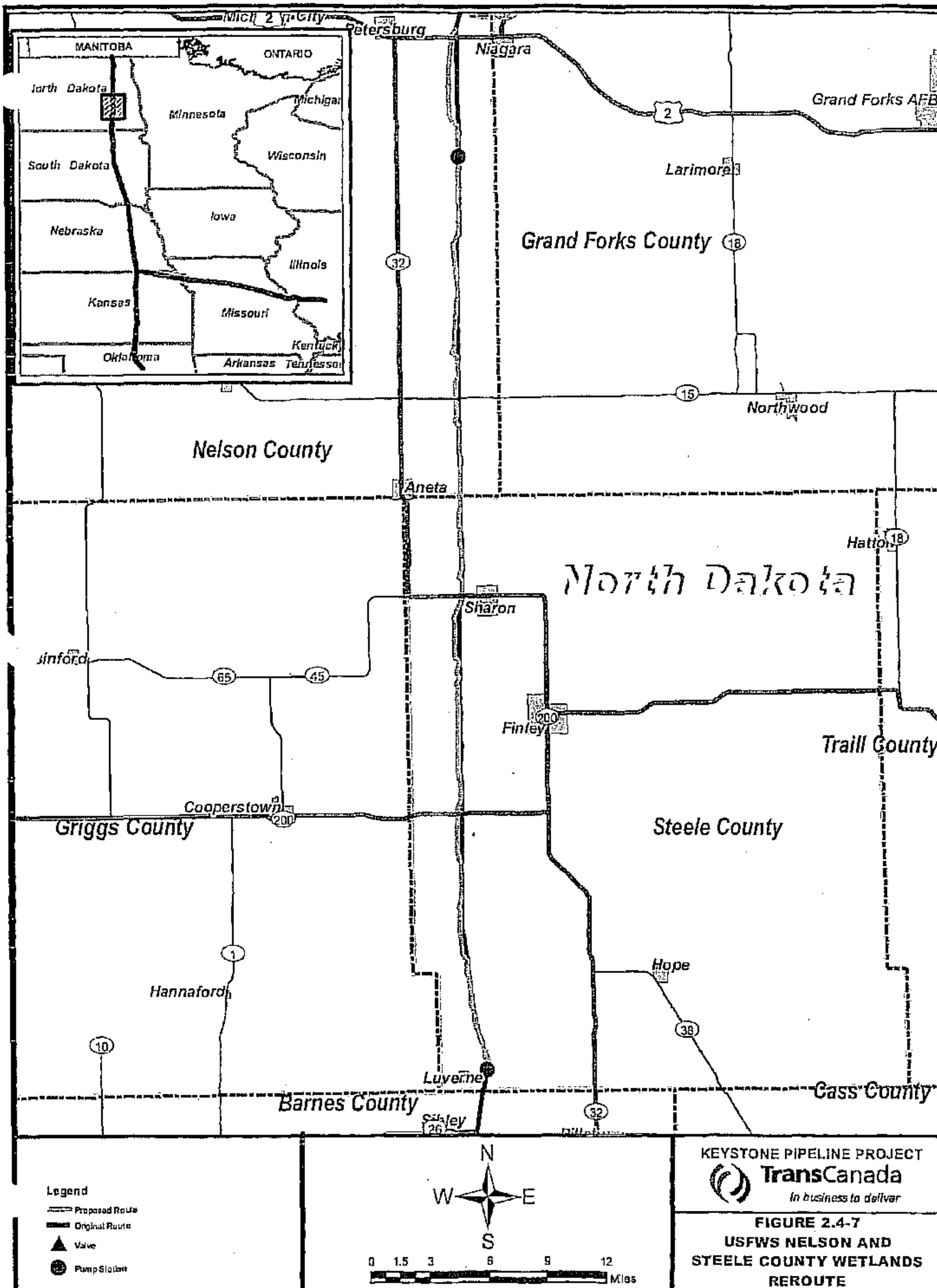

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FIGURE 2.4-7
USFWS NELSON AND STEELE COUNTY WETLANDS REROUTE

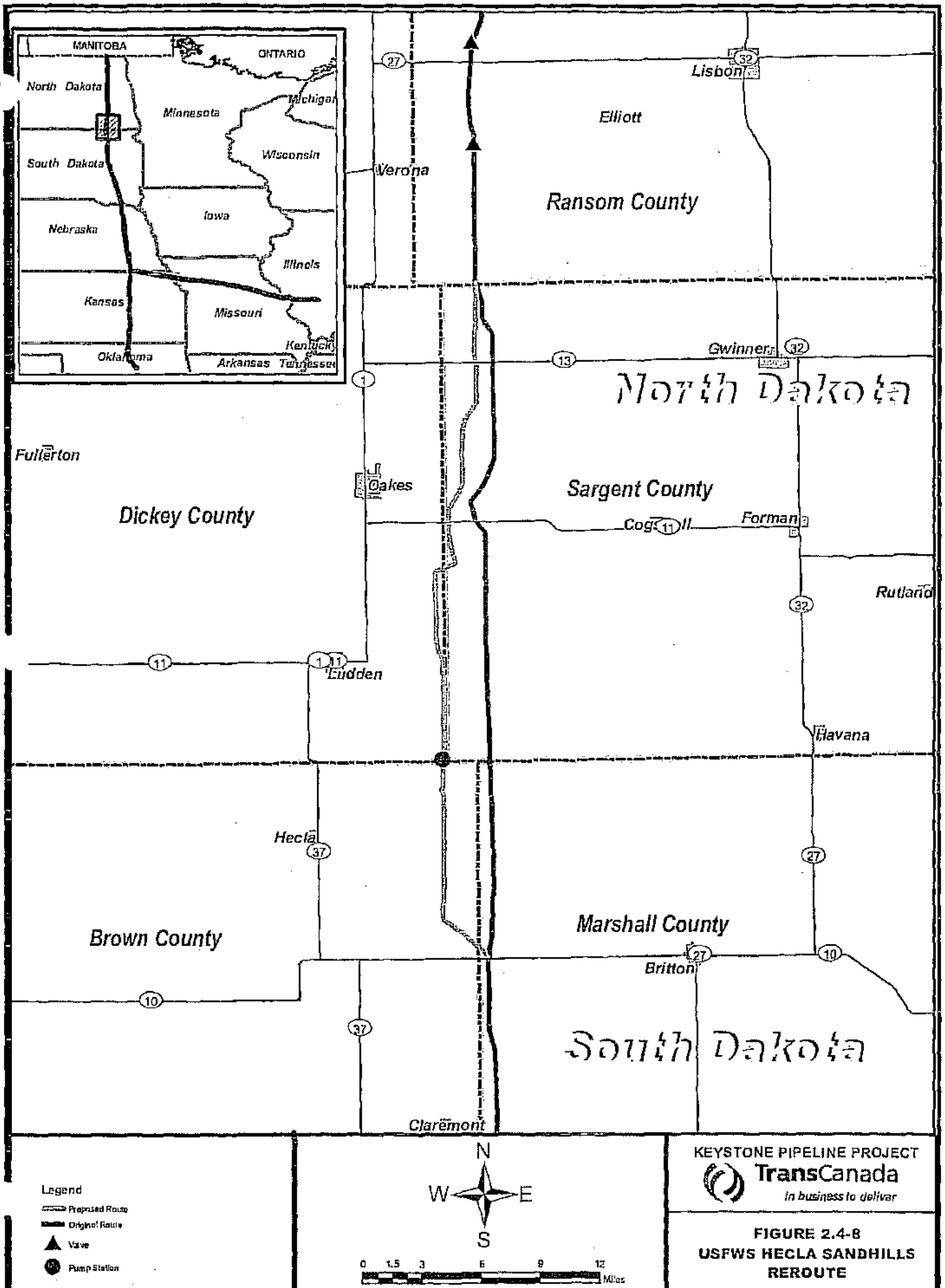

FIGURE 2.4-8
USFWS HECLA SANDHILLS REROUTE

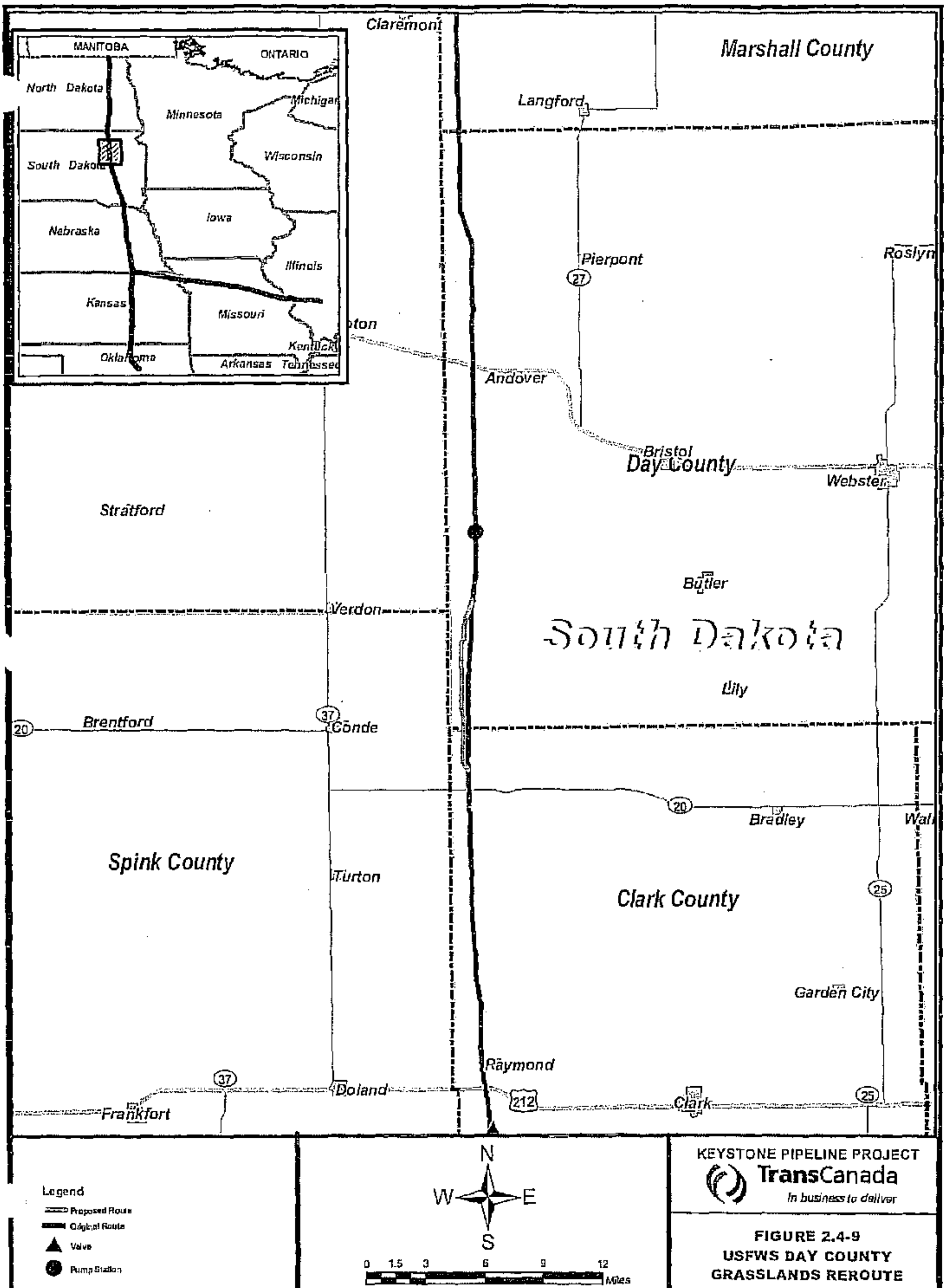

FIGURE 2.4-9
USFWS DAY COUNTY
GRASSLANDS REROUTE

USFWS Raymond Prairie Chicken Leks Reroute (MP 276.0 to MP 293.0)

In a letter dated June 8, 2006, the USFWS requested Keystone minimize impacts to habitat of the Raymond Prairie Chicken Leks, an area of tall grass prairie surrounded by intensively farmed cropland. The USFWS noted that these grasslands provide habitat for one of the few stable populations of greater prairie chicken leks in the eastern Dakotas.

To minimize impacts to the tall grass prairie, the route was shifted to a maximum deviation approximately 1 mile to the east of the original pipeline route (**Figure 2.4-10**). The USFWS Raymond Prairie Chicken Leks Reroute is approximately 17.0 miles in length and increases the length of the original pipeline route by approximately 0.5 mile.

Elkhorn River Reroute (MP 497.2 to MP 508.3)

The Nebraska Game and Parks Commission owns and manages lands on the north side of the Elkhorn River along the original pipeline route. The agency requested that Keystone reroute the pipeline to avoid side hill construction and an erosive area along the Elkhorn River.

Per the Nebraska Game and Parks Commission's request, the pipeline was rerouted to avoid the state owned and managed lands. The route was shifted at its maximum deviation approximately 1.4 miles to the east of the original route (**Figure 2.4-11**). It should be noted that this reroute was extended south to connect with the northern limit of the Leigh Lake reroute described in the following section to minimize side hill construction on the original pipeline route. The Elkhorn River reroute is a approximately 11.1 miles in length and increases the length of the proposed pipeline by approximately 0.6 mile.

Leigh Lake Reroute (MP 508.1 to MP 515.1)

During open house meetings, Keystone was advised that its proposed pipeline route would cross the project boundaries of a future lake to be constructed on the west side of Leigh, Nebraska, by the Lower Elkhorn Natural Resources District.

To avoid future operations of the proposed pipeline beneath Leigh Lake, the pipeline route was shifted at its maximum deviation approximately 1.1 miles to the west of the original pipeline route (**Figure 2.4-12**). The Leigh Lake reroute is approximately 7.0 miles in length and increases the length of the original pipeline route by approximately 0.8 mile.

Saline County Reroute (MP 585.0 to MP 599.7)

During open house meetings, local landowners advised Keystone's that the proposed pipeline route crossed an area of flood irrigation agricultural land. Flood irrigated land is typically flat with a gradual slope to allow for irrigation water to flow along the ground surface from one end of a field to the other. It is very difficult to restore flood irrigation fields to their original productivity after pipeline construction.

Landowners at the open house meeting recommended Keystone re-locate its pipeline westerly approximately 1 to 2 miles in order to avoid flood irrigation lands. After meeting with the landowners, Keystone agreed to reroute the pipeline (**Figure 2.4-13**). This reroute reduces the overall length of the pipeline by approximately 0.1 mile and eliminates crossing flood irrigated agricultural lands.

Agency Reroute (MP 753.8 to MP 757.0)

During open house meetings, citizens and the Mayor of Agency, Missouri, requested that Keystone's proposed pipeline route that followed the existing Platte Pipeline be relocated to avoid pipeline construction through a residential area of the town of Agency, Missouri. This is an area where the Kinder Morgan's proposed Rockies

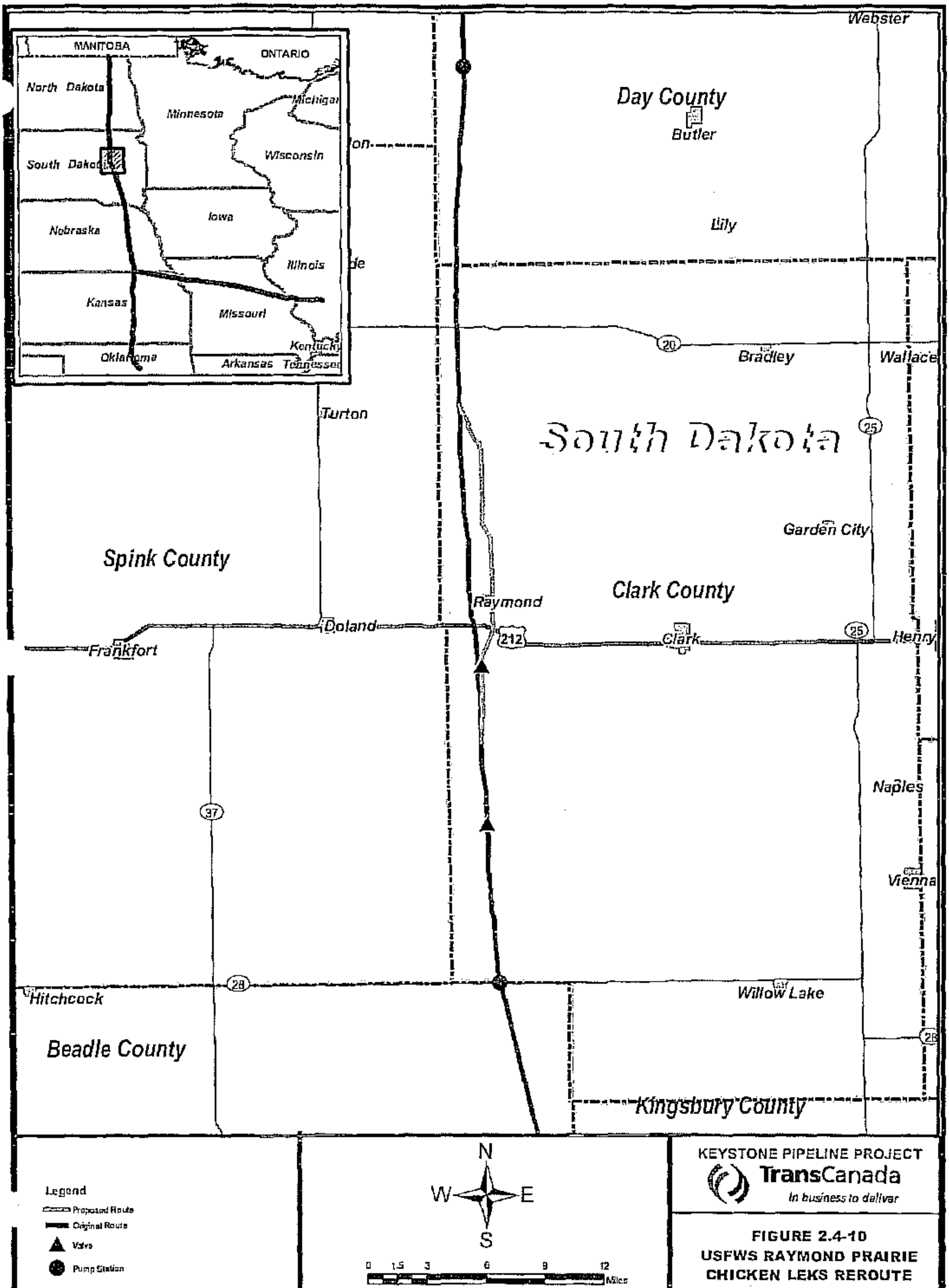

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FIGURE 2.4-10
USFWS RAYMOND PRAIRIE CHICKEN LEKS REROUTE

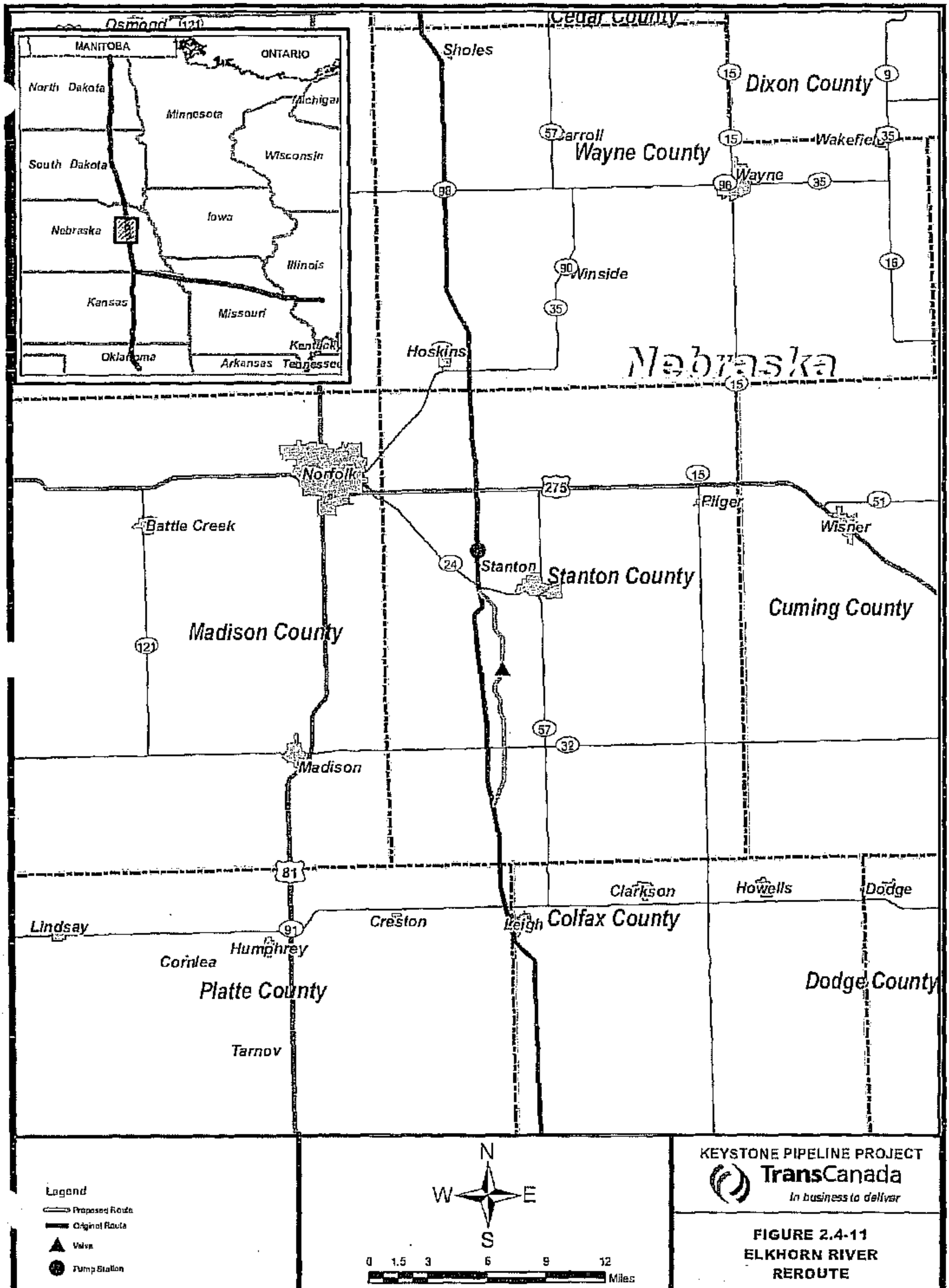

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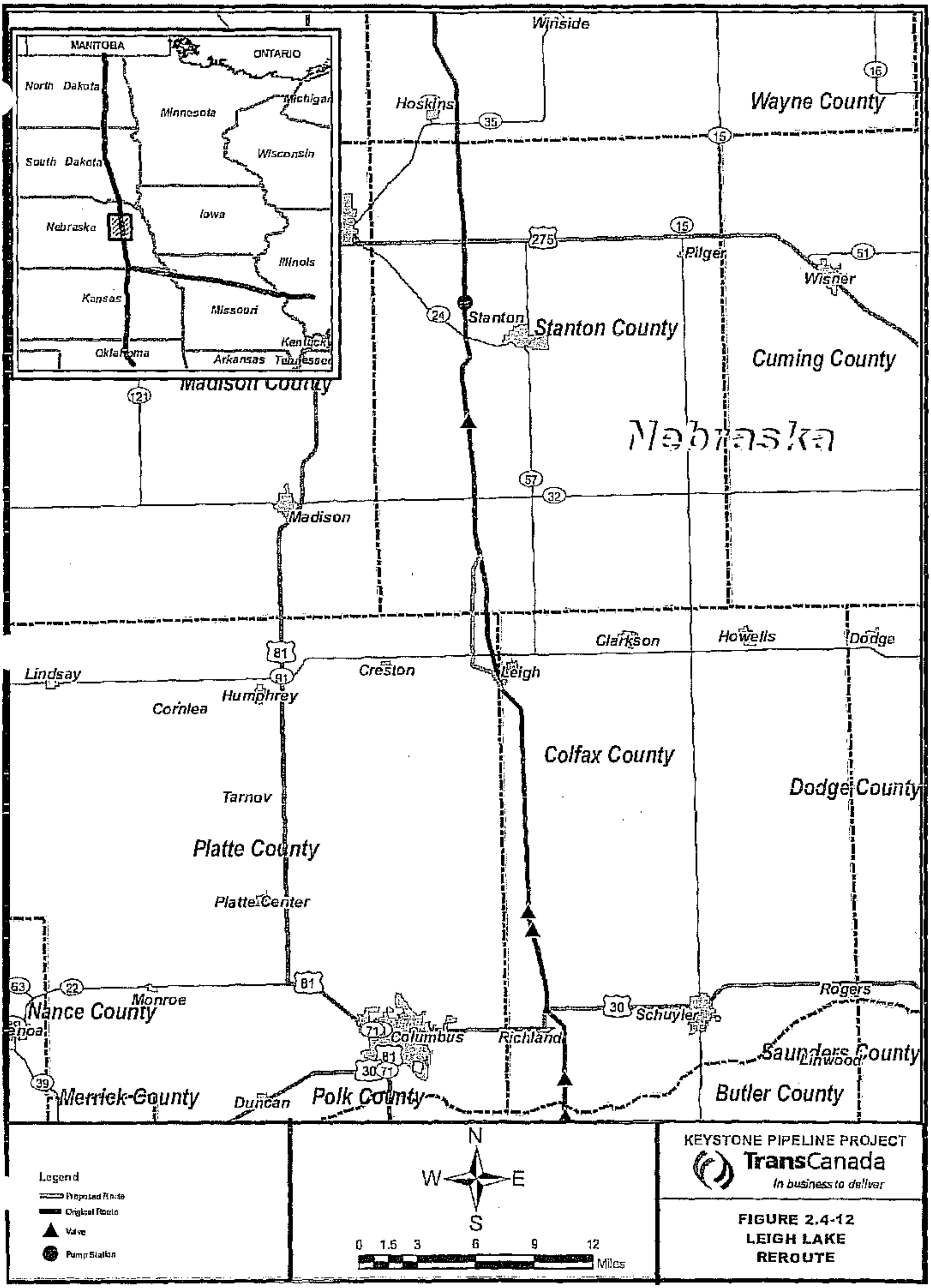
FIGURE 2.4-11
ELKHORN RIVER
REROUTE


MANITOBA
ONTARIO
North Dakota
Minnesota
Michigan
South Dakota
Wisconsin
Nebraska
Iowa
Illinois
Kansas
Missouri
Kentucky
Oklahoma
Arkansas
Tennessee
Winside
Hoskins
Wayne County
Pilger
Wisner
Stanton
Stanton County
Cuming County
Madison County
Nebraska
Madison
Clarkson
Howells
Dodge
Lindsay
Creston
Leigh
Humphrey
Cornlea
Colfax County
Dodge County
Tarnov
Platte County
Platte Center
Monroe
Nance County
Columbus
Richland
Schuyler
Rogers
Saunders County
Linwood
Merrick County
Duncan
Polk County
Butler County
Legend
Proposed Route
Original Route
Valve
Pump Station
N
W
E
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0 1.5 3 6 9 12
Miles
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FIGURE 2.4-12
LEIGH LAKE
REROUTE

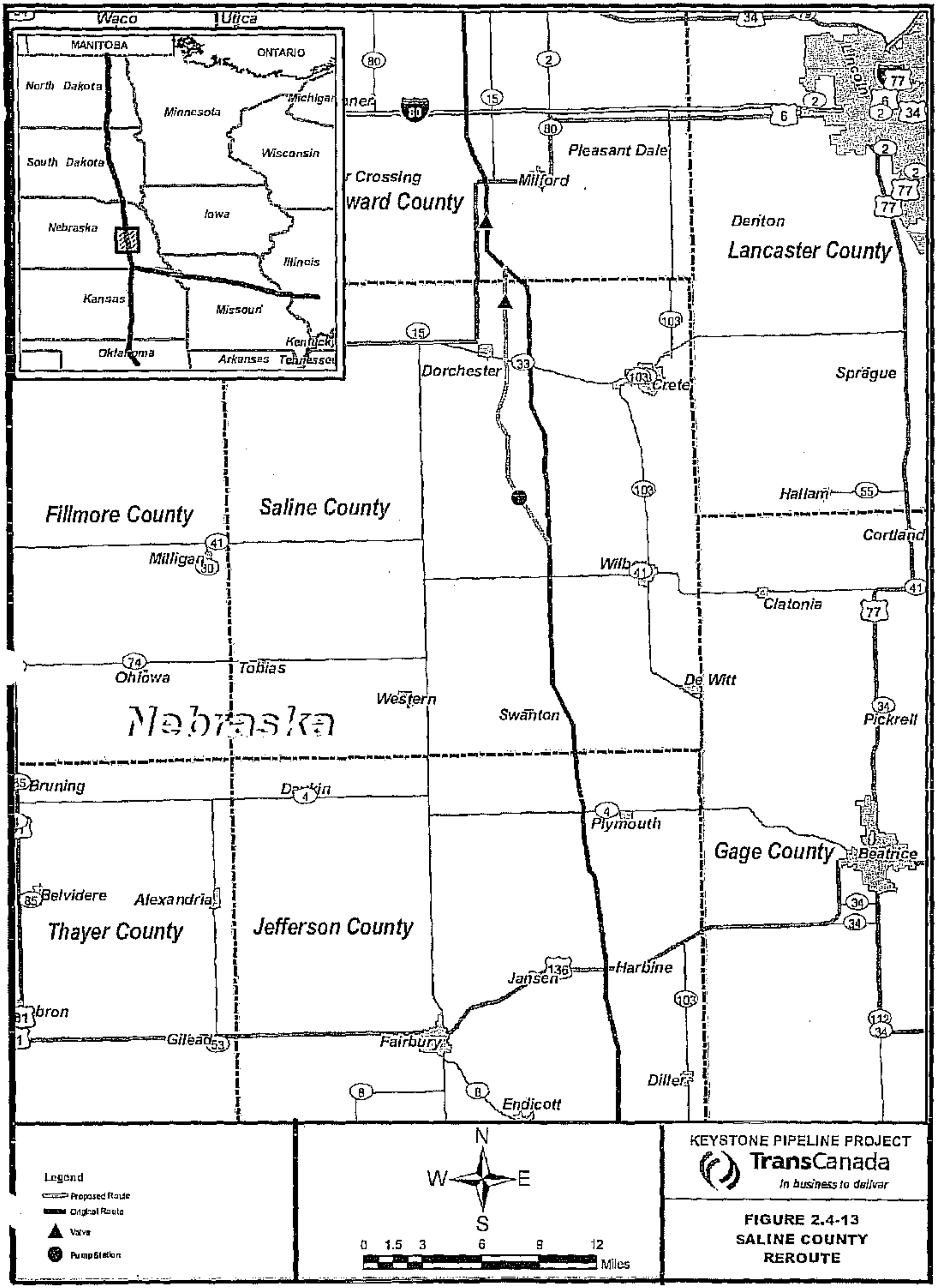

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FIGURE 2.4-13
SALINE COUNTY
REROUTE

Express Pipeline (REX) is proposed to be constructed in 2007 and Kinder Morgan has agreed to a reroute south of the residential area. REX also has opted to reroute south of a recreational shooting range to the west of Agency.

Landowners at the open house meeting recommended Keystone relocate its pipeline southerly approximately 0.4 mile in order to avoid the residential area of Agency, Missouri. After meeting with the landowners, Keystone agreed to reroute the pipeline (**Figure 2.4-14**). The reroute begins at MP 753.8 and ends at MP 757.0 based on the original pipeline route. The reroute is 3.4 miles long and adds 0.2 mile to the original pipeline route.

Troy Reroute (MP 958.7 to MP 973.4)

During open house meetings, landowners near Troy, Missouri, requested Keystone relocate the proposed pipeline alignment to follow an existing Central Electric Power Coop powerline through the northern edge of the city. Additionally, another landowner requested that the route across his sod farm be avoided or minimized to the extent possible.

After meeting with the landowners and Central Electric Coop, Keystone agreed to reroute the pipeline (**Figure 2.4-15**). The reroute begins at MP 958.7 and ends at MP 973.4, is 14.7 miles in length and reduces the length of the original pipeline route by approximately 0.6 mile.

Patoka Reroute (MP 1068.3 to MP 1073.3)

Keystone's original pipeline route followed existing pipelines into the northern area of the Patoka Terminal. During meetings with Patoka Terminal companies, it was determined that the more optimum location for the proposed pipeline to tie into the Terminal's tank manifolds was into the southern area of the Patoka Terminal. It also was determined that there are two existing pipelines that currently enter the southern area of the Patoka Terminal.

To facilitate terminating the pipeline in the preferred southern area of the Patoka Terminal, the pipeline was rerouted parallel with the two existing pipelines (**Figure 2.4-16**). The reroute begins at MP 1068.3 and ends at MP 1073.3. The reroute is 5.0 miles in length and increases the length of the original pipeline route by approximately 0.1 mile.

Oklahoma Reroute (MP 208.2 to MP 252.0)

During data collection and route refinement efforts associated with the Cushing Extension in Kay, Noble, and Payne Counties, Oklahoma, Keystone noted that its proposed pipeline route crosses Native American tribal and allotted lands. To avoid impacts to all such lands Keystone has developed a reroute (**Figure 2.4-17**). The reroute consists of three separate realignments located between MP 234.3 to MP 240.4, MP 242.0 to MP 243.7, and MP 246.2 to MP 252.0, based on the original pipeline route. In total, this reroute is 47.4 miles long and adds 0.4 mile to the original pipeline route.

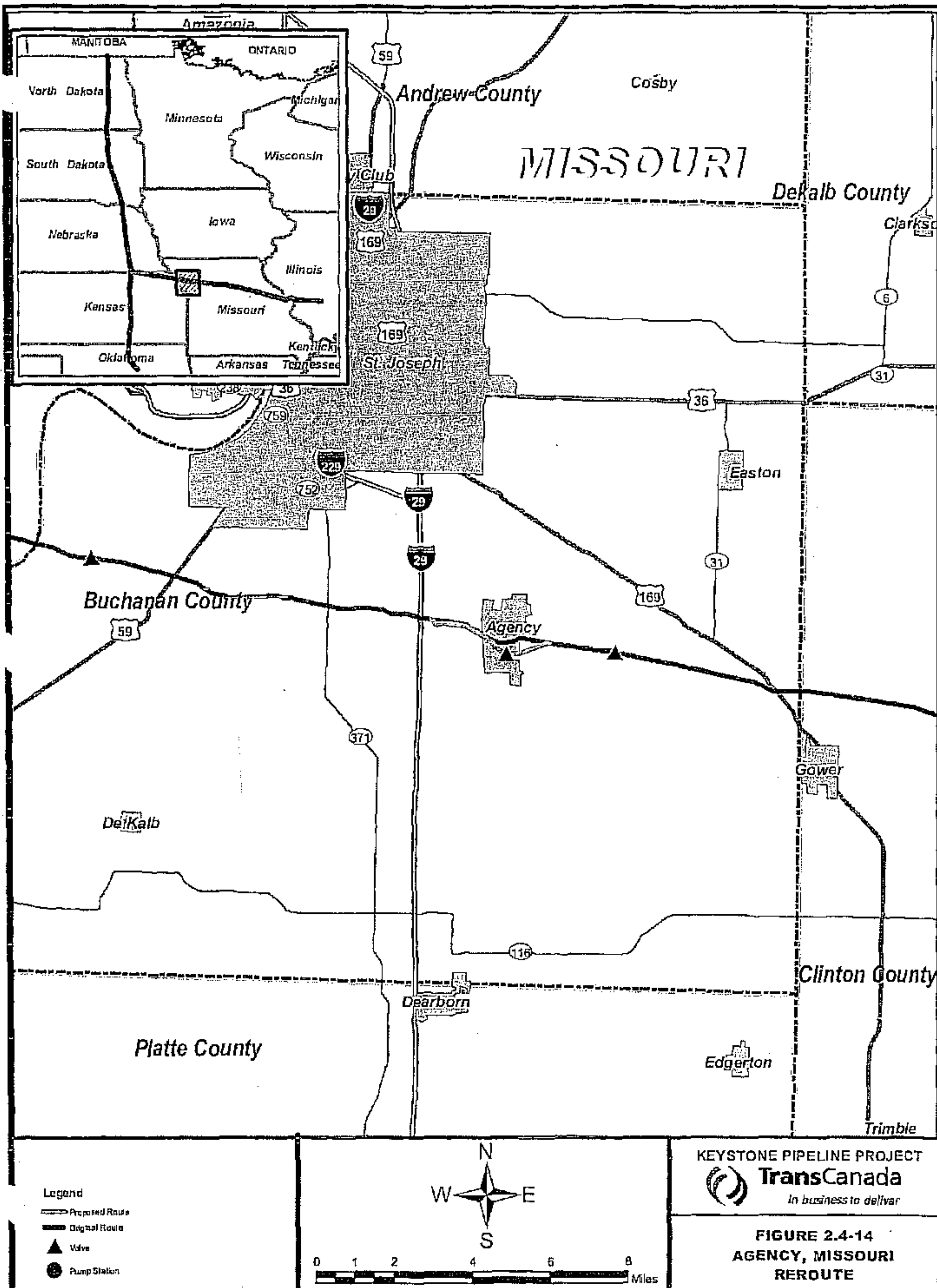


FIGURE 2.4-14
AGENCY, MISSOURI
REROUTE

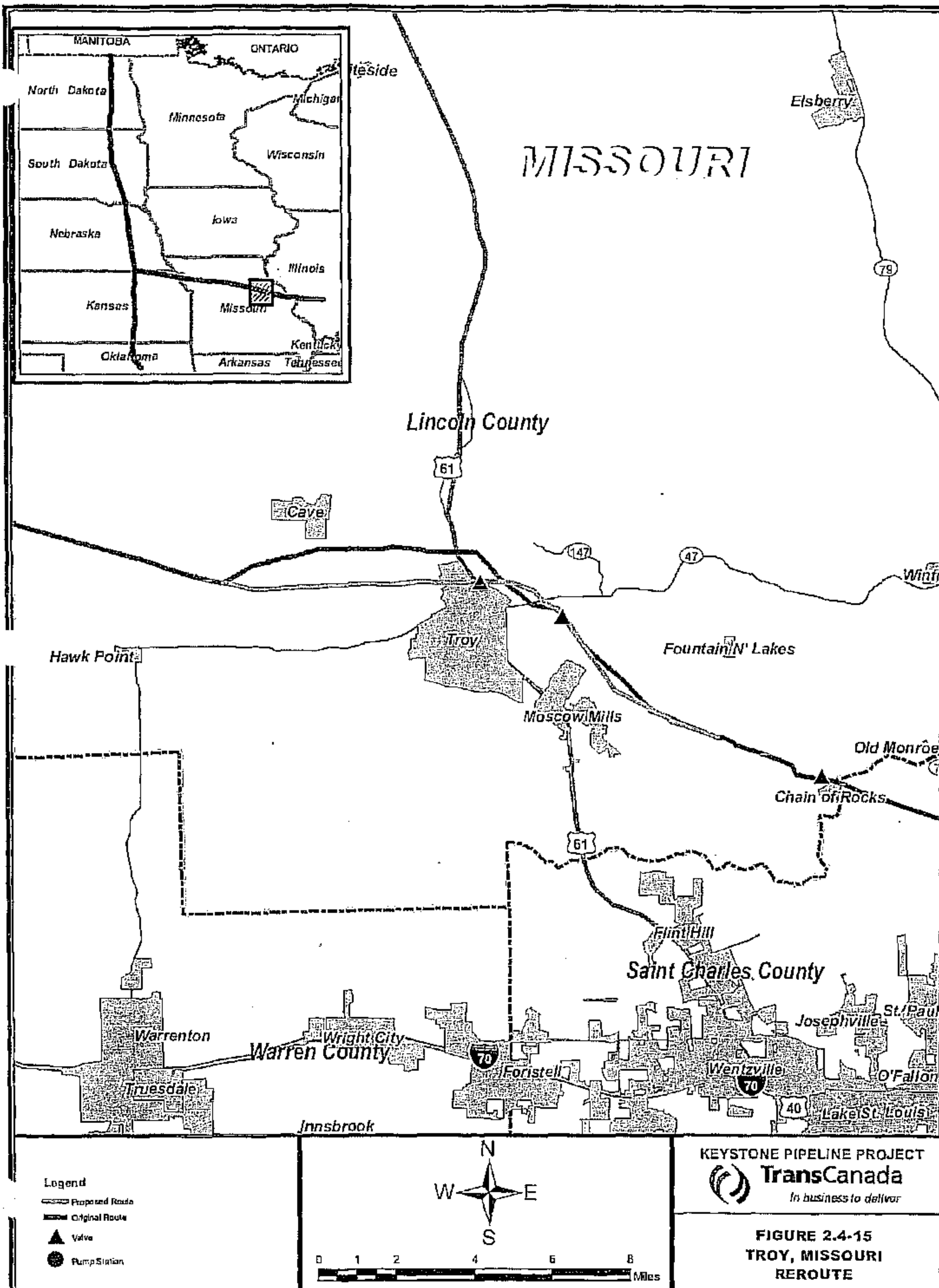


FIGURE 2.4-15
TROY, MISSOURI
REROUTE

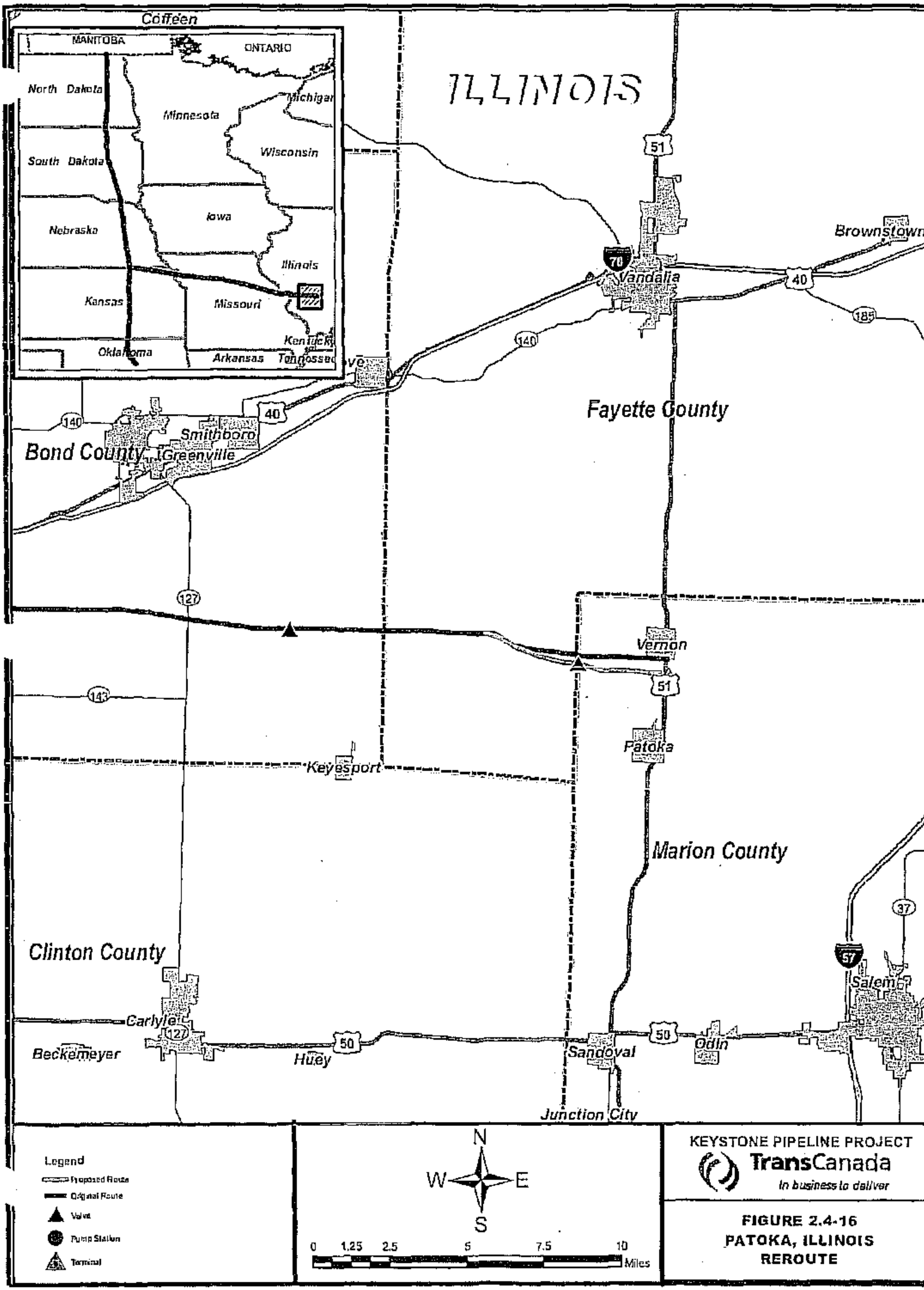


FIGURE 2.4-16
PATOKA, ILLINOIS
REROUTE

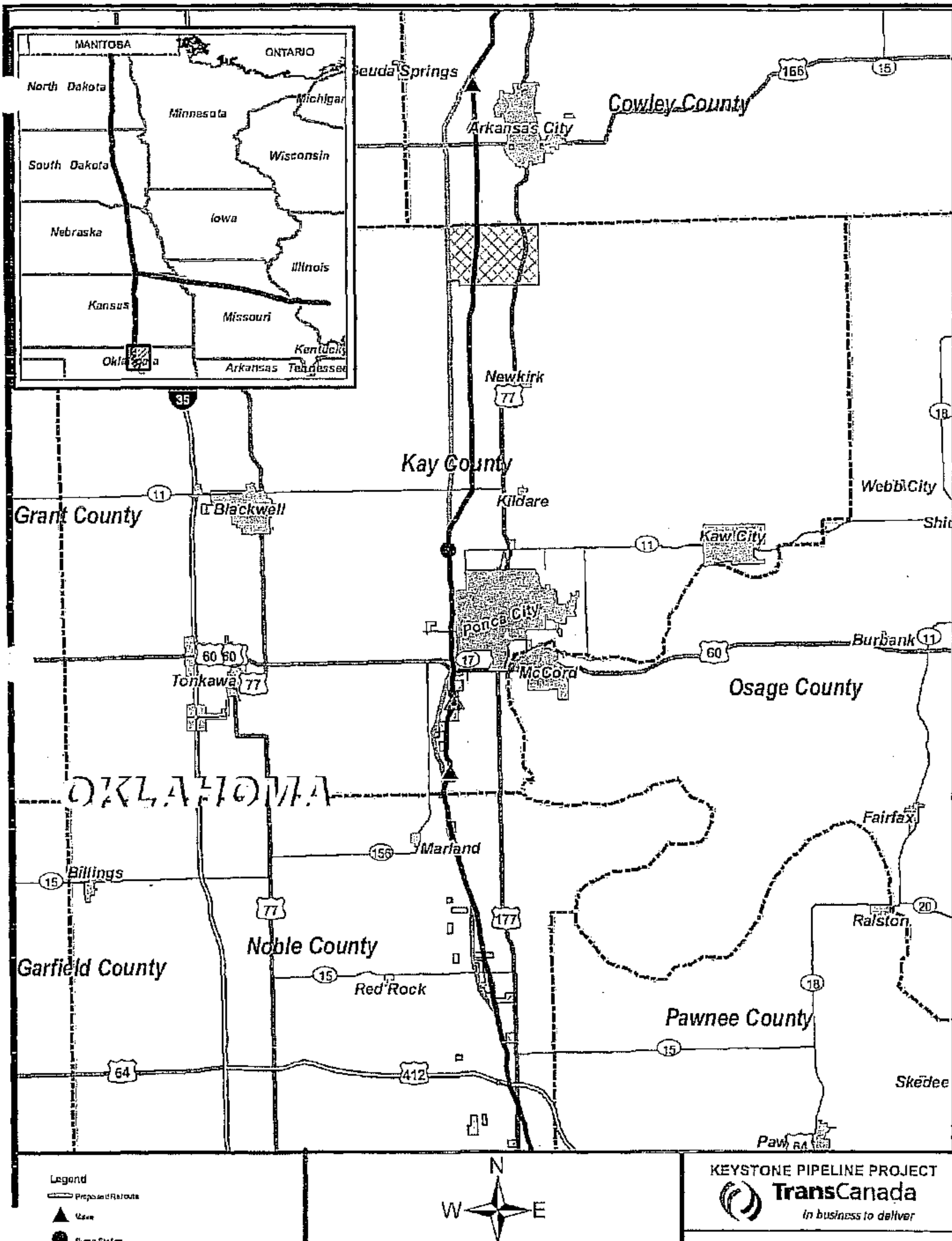


FIGURE 2.4-17
OKLAHOMA REROUTE

AFFECTED ENVIRONMENT

CHAPTER 3

3.0 AFFECTED ENVIRONMENT

3.1 Affected Environment

The Affected Environment section addresses the natural and human resources potentially affected by the Keystone Pipeline Project. The description of the Affected Environment is based on existing environmental information. Sources of these data include aerial photography, U.S. Geological Survey (USGS) topographic maps, National Wetland Inventory maps, publicly available databases, GIS files downloaded from the appropriate resource-based information system, and data requested from federal and state agencies for the project area. These data were compiled, quantified, and evaluated for this ER.

Field surveys for cultural resources, biological resources, waters of the U.S., and wetland delineations have been initiated and will continue into 2007. Protocols for field surveys and preliminary results for spring/summer 2006 field surveys have been submitted to the Department of State (filed on September 15 and November 15, 2006, respectively). Final 2006 field survey reports will be submitted in early 2007. Information gathered from these surveys will be used for compliance purposes, including compliance with Section 106, the ESA, and the Migratory Bird Treaty Act (MBTA), as well as federal and state permitting.

3.2 Climate and Air Quality

The climate and air quality section in this ER describes the regional climate and meteorological conditions that influence transport and dispersion of air pollutants and discusses the existing levels of criteria air pollutants in the region. Criteria pollutants are those pollutants for which ambient air quality standards have been set. This section also presents a summary of the regulatory requirements for air quality permits in each of the affected states (North Dakota, South Dakota, Nebraska, Kansas, Missouri, Illinois, and Oklahoma).

Operational air emissions generally are restricted to proposed pump stations. The proposed pump stations are electrically driven with electricity to be provided from existing local electric utilities. There is no backup power supply proposed for the pump stations. Air quality impacts from the construction and operation of Keystone's facilities are summarized in Section 4.2.1.

The data presented here are representative of the region where pipeline construction emissions could impact air quality. Climate data for Grand Forks, North Dakota; Lincoln, Nebraska; Tulsa, Oklahoma; and Salisbury, Missouri, are found in **Table 3.2-1**.

3.2.1 Regional Climate

The project area is located within the humid continental climate that is found over great expanses in the temperate regions of the mid-latitudes. The humid continental climate is noted for its variable weather patterns and its large temperature range due to its interior location in mid-latitude continents. This climate lies in the boundary zone between many different air masses, principally polar and tropical. Polar-type air masses collide with tropical type air masses causing uplift of the less dense and moister tropical air resulting in precipitation. These huge systems generally work their way across the surface in a west to east fashion, embedded in the dominant wind flow of the westerly wind belt.

Annual temperature ranges can exceed 82 degrees Fahrenheit (°F). For example, the minimum average low temperature in January in Grand Forks,North Dakota, is -5.5°F while the average maximum temperature in July in Grand Forks is 81°F (**Table 3.2-1**). Winter low temperatures of -40°F and summer high temperatures of 104°F have been recorded for this city. During the winter, the polar high expands in area to influence the northern portion of the continental humid climate. Record-setting cold temperatures occur during winter when continental arctic air masses sweep into the region. Otherwise, continental polar air masses dominate for much of the winter.

Precipitation in the humid continental climate is primarily due to invasions of maritime tropical air. A noticeable decrease and seasonality to the precipitation occurs as distance from the Gulf of Mexico and the Caribbean Ocean increases.

3.2.1.1 Cool Summer Subtype

The cool summer subtype of the humid continental climate in North America is found throughout much of the Great Lakes region and upper Midwest extending into south central Canada. Most of its precipitation falls in the summer half of the year. However, it receives less precipitation than the warm summer subtype due to the colder temperatures and their associated lower humidity. Average annual temperature at Grand Forks is 50°F. The cool summer subtype typically has very cold temperatures during the winter, with many months averaging below 32°F.

3.2.1.2 Warm Summer Subtype

The warm summer subtype is noted for its hot, humid summers and occasional winter cold waves.

Table 3.2-1 Climate Data in the Vicinity of Pipeline Route

GRAND FORKS, ND [1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (°F)	13.5	20.4	32.6	51.8	67.5	76.2	81.2	80.2	69.0	55.3	34.7	19.8	50.2
Average Min. Temperature (°F)	-5.5	1.1	14.6	30.7	42.1	52.2	56.6	54.3	44.5	33.3	18	2.5	28.7
Average Total Precipitation (in.)	0.69	0.5	0.8	1.18	2.31	3.17	3.09	2.69	1.97	1.37	0.87	0.62	19.27
Average Total Snow Fall (in.)	10	5.2	7.1	2.8	0.2	0	0	0	0	1	6.8	7.9	41.1
Average Snow Depth (in.)	7	7	4	0	0	0	0	0	0	0	1	4	2
LINCOLN, NE [1]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	33.4	40.0	50.5	63.7	73.8	84.5	89.2	86.6	78.7	66.4	49.5	37.3	62.8
Average Min. Temperature (°F)	11.9	17.9	27.2	38.8	50.1	60.7	66.0	63.6	53.1	40.3	27.4	16.4	39.4
Average Total Precipitation (in.)	0.72	0.86	2.04	2.87	4.25	3.75	3.42	3.36	2.92	1.88	1.56	0.76	28.39
Average Total Snow Fall (in.)	6.5	5.4	4.9	1.5	0.0	0.0	0.0	0.0	0.0	0.6	2.7	5.3	26.8
Average Snow Depth (in.)	2	2	0	0	0	0	0	0	0	0	0	1	0
SALISBURY, MO [1]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	36.4	42.6	53.2	65.9	75.7	84	88.6	87.3	80.1	69	53.5	41.1	64.8
Average Min. Temperature (°F)	17.4	22.5	31.2	42.9	53	62	66.3	63.8	55.5	44.4	33	22.8	42.9
SALISBURY, MO [1]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Total	1.63	1.68	2.75	3.57	4.92	4.84	4.29	3.84	4.22	3.31	2.5	1.95	39.51

Table 3.2-1 Climate Data in the Vicinity of Pipeline Route

Precipitation (in.)													
Average Total Snow Fall (in.)	6.4	4.5	3.2	0.4	0	0	0	0	0	0	1.1	4.6	20.2
Average Snow Depth (in.)	2	1	0	0	0	0	0	0	0	0	0	0	0
TULSA, OK [2]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (°F)	46.5	52.9	62.4	72.1	79.6	88	93.8	93.2	84.1	74	60	49.6	71.4
Average Min. Temperature (°F)	26.3	31.1	40.3	49.5	59	67.9	73.1	71.2	62.9	51.1	39.3	29.8	50.1
Average Total Precipitation (in.)	1.6	1.95	3.57	3.95	6.11	4.72	2.96	2.85	4.76	4.05	3.47	2.43	42.42
Average Total Snow Fall (in.)	3	2.1	1.4	0	0	0	0	0	0	0	0.6	2	9.1
Average Snow Depth (in.)	[3]	[3]	[3]	0	[3]	0	0	0	0	0	[3]	[3]	[3]

[1]Source: HPRCC 2006.

[2]Source: NCDC 2006.

[3]Annual statistics for mean snow depths are not appropriate.

Lincoln, Nebraska, and Salisbury, Missouri, lie in the warm summer subtype. Lincoln has an average annual temperature of 62.8°F, while Salisbury is a little warmer. Both locales have rather large annual average temperature ranges of over 76°F. Summer high temperatures average over 86°F, while winter low temperatures average 13 to 20°F. Typical of the humid continental climate most of its precipitation falls during the summer when air masses are warmer and wetter.

3.2.2 Ambient Air Quality

Potential sources of emissions along the proposed pipeline ROW can be classified as one of three types: stationary, mobile, and fugitive. Stationary sources could include pump stations; however, because they are all electric, pump stations are not considered to be potential sources of stationary emissions on the Keystone Pipeline Project. Mobile sources of emissions are the vehicles and equipment used during construction of the pipeline, pump stations, and other ancillary facilities. Fugitive sources include road dust, dust from the operation of earthmoving equipment, and leaks or programmed releases of volatile constituents in fuels and crude oil from valves, fittings, or sump tanks.

Six common air pollutants comprise the federal list of criteria pollutants: ozone (O_3); nitrogen dioxide (commonly called NO_2); carbon monoxide (CO); sulfur dioxide (SO_2); lead (Pb); and particulate matter based on a particle size of 10 microns or less (PM_{10}). The criteria pollutants are described in more detail below and the national standards for the control of criteria pollutants are discussed in Section 3.2.3.

The proposed underground pipeline will not have consequential air emissions under normal operating conditions. The pump stations are electric driven and will not contribute to local air emissions.

The Clean Air Act (CAA), 42 USC 7401 et seq. as amended in 1977 and 1990 is the basic federal statute governing air pollution. The provisions of the CAA that potentially are relevant to this project are listed below and discussed in the following sections:

- National Ambient Air Quality Standards (NAAQS);
- Prevention of Significant Deterioration (PSD);
- New Source Review (NSR);
- New Source Performance Standards (NSPS);
- Maximum Achievable Control Technology (MACT) Standards; and
- Title V Operating Permits.

The only air quality standards that apply to this project are the NAAQS. All pump stations are electric, and therefore there are no significant stationary services subject to the standards listed above (PSD, NSR, NSPS, MACT, and Title V Operating Permits).

3.2.3 National Ambient Air Quality Standards

The CAA empowered the USEPA to promulgate NAAQS air quality standards for six common air pollutants: O_3, CO, Pb, oxides of nitrogen (NO_x), PM_{10}, and SO_2. These standards were to include primary standards designed to protect health, and secondary standards to protect public welfare, predominately visibility. The NAAQS reflect the relationship between pollutant concentrations and health and welfare effects and therefore, are supported by sound scientific evidence. **Table 3.2-2** summarizes the primary and secondary standards for the six pollutants, and the averaging time for determining compliance with the standards.

The states are required to implement and enforce the NAAQS under a process called State Implementation Plans (SIPs), which are approved by the USEPA. Generally the SIPs are comprised of air quality rules that are applicable to stationary sources that may emit criteria or hazardous air pollutants. The CAA as amended in

1990 assigned new NAAQS attainment deadlines and categorized non-attainment as marginal, moderate, serious, severe, or extreme, depending upon the degree of violation of the NAAQS. The standards, other than ozone, particulate matter, and those based on averages, are not to be exceeded more than once a year. The eight-hour ozone standard is attained when the fourth highest eight-hour concentration in one year, averaged over three years, is equal to or less than the standard of 0.08 parts per million (ppm).

Table 3.2-2 National Ambient Air Quality Standards

Pollutant	Standard Value	Standard Type
CO		
8-hour Average	9 ppm (10 micrograms per cubic meter [$\mu g/m^3$])[1]	Primary
1-hour Average	35 ppm (40 $\mu g/m^3$)[1]	Primary
NO_2		
Annual Arithmetic Mean	0.053 ppm (100 $\mu g/m^3$)	Primary & Secondary
O_3		
1-hour Average[2]	0.12 ppm (235 $\mu g/m^3$)[1]	Primary & Secondary
8-hour Average	0.08 ppm (157 $\mu g/m^3$)[1]	Primary & Secondary
Pb		
Quarterly Average	1.5 $\mu g/m^3$	Primary & Secondary
PM_{10}		
Annual Arithmetic Mean	50 $\mu g/m^3$	Primary & Secondary
24-hour Average	150 $\mu g/m^3$	Primary & Secondary
$PM_{2.5}$		
Annual Arithmetic Mean	15 $\mu g/m^3$	Primary & Secondary
24-hour Average	65 $\mu g/m^3$	Primary & Secondary
SO_2		
Annual Arithmetic Mean	0.03 ppm (80 $\mu g/m^3$)[1]	Primary
24-hour Average	0.14 ppm (365 $\mu g/m^3$)[1]	Primary
3-hour Average	0.50 ppm (1300 $\mu g/m^3$)[1]	Secondary

[1]Parenthetical value is an approximately equivalent concentration. Regional air basins are designated as either in attainment of the NAAQS or as non-attainment for violating the NAAQS. States or air quality control regions (AQCRs) that are non-attainment must require control equipment on their stationary sources in order to reduce criteria pollutants.

[2]The ozone one-hour standard applies only to areas that were designated non-attainment when the ozone eight-hour standard was adopted in July 1997. This provision allows a smooth, legal, and practical transition to the eight-hour standard.

Source: USEPA 2006.

The Keystone Pipeline Project does not pass through any non-attainment areas.

3.3 Geology, Mineral Resources, and Paleontology

This section discusses the geology, mineral resources, and paleontology along the Keystone Mainline and Cushing Extension routes. Geologic hazards are discussed in Section 3.12.7.

KEYSTONE MAINLINE

3.3.1 North Dakota

3.3.1.1 Geology

The Keystone Pipeline Project is located in the Dakota-Minnesota Drift and Lake-bed Flats physiographic subdivision (Hammond 1965). Overall, this area is typified by low relief and is covered by glacial moraines and lakebeds (Radbruch-Hall et al. 1982). The majority of the proposed route follows areas of low relief, except for locations that cross the Pembina River and Sheyenne River Valleys, where the change in elevation from the valleys to the top the escarpments can range from 200 to 300 feet. Elevations along the proposed route range from 950 to 1,550 feet above mean sea level (amsl). The proposed route in northern North Dakota generally parallels the Pembina Hills, an escarpment that marks the western edge of the Red River Valley (Bluemle and Ashworth 2002).

The surficial unconsolidated geologic materials crossed by the proposed route are composed of alluvium, lake sediments, and glacial drift (Bluemle 1977). The lake sediments were derived from the ancient Lake Agassiz, a huge lake that occupied portions of Manitoba and Ontario, extreme eastern North Dakota, and northern Minnesota around 12,000 to 7,500 years ago (Bluemle 2002a). The glacial drift resulted from the action of continental glaciers on the landscape over several glacial episodes. The alluvial deposits have resulted from the action of streams in recent time.

The bedrock geology that underlies the surficial materials along the proposed route are Upper Cretaceous units consisting of the Pierre Formation, Niobrara Formation, the Carlisle Formation, and the Greenhorn Formation (Bluemle 1988). These formations are composed of marine shale, limestone, and sandstone and occur beneath the cover of the glacial and alluvial materials described above. The Cretaceous rocks outcrop along gullies, river valleys, and road cuts along the Pembina Escarpment (Bluemle and Ashworth 2002).

3.3.1.2 Mineral Resources

The major mineral resources along the proposed route in North Dakota are sand, gravel, crushed stone and clay (USGS 2004a). There are no oil, natural gas, coal, or metallic ore resources.

3.3.1.3 Paleontological Resources

In isolated places where the Upper Cretaceous rocks outcrop, there is the potential of finding various fossils of marine organisms that lived in shallow seas that covered the area in late Cretaceous time. These animals include turtles, fish, and invertebrates (clams, cephalopods, gastropods, corals, and crustaceans) (Walhalla, North Dakota, undated). The glacial deposits may contain fossils of large vertebrates including mastodon and mammoth (Paleontology Portal 2003).

3.3.2 South Dakota

3.3.2.1 Geology

The proposed route crosses the Dakota-Minnesota Drift physiographic subdivision (Hammond 1965). As described above, the Drift and Lake-bed Flats is an area of low relief. The route is in the James River Valley, a broad valley of low relief that trends north to south across the eastern portion of the state. The James River

Valley was formed when the dam forming a large glacial lake (Lake Dakota) was breached and the outflow carved the valley (South Dakota Department of Environment and Natural Resources [SDDENR] 2006). The elevations in the James River Valley area at about 1,200 feet amsl and it is situated between areas of higher elevation, the Coteau du Missouri to the west and the Coteau du Prairies to the east (South Dakota State Geological Survey [SDSGS] 1964). A major point of relief occurs in Yankton County along the Missouri River.

Elevations along the proposed route vary from around 1,300 feet amsl in the north to about 1,150 feet amsl in the south. There is very low relief along the route except where major drainages have cut into the glacial deposits. There is about 140 feet of relief where the route crosses the James River and about 100 feet of relief where the route drops into the Missouri River Valley.

The geologic surficial deposits along the proposed route are composed of glacial drift consisting of till deposits made up of material derived from the Cretaceous bedrock (SDSGS 1964). The glacial till deposits can be hundreds of feet thick especially in the eastern part of the state. The surficial deposits also may include loess (fine-grained glacial material re-deposited by wind) and alluvium (Tomhave and Schultz 2004).

The bedrock underneath most of the proposed route is Upper Cretaceous rocks similar to those described in North Dakota. The Cretaceous units include the Pierre Shale, Niobrara Formation, Carlisle Shale, Greenhorn Formation, and Graneros Shale (Tomhave and Schultz 2004). There may be minor areas of Dakota Formation which is Upper-lower Cretaceous. The Upper Cretaceous units are mainly composed of shale and minor amounts of limestone and sandstone. The Dakota Formation consists of medium- to coarse-grained sandstone with minor interbedded shale. In Hansen County, the bedrock is Precambrian in age and is composed largely of quartzite (SDSGS 1964). As in North Dakota, the bedrock occasionally outcrops along road cuts and stream valleys.

There are potential karst features along the proposed route in southern portions of Miner County, northern portions of Hanson County and in the southern part of Hutchinson County and all of Yankton County to the Nebraska State line (Davies et al. 1984). Karst occurs as a result of the dissolution of certain rocks by water. The dissolution can cause caves or can result in subsurface voids, which if manifested to the surface can cause hazards to life and property in the form of sinkholes. The area is underlain by carbonate rocks of the Cretaceous Niobrara Formation. Small fissures may develop in the Niobrara but are less than 1,000 feet long and 100 feet deep and are widely spaced with over 1,000 feet of competent rock between fissures (National Atlas of the United States [NAUS] 2006). However, the Niobrara Formation where fissures occur generally is covered by 50 feet or more of cover.

3.3.2.2 Mineral Resources

Sand and gravel and crushed stone are the major mineral resources extracted in the vicinity of the proposed route. Day and Clark counties are important producers of sand and gravel and Hanson County is a major producer of crushed stone (USGS 2004b). There are no oil, natural gas, coal, or metallic ore resources in the vicinity of the proposed route (SDSGS 1964).

3.3.2.3 Paleontological Resources

As in North Dakota, the Upper Cretaceous rocks fossils are marine organisms that lived in shallow seas in the late Cretaceous time and include turtles, fish, and invertebrates (clams, cephalopods, gastropods, corals, and crustaceans). The glacial deposits may contain fossils of large mammal vertebrates that were common during the ice ages: mastodon, bison, mammoth, and horse (Paleontology Portal 2003).

3.3.3 Nebraska

3.3.3.1 Geology

The northern portion of the proposed mainline route in Nebraska is located in the Middle Western Upland Plain physiographic subdivision which extends east-west from Nebraska to Ohio (Hammond 1965). The area is characterized by rolling and dissected topography and the glacial deposits are thin in upland areas (Radbruch-Hall et al. 1982). South of Wayne County to the Kansas State line, the proposed route travels across the West-Central Rolling Hills. This area also is underlain by glacial deposits and is of low to moderate relief. Moderate relief is found along the Missouri River where the proposed route crosses from South Dakota into Nebraska.

Elevations along the proposed route in Nebraska vary from around 1,150 feet amsl in the Missouri River Valley to more than 1,800 feet in the southern part of the state. The relief along the edge of the Missouri River is about 100 feet and from 100 to 130 feet where the route crosses the Elkhorn River. The topography is generally rougher north of the Platte River where the surficial deposits are more dissected.

The surficial deposits consist of glacial materials and alluvium. In many places glacial drift also is covered in loess (Bennison and Chenowith 1984). In the north, where the route crosses Cedar County, the surficial deposits are thin and loess lies directly over bedrock with no deposits of glacial drift. In the valley of the Platte River, the deposits are recent alluvium.

Most of the proposed mainline route in Nebraska crosses upper and Lower Cretaceous and Upper Tertiary rock units (King and Beikman 1974). From the South Dakota State line to Butler County, the route primarily crosses Upper Cretaceous rocks as described for North and South Dakota: Pierre Shale, Niobrara Formation, Carlisle Shale, Greenhorn Formation, and Graneros Shale (Bennison and Chenowith 1984). In portions of Cedar, Wayne, and Stanton counties the route crosses areas underlain by Miocene (Tertiary) deposits of the Ogallalla Group. The Ogallalla Group consists of sandstones and shale interbedded with layers of ashfall material. South of Butler County to the Kansas State line, the route crosses primarily Lower Cretaceous rocks of the Dakota Group and which consists of sandstone and shale.

As in southeastern South Dakota, areas prone to karst development along the proposed route in Nebraska are in Cedar and Wayne counties. The route in this area is underlain by upper Cretaceous bedrock that has limestone in the Niobrara Formation that may weather into shallow, widely spaced fissures (Davies et al. 1984).

3.3.3.2 Mineral Resources

The major minerals along the proposed route are sand, gravel, crushed stone, and clay (USGS 2004c). There are no oil, natural gas, coal, or metallic ore resources in the vicinity of the proposed route.

3.3.3.3 Paleontological Resources

Fossils that may potentially be found in the upper Cretaceous rocks include turtles, fish, and ammonites (Paleontology Portal 2003). The glacial deposits may have the remains of large vertebrates including elephants and horses.

3.3.4 Kansas

3.3.4.1 Geology

The Keystone Mainline route crosses the West-Central Rolling Hills physiographic subdivision in Kansas (Hammond 1965). The area is underlain by glacial deposits and is characterized by low to moderate relief and is referred to as the Glaciated Region of Kansas (Buchanan and McCauley 1987). Areas of sharp relief can be encountered along the bluffs above the Missouri River in Doniphan County where glacial loess deposits form bluffs over 300 feet above the Missouri River floodplain (Kansas Geological Survey [KGS] 1999a).

Elevations along the proposed route in Kansas range from around 790 feet amsl at the Missouri River to 1,500 in eastern Marshall County. The topography is generally rough, which is indicative of the erosion of the surficial deposits. At the Missouri River, there is about 220 feet of relief where the route comes down to the floodplain of the river. Steep relief also is found where the route crosses the Big Blue and Nemaha Rivers where the changes in elevation vary from 100 to 130 feet.

The surficial geologic materials are glacial deposits and alluvium. The mainline route crosses an area of glacial drift composed of till, lake deposits, and loess (SGSK 1964). Alluvium is found in river valley and drainages. The glacial deposits are commonly not continuous or thick and bedrock units are exposed in drainages but the loess deposits can be more than 100 feet thick in places (KGS 1999a).

The bedrock is composed of Pennsylvanian and Permian rocks. The Shawnee Group and the Wabaunsee Group are Pennsylvanian in age and are largely composed of limestone and shale and localized sandstone (State Geological Survey of Kansas [SGSK] 1964). The Permian rocks consist of the Admire, Council Grove, Chase, and Sumner Groups which are composed mainly of limestone and shale. The route is underlain by the Permian rocks in Marshall, Nemaha, and western Brown Counties. The Pennsylvanian rocks are crossed in eastern Brown and Doniphan Counties.

There are small isolated areas of potential karst development identified on the national karst map characterized as fissures, tubes and caves usually less than 1,000 feet long and less than 50 feet deep. (Davies et al. 1984). The karst appears to be similar to South Dakota and Nebraska; widely spaced, relatively small solution fissures in nearly flat-lying carbonate rocks covered with varying amounts of overburden.

3.3.4.2 Mineral Resources

The major mineral resources in northeast Kansas are sand, gravel, and crushed stone (USGS 2004d). The proposed route lies in the Forest City structural basin and there are several small oil fields in northeast Nemaha County and northwest Brown County (Brooks et al. 1975). Coal beds are present in Pennsylvanian rocks but are generally too deep to mine, although there is potential for coal bed methane production (Rice 1995).

3.3.4.3 Paleontological Resources

The Pennsylvanian-aged rocks have the potential to have invertebrate fossils including mussels, echinoids, bryozoans, crinoids, snails, corals, and trilobites (Paleontology Portal 2003). Permian time was not conducive to abundant life but fossils of fish including shark may be found. The surficial glacial deposits in the area have the potential to contain typical ice-age large vertebrates.

3.3.5 Missouri

3.3.5.1 Geology

The proposed mainline route crosses three physiographic subdivisions from west to east: West-Central Rolling Hills, Mid-continent Plains and Escarpments, and Middle Western Upland Plain (Hammond 1965). These areas are generally low to moderate relief with rolling hills and dissected drainages (Radbruch-Hall et al. 1982). Areas of steep relief are found adjacent to the major river valleys.

Elevations along the proposed route in Missouri vary from 790 feet amsl at the Missouri River to 1,165 amsl feet in northwest Missouri down to around 400 amsl feet in the Mississippi River flood plain. From the Missouri River to Montgomery County, Missouri, the topography is similar to that crossed in Kansas, but with steeper relief. Areas with slopes greater than 15 percent are present in northwest Missouri (less than two percent of the total distance of the proposed route). The greatest elevation change is along the Missouri River in northwest Missouri where the elevation change at the edge of the floodplain is about 250 feet.

The surficial geology is composed of alluvium and glacial drift composed of till and loess. The Missouri River generally marks the southern limit of glaciation and most of northern Missouri is covered with a mantle of glacial drift. The area is referred to by Raisz (1957) as the Loess-covered Till Prairies. While the glacial deposits are thick in places, deep erosion has exposed bedrock in the drainages. Alluvium is present in the river valleys and is especially thick in the flood plains of the Mississippi and Missouri Rivers.

The proposed route crosses Pennsylvanian-aged rocks from the northwest corner of the state to Montgomery County and then for a small distance west of the Mississippi River north of St. Louis. From Montgomery County to the Mississippi River, the route crosses Mississippian-aged rocks. The Pennsylvanian rocks that underlie the route consist of sandstone, limestone, shale, and coal (Oetking et al. 1966). The Mississippian rocks are composed mainly of cherty limestone and minor amounts of shale and sandstone.

In Caldwell, Lincoln, and St. Charles County, there are potential karst development areas identified on the national karst map characterized as fissures, tubes and caves usually less than 1,000 feet long and less than 50 feet deep (Davies et al. 1984). The karst description is the same as for South Dakota and Nebraska. Most of the classic karst geology in Missouri occurs in the Ozarks south of the proposed pipeline route and south of the Missouri River.

3.3.5.2 Mineral Resources

Important mineral resources in the vicinity of the proposed route are sand, gravel, crushed stone and fine clay (USGS 2004e). Oil, natural gas, and prospective coal bed methane resources are present where the proposed route traverses the Forest City Basin (Charpentier 1995). The proposed route crosses the basin from the Kansas State line to the western side of Chariton County. There are several oil fields in Clinton County but not near the proposed route. There also is an oil field located in St. Louis on the south side of the Missouri River (Association of Missouri Geologists 1982). Coal also is found in Pennsylvanian beds that the route crosses and mineable coal resources are present in Audrain, Buchanan, Caldwell, Carrol, Chariton, Montgomery, and Randolph counties (USGS 2004f).

3.3.5.3 Paleontological Resources

The surficial alluvial and glacial deposits may contain fossils of animals that lived during the ice ages and these deposits have yielded particularly good mastodon specimens (Paleontology Portal 2003). The Paleozoic rocks may contain fossil fish and a number of invertebrates including mollusks, corals, and echinoderms.

3.3.6 Illinois

3.3.6.1 Geology

The proposed mainline route is located in the Middle Western Upland Plain physiographic subdivision (Hammond 1965). The area has generally low to moderate relief. The only areas of substantive relief occur where the route crosses major drainages and at the edge of the Mississippi River alluvial valley.

The Mississippi River floodplain is relatively flat at an elevation of slightly over 400 feet amsl. As the proposed route climbs out of the floodplain, it crosses fairly level ground along Kahokia Creek and undulating incised terrain north and east of Edwardsville, Illinois. East of Edwardsville, the route climbs on to the till plains where there is slight rolling relief except for incised drainages where rapid elevation changes of up to 100 feet can occur in the larger drainages. The elevations on the till plains generally range from 500 to 600 feet amsl.

The surficial geology consists of glacial deposits and alluvium. As the route enters the state, it crosses the broad alluvial valley of the Mississippi River, which is composed of sand silt and clays (Lineback 1979). East of the Mississippi River, the route climbs onto loess deposits that are adjacent to the floodplain. Further east, the route crosses glacial tills that vary from 50 up to 200 feet thick.

The bedrock geology is comprised of Mississippian and Pennsylvanian-aged sedimentary rocks (Willman et al. 1967). The Mississippian subcrop is mainly underneath the alluvium of the Mississippi River. The Mississippian rocks are composed largely of limestone and sandstone with minor shale. A few miles east of the river, the route crosses Pennsylvanian rocks that consist of sandstone, shale, and coal.

Karst is present in Illinois in carbonate rocks that outcrop or are close to the surface along western edge of the state along the Mississippi River (Illinois State Geological Survey [ISGS] 2003). Numerous sinkholes and collapse structures have been identified. The area crossed by the proposed route from the Mississippi River to about three miles east of the river is underlain by bedrock that may be prone to the development of karst. However, no karst features have been identified in that particular area (Davies et al. 1984; USGS 2000).

3.3.6.2 Mineral Resources

The coals that are mined in the area are found in the Pennsylvanian rocks. These coal beds have been mined for many years and Illinois has a large coal reserve and numerous active coal mines (ISGS 2004). In addition to coal, the Illinois Basin has oil and gas resources (ISGS 2005c). Other mineral resources in the vicinity of the proposed route are crushed stone, sand, gravel, and clay (USGS 2004g).

3.3.6.3 Paleontological Resources

Fossils that potentially are found in the surficial deposits of Illinois can include beaver, mastodon, mammoth, and moose (Paleontology Portal 2003). The older Paleozoic rocks contain a diverse fauna while the Pennsylvanian rocks have many fossil plants as well.

CUSHING EXTENSION

3.3.7 Kansas

3.3.7.1 Geology

The proposed Cushing Extension route begins in the West-Central Rolling Hills physiographic subdivision and crosses into the Mid-continent Plains and Escarpments in the vicinity of southeastern Washington County (Hammond 1965). The Mid-continent Plains and Escarpments subdivision is an area of low to moderate relief. From the Nebraska state line to southern Washington County, the route crosses the Glaciated Region of northeast Kansas (Buchanan and McCauley 1987). South of the Glaciated Region, the entire length of the Cushing Extension in Kansas is in an area referred to as the Flint Hills. The Flint Hills is made up of a series of north-south trending escarpments formed by the erosion of the outcrops of gently west-dipping Permian sedimentary rocks. The upland areas of the Flint Hills are commonly covered with cherty gravels which are more resistant to erosion and thereby forming the prominent escarpment (KGS 1999b). Karst is not present along the Kansas portion of the Cushing Extension (Davies et al. 1984; USGS 2000).

The proposed extension crosses into Kansas at an elevation of about 1,330 feet amsl at the state line. For much of the route, it crosses gentle rolling hills where elevations generally range from 1,150 to over 1,400 feet amsl. Some relief is provided at major drainages where elevation changes are commonly around 100 feet, but are not steep. The lowest elevations are found in the Arkansas River valley where the elevation is around 1,070 feet amsl.

In the Glaciated Region, the surficial deposits are composed glacial till, loess, and alluvium. The proposed extension route crosses only a few miles of the Glaciated Region. Where the route leaves the glaciated area in southeastern Washington County, there are relatively thick (greater than 30 feet) deposits of loess until the route is in Dickinson County (Frye and Leonard 1952). South of the glaciated area, the dominant surficial materials are alluvium and colluvium and as mentioned above, cherty gravels are present in upland areas of the Flint Hills. Occasional loess deposits are present in Cowley County on the southern portion of the lateral.

The proposed route crosses Lower Cretaceous bedrock (Dakota Formation) in Washington County (SGSK 1964). The Dakota Formation is composed of sandstone and shale. From southern Washington County, Kansas to the Oklahoma State line the proposed extension crosses rocks of the Permian Council Grove, Chase, and Sumner Groups, which are composed primarily of limestone and shale (SGSK 1964).

3.3.7.2 Mineral Resources

Oil and natural gas are important mineral resources present along the Cushing Extension. From Marion County south to the Oklahoma state line, the route passes near or crosses a number of oil and gas fields (KGS 2005c). There are five small oil fields in Clay County, four of which are now abandoned. The proposed route passes near the active El Dorado oil field west of El Dorado, Kansas. The field was discovered in 1915 and has produced over 300 million barrels of oil (KGS 2006). In addition to oil and natural gas, sand, gravel, crushed stone, and dimension limestone are important mineral resources present along the Cushing Extension (USGS 2004d). Sulfur also is an important byproduct of oil production in Butler County.

3.3.7.3 Paleontological Resources

Permian time was not conducive to abundant life but fossils of fish such as shark may be found in addition to invertebrates including corals, brachiodpods, ammonoids, and gastropods (KGS 2005a). It also is possible that the surficial unconsolidated deposits in the area have the potential to contain typical ice-age large vertebrates such as mammoths, mastodons, camels, and saber-toothed tigers (Paleontology Portal 2003). The unconsolidated deposits also contain invertebrates such as mollusks which have been used to correlate different glacial episodes to various deposits (Frye and Leonard 1952).

3.3.8 Oklahoma

3.3.8.1 Geology

The Cushing Extension route in Oklahoma is in the Mid-continent Plains and Escarpments physiographic subdivision (Hammond 1965). The area is typified by low to moderate relief. Much of the relief is the result of escarpments formed from the erosion of gently west dipping bedrock formations similar to the Flint Hills of Kansas. The southern extension of the Flint Hills into Oklahoma is called the Osage Hills (KGS 1999b).

The proposed extension crosses relatively flat ground from the Kansas – Oklahoma state line to the Cimarron River. Elevations range from 900 to 1,150 amsl over broad rolling hills and relief changes along rivers and drainages are generally around 50 feet or less. The crossing of the Cimarron River has the greatest relief where elevation changes of 140 to 180 feet occur on each side of the river. South of the Cimarron River to the end of the line, the route crosses areas of sharply dissected drainages north and west of Cushing, Oklahoma, and elevations range from 860 to 1,070 feet amsl.

Surficial geologic deposits consist of alluvium and terrace deposits. The alluvium is associated with rivers and drainages and is thickest in the Cimarron River Valley (Bingham and Bergman 1980). The terrace deposits also are found along the margins of the major river valleys. The surficial deposits are composed primarily of sand, silt, and clay. The proposed route crosses mainly bedrock of Lower Permian age from the Kansas-Oklahoma state line to northeast Noble County. Where the route crosses the Salt Fork of the Arkansas River, there may be outcrops of Upper Pennsylvanian rocks along the edge of the floodplain. The Lower Permian rocks belong to the Wellington Formation and consist of sandstone, mudstone conglomerate, and chert. After the route crosses Highway 177 in northeast Noble County, it crosses the Upper Pennsylvanian of the Oscar and Vanoss Groups that are composed of sandstone, shale, and limestone (Bingham and Moore 1975; Bingham and Bergman 1980). Karst is not present along the Oklahoma portion of the Cushing Extension (Davies et al. 1984; USGS 2000).

3.3.8.2 Mineral Resources

Oil and natural gas are important mineral resources present in the area crossed by the Cushing Extension route. There are numerous oil and gas fields in the vicinity (Boyd 2002a). The oil fields primarily produce from Mississippian, middle and upper Pennsylvanian, and Permian reservoirs (Boyd 2002b). Discoveries of prolific oil fields near Cushing, Oklahoma in the early twentieth century resulted in Cushing becoming a major crude oil refining and pipeline transportation hub (Mid-Continent Oil and Gas Association of Oklahoma 2006). In 1916, Sinclair built a major crude oil pipeline from Cushing to Wood River, Illinois.

Other mineral resources in the counties along the route include sand, gravel, and crushed stone (Johnson 1998; USGS 2004h).

3.3.8.3 Paleontological Resources

The Wellington Formation (Lower Permian) in Noble County has yielded vertebrates fossils from fish, amphibians, and reptiles (May and Hall 2002). Fossil plants, insects, and invertebrates also can be found in the Permian formations in north central Oklahoma. The alluvium and terrace deposits associated with the rivers may contain fossilized wood, snails, clams, and large land invertebrates such as horses, camels, bison, and mammoths (Johnson 1996).

3.4 Soils

The Keystone Pipeline Project route will be located almost entirely within the northern part of the Central Lowlands physiographic province (Thornbury 1965). Within the project region, the geologic surface has been formed by repeated episodes of continental glaciation. As a result, glacial deposits and re-worked alluvium form the parent materials for the majority of soils along the route. As a general rule, bedrock-controlled terrain exists in the project area only within the Missouri and Mississippi River valleys in the vicinity of St. Louis, Missouri. Isolated bedrock exposures also may occur elsewhere along stream valleys and associated hillslopes.

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.

KEYSTONE MAINLINE

North Dakota

In North Dakota, most of the soils have thick, dark topsoil layers and mixed mineralogy. Nearly level to undulating soils such as the Barnes, Svea, and Hecla series occur on upland till plains and glacial lake plains. These soils are well drained or moderately well drained. Sodic soils, such as the Aberdeen series, also occur on glacial lake plains. Very poorly drained, wet soils, such as the Parnell series occur in the numerous prairie potholes and along streams (U.S. Department of Agriculture-Soil Conservation Service [USDA-SCS] 1981). Soil fertility is inherently high and remains so where maintained by agricultural practices. Prime farmland soils are extensive, occupying approximately half of the proposed route in North Dakota. The average freeze-free period is 100 to 120 days at the northern border of the U.S., and lengthens to 120 to 140 days further south through the state (USDA-SCS 1981).

South Dakota

In the northern portions of South Dakota (to central Miner County), the soils are generally similar to those of North Dakota but have warmer mean annual temperatures. Houdek, Prosper, and Clamo soils series occur on nearly level to rolling glacial till plains. These are well drained to moderately well drained soils with thick, dark, fertile topsoil layers. Saline or sodic soils, such as the Dudley and Jerauld series, are interspersed on uplands with other soils more suited to cropland. Parnell and Tetonka soils occur in upland depressions with drainage restrictions. The average freeze-free period is about 130 to 155 days (USDA-SCS 1981).

From central Miner County to the Nebraska state line, uplands are formed from both loess (wind-deposited silts) and medium-textured glacial till. Most of the soils are deep, silty or loamy, and have thick, organically enriched topsoil layers that make them well-suited for agricultural uses. Overall, about 45 percent of the proposed route within South Dakota consists of prime farmland soils. Well drained, nearly level to moderately sloping soils, such as the Belfore and Moody series, formed from the loess parent materials. Other well drained, nearly level to moderately sloping soils, such as the Clamo, Egan, and Wentworth series, formed in glacial till. Upland depressions are typically poorly drained and contain wet, dark soils. In the Missouri River region, stream valley floors and bottomlands contain poorly drained soils with thick, dark-colored topsoils, such as the Lamo and Luton series. These are interspersed with well drained to poorly drained, highly stratified soils, such as the Albaton and Haynie series, which formed in more recent mixed sediments. The average freeze-free period is about 135 to 165 days (USDA-SCS 1981).

Nebraska

Along the proposed route into central Nebraska, soil characteristics are similar to those described for southern South Dakota. However, from Butler County, Nebraska, into northeastern Kansas, most of the soils are formed in loess deposits that are generally tens of feet thick over glacial deposits. These soils are deep, silty and loamy and have relatively thick, dark, fertile topsoil layers. Dissected topography is more extensive in southern Nebraska and these soils are highly erodible on slopes. Fertile, dark topsoils remain characteristic. Hastings and Holdrege soils formed on silty uplands and the Hall and Hord soils occur in silty sediments on stream terraces. Prime farmland soils are extensive in Nebraska, occupying approximately 63 percent of the proposed route. The average freeze-free period is about 160 to 180 days in this part of Nebraska.

Kansas

In southern Nebraska and northeastern Kansas, sedimentary bedrock may outcrop along valley sideslopes and ridge crests. These rocks consist mostly of shales, siltstones, and limestones in various stages of weathering. Shallow soils such as the Kipson series form in these locations. Elsewhere along the western part of the proposed route in Kansas, the Irwin, Ladysmith, and Geary soil series occur on the silty uplands. These are deep soils with fertile topsoils and loamy or clayey subsoils. The average freeze-free period is about 170 to 190 days.

Further along the proposed route in Kansas, from about central Marshall County eastward, the soil moisture regime becomes wetter. Loess-mantled ridgetops and upper sideslopes are occupied by deep, silty soils with fertile, dark topsoil layers. Marshall and Monona soil series are examples. Some soils in flatter landscape positions, such as the Sharpsburg, Wymore, and Grundy series, have more clayey subsoils. Loamy soils such as the Burchard and Shelby series formed in glacial till. All of these soils have thick topsoil layers. On bottom lands, soils with internal drainage limitations (such as the Kennebec, Colo, and Wabash series) occur. About 46 percent of the proposed route in Kansas consists of prime farmland soils. The average freeze-free period is about 160 to 190 days (USDA-SCS 1981).

Missouri

Silty loess deposits thicken near the Missouri River and deep, highly erodible soils parallel the river in both Kansas and Missouri. The erosion hazard remains high on rolling and moderately steep slopes for several miles inland on either side of the Missouri River floodplain. Poorly drained and very poorly drained soils such as the Colo, Vesser, and Wabash series occur in the Missouri River bottomlands and along tributary drainages. Loess deposits thin eastward into the state of Missouri, and the soils have formed in clayey glacial till on dissected hills. Deep, well drained and moderately well drained soils, such as the Armstrong, Keswick and Lindley series, occur on Missouri uplands. Soils along this portion of the proposed route typically have claypan layers, but some lack the highly fertile, dark topsoil found further north. Deep, poorly drained soils, such as the Adair and Clarinda series, also may occur on upland slopes. Wetness and poor soil drainage are common along much of the proposed route in central and eastern Missouri. In addition, the shrink-swell potential may be severe through the Missouri uplands. Shallow and moderately deep soils occur over cherty limestones near the surface in some places in central and eastern Missouri. About 54 percent of the proposed route through the state consists of prime farmland. The average freeze-free period ranges from about 180 to 190 days (USDA-SCS 1981).

Illinois

Through the Mississippi River valley and eastward to Patoka, Illinois, the proposed route crosses wide river bottomlands and bordering hillslopes. Shallow and moderately deep soils occur over cherty limestones bordering the river valley. Uplands are comprised of dissected glacial till and other parent materials. Soil characteristics vary widely. Depths range from shallow to deep and range from sandy to clayey. Most of the upland soils near the Mississippi River are medium-textured, well drained or moderately well drained, and lack highly fertile, dark topsoil layers. Extensive areas of alluvial soils are poorly drained, very deep, and more fertile due to organic material enrichment. Inland toward Patoka, upland topography becomes nearly level to gently rolling. Soils are generally deep and wetness is the major land use problem. Most of the soils are silty near the surface, with clay accumulations at greater depths. About 93 percent of the proposed route within Illinois to Patoka consists of prime farmland. The average freeze-free period ranges from about 180 to 200 days (USDA-SCS 1981).

CUSHING EXTENSION

Nebraska

Along the Cushing Extension in southern Nebraska, the soils are derived from loess, as described for the Mainline. Soils are deep and silty, with dark, organically enriched surface layers. Soils such as the Hastings and Holdrege series are highly erodible on slopes. As described for the Mainline, prime farmlands are extensive in the area and the average freeze-free period is about 160 to 180 days (USDA-SCS 1981).

Kansas

Further south along the Cushing Extension in Kansas, sandstones and limestones may outcrop along valley sideslopes and ridge crests. Shallow soils such as the Hedville series form in these locations. Elsewhere, the Irwin, Ladysmith, and Geary soil series occur where silty loess deposits mantle the bedrock on uplands. These are deep soils with fertile topsoils and loamy or clayey subsoils. Along smaller streams, Hobbs soils commonly occur. These are deep, stratified soils with fertile topsoils. Along major streams, wetter soils such as the Solomon, Sutphen, and Roxbury series occur. These are deep loamy, silty, or clayey soils that have fertile, organically enriched topsoils and may be wet near the surface during parts of the year. In some locations, the topsoil layer may have a thickness of 20 inches or more. Most of the land along the Cushing Extension is used for agricultural purposes. The average freeze-free period is about 170 to 190 days (USDA-SCS 1981).

Oklahoma

Near the Kansas – Oklahoma border, soils transition to a warmer temperature regime. On gently sloping uplands, soils are deep and have dark topsoil layers that overlie clay accumulations in the subsoil. Representative soils series include the Anocon, Grant, Tabler, and Bethany soils. Elsewhere, dark, fertile topsoil layers are common. Shallow to deep, well drained soils such as the Minco and Lucien series occur on steeper slopes. The hazard of soil erosion may be significant in these areas. Deep, clayey or loamy soils such as the Miller, Port, or Reinach series occur along drainages. Topsoil layers in these drainage soils extend to depths of 20 inches or more, and in some locations may be wet at depths of two feet or more below the surface during part of the year. The average freeze-free period is about 190 to 230 days (USDA-SCS 1981).

Summary Soil Characteristics

General soil characteristics for the Keystone Pipeline Project have been assessed by means of the STATSGO database (Soil Survey Staff, no date). This investigation focused on soil characteristics or limitations of particular interest to the proposed pipeline construction. The results of the STATSGO data assessment are shown in **Tables 3.4-1** and **3.4-2**.

Table 3.4-1 Summary of Sensitive Soils Along the Proposed Pipeline Route

State/County	Total Miles[1]	Highly Erodible[2]	Prime Farmland[3]	Hydric[4]	Compaction Prone[5]	Stony – Rocky[6]	Shallow Bedrock[7]	Droughty[8]
KEYSTONE MAINLINE								
North Dakota	216.9	18.7	115.1	28.4	14.4	3.1	29.5	0.0
South Dakota	218.9	11.6	99.8	26.8	27.7	1.5	0.0	0.0
Nebraska	213.7	43.8	134.8	8.9	10.9	0.5	4.0	0.0
Kansas	98.8	23.6	46.3	2.0	8.6	0.2	29.6	0.0
Missouri	273.1	48.9	145.9	51.8	140.3	16.5	80.2	0.0
Illinois	56.5	4.5	40.8	16.3	35.2	0.1	0.1	0.0
Keystone Mainline Subtotal[9]	1,077.9	151.1	582.7	134.2	237.1	21.9	143.4	0.0
CUSHING EXTENSION								
Nebraska	2.4	1.1	1.4	0.0	0.0	0.0	0.0	0.0
Kansas	209.7	13.0	156.7	1.4	10.9	9.8	140.1	0.0
Oklahoma	79.7	4.4	53.1	<0.1	0.3	7.8	47.3	0.0
Cushing Extension Subtotal[9]	291.8	18.5	211.2	1.4	11.2	17.6	187.4	0.0
Project Total	1,369.7	169.6	793.9	135.6	248.3	39.5	330.8	0.0

[1]Mileage does not account for areas or disturbance associated with metering or pump stations, transmission lines, laterals, or pipe storage/contractor yards. Individual soils may occur in more than one characteristic class.

[2]Includes all soils listed as highly erodible.

[3]Includes land listed by the NRCS (2005) as potential prime farmland if adequate protection from flooding and adequate drainage are provided.

[4]As designated by the NRCS (2005).

[5]Includes soils that have clay loam or finer textures in somewhat poor, poor, and very poor drainage classes.

[6]Includes soils that have either: 1) a cobbly, stony, bouldery, gravelly, or shaly modifier to the textural class, or 2) have >five percent (weight basis) of stones larger than three inches in the surface layer.

[7]Includes soils that have bedrock within 60 inches of the soil surface.

[8]Includes coarse-textured soils (sandy loams and coarser) that are moderately well to excessively drained.

[9]Discrepencies in mileage are due to rounding.

Table 3.4-2 Average Slope Class Along the Proposed Pipeline Route

State/County	Total Miles[1]	Slope Class[2] (percent) 0-5	>5-8	>8-15	>15-30	>30
		——Miles——				
KEYSTONE MAINLINE						
North Dakota	216.9	170.9	43.5	2.5	0.0	0.0
South Dakota	218.9	189.9	17.9	11.1	0.0	0.0
Nebraska	213.7	119.7	42.2	51.8	0.0	0.0
Kansas	98.8	31.7	58.2	8.9	0.0	0.0
Missouri	273.1	133.5	17.6	104.9	16.9	0.0
Illinois	56.5	34.0	2.9	19.6	0.0	0.0
Keystone Mainline Subtotal[3]	1,077.9	679.7	182.5	198.8	16.9	0.0
CUSHING EXTENSION						
Nebraska	2.4	0.2	2.2	0.0	0.0	0.0
Kansas	209.7	161.9	47.8	0.0	0.0	0.0
Oklahoma	79.7	74.2	5.5	0.0	0.0	0.0
Cushing Extension Subtotal[3]	291.8	236.3	55.5	0.0	0.0	0.0
Project Total	1,369.7	916.0	238.0	198.8	16.9	0.0

Note: Depth to bedrock listed in the STATSGO database is greater than 24 inches for the entire Keystone Project.

[1]Mileage does not account for disturbance associated with metering or pump stations, transmission lines, laterals, or pipe storage/contractor yards.

[2]Slopes are grouped by the averages of the high and low slope ranges provided in the STATSGO database for each map unit identification (MUID) component soil series. For example, Tresano series, 3 to 10 percent slopes, is 20 percent of MUID CO010. Its average slope is six and one-half percent. The representative acreage, calculated by multiplying percent composition by the total MUID acreage, is included in the >five to eight percent slope class.

[3]Discrepencies are due to rounding.

3.5 Water Resources

3.5.1 Surface Water

KEYSTONE MAINLINE

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

- The Souris – Red – Rainy rivers region (in eastern North Dakota)
- The Missouri River region (in North and South Dakota, Nebraska, Kansas, and Missouri)
- The Upper Mississippi region (in Missouri and Illinois)

North Dakota

Primary drainages along the proposed route are indicated at a greater level of detail in **Figure 3.5-1**. As indicated in Appendix F, Table F-1, the larger stream crossings proposed in North Dakota include the Pembina River, the Tongue River, the Park River branches, Forest River branches, the Goose River and tributaries, and the Sheyenne River and several of its tributaries. In addition, the proposed route is located alongside Lake Ashtabula on the Sheyenne River in southern Steele County and northern Barnes County. Along the route in Steele County, the surface drainage flows away from Lake Ashtabula. A railroad grade also lies between the proposed route and the lake. Near Sibley in northern Barnes County, numerous side drainages and aquifer outcrops drain toward Lake Ashtabula from the vicinity of the proposed pipeline route. Lone Tree Lake and Lake Taayer also occur near the route, downstream of proposed tributary stream crossings in western Barnes County. Prairie potholes and ponds are common in and along the project route through North Dakota.

South Dakota

In South Dakota, primary drainages include Foster Creek and associated tributaries in southwestern Clark County, Pearl Creek and its tributaries in northeastern Beadle County; the Wolf Creek drainage in Hanson and Hutchinson counties; and the James River, Beaver Creek, and the Missouri River in Yankton County. The Missouri River at the proposed crossing is approximately 2,000 feet wide and the crossing will be located at the head of a braided reach downstream of the Highway 81 bridge. Marne Creek and a river side channel border the proposed approach to the river. Gavins Point Dam, a major control structure on the river, is located about three miles upstream of the proposed crossing. A large number of prairie potholes, ponds, and small lakes are located along the proposed route in southern Day County and Clark County.

Nebraska

A large number of drainage crossings are proposed in Nebraska, as shown in Appendix F, Table F-1. In addition to the Missouri River tributaries, the primary watersheds along the pipeline route include the Elkhorn River drainage, the Platte River drainage, and the Big Blue River basin. The Elkhorn is a highly meandering river with numerous oxbows and sloughs along its floodplain in the project vicinity. The Platte River at the proposed pipeline crossing is a highly braided stream, approximately 1,200 feet wide. It is located within sandy floodplain deposits up to three miles wide.

Kansas

The Big Blue River and its tributaries will be crossed in Kansas. Additional stream crossings in Kansas are proposed within the North Elm Creek drainage, the Robidoux Creek drainage, Wildcat Creek drainage, the Delaware River watershed, the Harris Creek drainage, and others. At the second proposed crossing of the

Missouri River, the channel is approximately 600 feet wide. A system of channel controls (levee and jetties) is located along the west bank and levees and ditches are located along the east bank.

Missouri

As indicated in Appendix F, Table F-1, a large number of streams will be crossed along the proposed route through Missouri. Major drainages to be crossed will include the Platte River (of Missouri); Castile Creek in Buchanan and Clinton counties; the Little Platte River, Mud Creek in Caldwell County; the Grand River watershed; the Chariton River and a number of its tributaries; Coon Creek tributaries in Montgomery County; the West Fork drainage of the Cuivre River in Audrain County; and the Cuivre River in Lincoln and St. Charles counties.

The proposed route crosses the Grand River. The floodplain is approximately five and one-half miles wide at the proposed crossing and there is a levee inland from the east bank of the river. The Missouri River is about 18 river miles downstream of the Grand River crossing, along an extensive system of levees. The Chariton River crossing will be about 12 miles upstream of the Missouri River, along an excavated channel. Levee systems are extensive along the Mussel Fork and the Little Chariton tributaries in the vicinity of the proposed route. At Bear Creek and Camp Creek in Lincoln County, the proposed route crosses deeply inset valleys less than a mile upstream of the Cuivre River. Further east, the Cuivre River is crossed twice as the proposed route enters St. Charles County. North of O'Fallon, Missouri, the proposed route begins to cross the extensive levee and ditch system on the floodplain at the confluence of the Mississippi and Missouri rivers. Abandoned stream meanders, ponds, and poorly drained conditions are common in the locale.

Illinois

The proposed route leaves the confluence floodplain system about five miles after crossing the Mississippi River. The Mississippi River is about 0.4 mile wide at the proposed crossing location. Cahokia Creek will be crossed within about three miles further eastward into Illinois from the Mississippi River floodplain. Highland Silver Lake will be crossed on the East Fork of Silver Creek north of Highland, Illinois. East of the Fayette County line, the proposed route crosses about three miles of floodplain (typically a one-half to one-mile portion is submerged in the spring months) associated with the Kaskaskia River as it flows into Carlyle Lake. This portion of the route is within the Carlyle Lake State Fish and Wildlife Area and Carlyle Dam is approximately 14 miles down the lake to the southwest. Carlyle Lake is a 26,000-acre multi-purpose lake administered by the USACE. The proposed eastern pipeline terminus near Vernon, Illinois, is approximately five miles further east.

In addition to stream crossings, a number of lakes and ponds are located along the proposed pipeline route. These also are indicated in Appendix F, Table F-1. Further map inspections indicate that additional waterbodies (primarily reservoirs or larger lakes) are located within several miles downstream of proposed pipeline crossings. These features are listed in **Table 3.5-1**. Levees and other surface water control features along the proposed route are summarized in **Table 3.5-2**.

3.5.2 Water Quality

The CWA, Section 303(c), requires each state to review, establish, and revise water quality standards for all surface waters within the state. To comply with this requirement, each state crossed by the proposed Keystone Pipeline Project has developed its own beneficial use classification system to describe state-designated use(s). Regulatory programs for water quality standards include default narrative standards, nondegradation provisions, a Total Maximum Daily Load (TMDL) regulatory process for impaired waters, and associated minimum water quality requirements for the designated uses of listed surface waterbodies within the state.

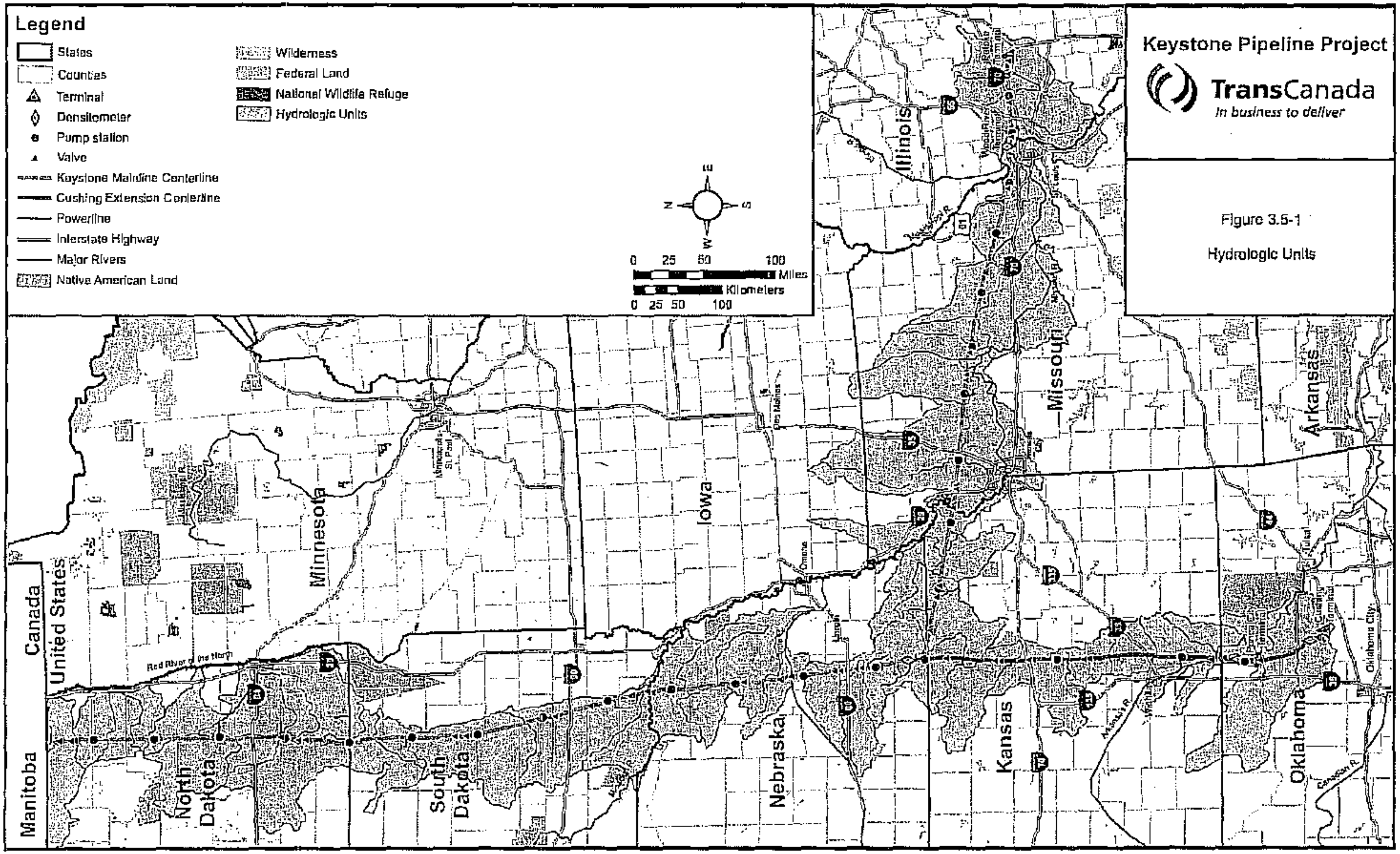

Legend
States
Counties
Terminal
Densitometer
Pump station
Valve
Keystone Mainline Centerline
Cushing Extension Centerline
Powerline
Interstate Highway
Major Rivers
Native American Land
Wilderness
Federal Land
National Wildlife Refuge
Hydrologic Units
0 25 50 100 Miles
0 25 50 100 Kilometers
Keystone Pipeline Project
TransCanada
In business to deliver
Figure 3.5-1
Hydrologic Units
Canada
United States
Manitoba
North Dakota
South Dakota
Minnesota
Iowa
Nebraska
Kansas
Missouri
Illinois
Arkansas
Oklahoma
Red River of the North
Omaha
Oklahoma City

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Affected Downstream Reservoir/Fishery/Wildlife Area	Other Description
KEYSTONE MAINLINE					
North Dakota	Pembina	Smith Coulee Tribs	10.5, 10.9	Weiler Dam/Reservoir	Immediately downstream of tributary crossings, also downstream Jay V Wessels Wildlife Management Area (WMA)
	Pembina	Busee Coulee	13.2	Unnamed reservoir	Downstream of crossing
	Pembina	Tribs to Tounge River	16.2, 17, 17.4	Herzog Dam/ two reservoirs	Two reservoirs just downstream of crossing of tributaries into reservoir
	Pembina	Crossing of Tongue River	18.4	Renwick Dam at Icelandic State Park	Two additional small dams and state wildlife areas immediately downstream of river crossing
	Pembina	Crossing of Willow Creek	20.62	Unnamed reservoir	at 134th Ave.
	Walsh	Crossing of unnamed trib	34.8, 35.3	Charles C Cook State Game Management Area and wetlands	
	Walsh	South Branch Park River	41.5	Homme Lake	Homme Lake and Homme Lake Project
	Nelson	South Branch Forest River Tribs	56.9, 57.4, 58.1	Reservoir/Dam	Large reservoir downstream; Forest River Biology Area below reservoir
	Nelson	Pickart Lake	74.0	Pickart Lake	Within 2,000 feet of the centerline, however; no stream crossings connected to reservoir
	Barnes	Tribs to Sheyenne River	168.0	Lake Ashtabula	Valley City National Fish Hatchery downstream of lake
	Ransom	Trib to Lone Tree Lake	180.3	Lone Tree Lake	Pipeline crosses trib that leads into Lone Tree Lake and Englevale Slough WMA
	Sargent	Trib to Lake Taayer	183.4	Lake Taayer	Lake Taayer, wetlands area

Table 3.5-1 **Waterbodies Within 10 Miles Downstream of Proposed Crossings**

State	County	Stream Crossing Point	Approx. Milepost	Affected Downstream Reservoir/Fishery/Wildlife Area	Other Description
South Dakota	Marshall	Renzienhausen Slough	228.7	Renzienhausen Slough	Renzienhausen Game Production Area (GPA), wetlands
	Day	Trib	257.5, 257.7	Amsden Lake	Unclear if trib is upstream or downstream
	Clark	Logan Dam/Reservoir	294.0	Logan Dam/Reservoir	Pipeline crosses directly upstream of reservoir
	Clark	Tribs to Fordham Reservoir	299.0	Fordham Reservoir	Area also includes Fordham GPA/Water Access (WA)
	Beadle	Crossing of Pearl Creek	326.0	Reservoir/Dam	Reservoir and LeClaire Waterfowl Production Area (WPA) dowstream of crossing
	Kingsbury	Lake Iroquois	329.0	Lake Iroquois	Crosses very close to or through Lake Iroquois
	Miner	Tribs to Twin lakes	354.3	Twin Lakes, National Wildlife Production Area (NWPA)	Downstream is Twin Lakes, NWPA, and associated GPA
	Hanson	Trib to Lake Eli	372.7	Lake Eli	NWPA, fishing, and hunting area
Nebraska	Colfax	Crossing of Tribs from Lake McCallister	539.8	Whitetail State Wildlife Management Area (SWMA), 3612 Fishing Spot	Feeds into the Platte River
	Colfax	Platte River	541.0	Whitetail SWMA, 3612 Fishing Spot	
	Butler	Crossing of Deer Creek	544.5, 547.5	Whitetail SWMA, 3612 Fishing Spot	Downstream of river crossing, also feeds into the Platte River
	Seward	Crossing of Lone Tree Creek	577.9	Three small reservoirs	Immediately downstream of crossing
	Jefferson	Crossing through Tribs of Big Indian Creek	626.9, 627.2	Unnamed Reservoir	
	Jefferson	Tribs to Big Indian Creek	633.1	Reservoir	Reservoir southwest of Diller
Kansas	No waterbodies located within 10 miles downstream of proposed crossing.				

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Affected Downstream Reservoir/Fishery/Wildlife Area	Other Description
Kansas Missouri	Buchanan	Tribs to New Mud Lake/Old Mud Lake	749.9	New Mud Lake/Old Mud Lake	May not be connected to reservoirs but located close to centerline
	Buchanan	Crossing Platte River	762.2	3112, 3120 Fishing Spot	
	Clinton	Crossing of Horse Fork, Little Platte River	778.6, 780.9	Smithville Reservoir, 2668 Fishing area	Large reservoir just south of Plattesburg
	Caldwell	Crossing of Brush Creek	801.2	2696 Fishing Spot	
	Chariton	Crossing of Grand River	840.6	2472 Fishing Spot	
	Chariton	Crossing Tribs of Palmer Creek	851.0, 851.8	Cut-Off Lake	Palmer Creek feeds into Cut-Off Lake then connects to Missouri River
	Montogomery	Crossing of Trib. to Middletown Lake	943.4	Middletown Lake	
	St. Charles	Tribs to Horseshoe and Mud Lake	985.2, 986.0	Horseshoe Lake and Mud Lake	Pipeline crosses through streams between the two waterbodies
	St. Charles	Crossing of Trib to Graus Lake	1002.6	Graus Lake	Pipeline crosses through streams that lead between the two areas
Illinois	Bond	Crosses Highland Silver Lake	1034.8	Highland Silver Lake	Very large reservoir
	Bond	Unnamed Reservoir	1046.2	Unnamed Reservoir	Southeast of Pocahontas
	Bond	Crosses Spring Branch	1059.0	Carlyle Lake and Carlyle Lake SWMA	Very large reservoir

Table 3.5-1 Waterbodies Within 10 Miles Downstream of Proposed Crossings

State	County	Stream Crossing Point	Approx. Milepost	Affected Downstream Reservoir/Fishery/Wildlife Area	Other Description
	Bond/Fayette	Carlyle Lake State Wildlife Management Area	1061.5-1064.5		Pipeline crosses through northern section and various streams and reservoirs
	Fayette/Marion	Tribs to Maggot Creek, North Fork	1066.0-1069.0	Carlyle Lake and Carlyle Lake SWMA	
			CUSHING EXTENSION		
Kansas	Clay	W. Fancy Creek	36.5	Turtle Creek Wildlife Area, Turtle Creek Lake	More than 10 miles downstream, approximately 15 to 20, very large reservoir
	Clay	Lincoln Creek	44, 45.5, 46	Milford Wildlife Area, Milford Lake	Lincoln Creek feeds into the Republican River which leads directly downstream to the Milford Wildlife Area and Milford Lake
	Clay	Republican River	50	Milford Wildlife Area, Milford Lake	Pipeline crossed directly through the Milford Wildlife Area at this crossing. Feeds directly into Milford Wildlife Area and Milford Lake
	Clay	Cane Creek	54	Milford Wildlife Area, Milford Lake	Pipeline crossed directly through the Milford Wildlife Area at this crossing. Feeds directly into Milford Wildlife Area and Milford Lake
	Clay	Trib to Milford Lake	58	Milford Wildlife Area, Milford Lake	
	Clay	Quinnby Creek	61, 62	Milford Wildlife Area, Milford Lake, Milford Lake Project	
	Dickinson	Lyon Creek	98.5, 100, 101.5	Herington Reservoir	Immediately downstream
	Marion	Cottonwood River	117	Marion Lake Reservoir, Marion Lake State Wildlife Area	River crossing is downstream, but passes very closely to lake and WA
	Cowley	Arkansas River	206	Kaw WMA, Kaw Lake	
	Cowley	Spring Creek	210	Kaw WMA, Kaw Lake	Fishing area 3040 directly downstream
Oklahoma	Kay	Cholocco Creek	212, 213	Kaw WMA, Kaw Lake	
	Noble	Trib to Sooner Lake	254	Sooner Lake	

Table 3.5-2 Levees and Water Control Structures

State	County	Milepost	Type of Flood Protection Structure	Waterbody
KEYSTONE MAINLINE				
North Dakota	N/A	N/A	None	N/A
South Dakota	Marshall	225.5	Spoil bank/ditch	Crow Creek Ditch/Crow Creek
Nebraska	Cedar	436.6	Ditch	Kaiser Ditch
	Cedar	438.2	Ditch/canal	Antelope Creek
	Colfax	537.9	Ditch	Barnholdt Ditch
	Colfax	544.0	Canal	Deer Creek Canal
Kansas	Doniphan	743.3	Embankment/levee	Missouri River
Missouri	Buchanan	743.7	Embankment/levee	Missouri River
	Buchanan	752.7	Embankment/levee	
	Buchanan	752.8	Embankment/levee	
	Chariton	840.5	Levee at or nearby	Grand River area
	Chariton	856.9, 857.1, 857.2	(3) levees	Mussel Fork
	Chariton	857.5	Levee	
	Chariton	867.0	Embankment/levee	Middle Fork Little Chariton River
	Lincoln	971.1	Levee	Cuivre River
	St. Charles	985.4	Ditch	Horseshoe/Mud Lake
	St. Charles	985.7, 985.8	(2) levees	Horseshoe/Mud Lake
	St. Charles	986.0	Ditch	Horseshoe/Mud Lake
	St. Charles	986.4	Levee	Horseshoe/Mud Lake
	St. Charles	987.0	Levee	Fish Slough
	St. Charles	987.4, 987.5	(2) levees	Fish Slough
	St. Charles	987.7	Levee	None
	St. Charles	988.3	(2) levees	None
	St. Charles	988.7	Levee	None
	St. Charles	989.8-990.2	(3) levees	Dardenne Lake Area
	St. Charles	991.8	Levee	None

Table 3.5-2 Levees and Water Control Structures

State	County	Milepost	Type of Flood Protection Structure	Waterbody
	St. Charles	1008.9	Levee	Mississippi River Area
	St. Charles	1018.9	Levee	Mississippi River Area
	St. Charles	1021.0	Levee	Mississippi River Area
Illinois	Fayette	1069.8-1070.2	Levee	Carlyle WMA
	Fayette	1070.4	Levee	Carlyle WMA
	Fayette	1071.4	Levee	Carlyle WMA
CUSHING EXTENSION				
Nebraska	None	None	None	None
Kansas	None	None	None	None
Oklahoma	None	None	None	None

Where stream segments have been designated by the states, the uses of surface waterbodies at proposed crossings are indicated in Appendix F, Table F-1. For waterbodies proposed to be crossed, the table also indicates that major uses are supported or impaired as listed by the USEPA. Stream segments listed as impaired by the USEPA, and the reasons for such listing, are identified in **Table 3.5-3**.

A number of National Sediment Quality Survey sampling points located within 10 stream- or river-miles of the proposed ROW are listed as being Tier 1 or Tier 2 sites (USEPA 2004). A Tier 1 site is one where sediment quality is such that associated adverse effects on aquatic life or human health are probable. A Tier 2 site is one where sediment quality is such that associated adverse effects on aquatic life or human health are possible (USEPA 2004). Given that sediment is transported as a natural result of surface flow dynamics, the possibility exists that sediment quality upstream or downstream of Tier 1 or Tier 2 sampling points may have adverse effects on aquatic life or human health. Such locations within proximity of the proposed ROW are identified in **Table 3.5-4**.

A watershed classified as an Area of Probable Concern (APC) is one in which 10 or more sediment sampling sites are categorized as Tier 1 and at least 75 percent of all sampling stations are categorized as either Tier 1 or Tier 2 (USEPA 2004). No APC-classified watersheds occur along the proposed route.

CUSHING EXTENSION

Nebraska

The Cushing Extension route runs approximately two and one-half miles in Nebraska from the Keystone Mainline, just east of Steele City, to the Nebraska border. Tributaries to the Little Blue River are the only proposed stream crossings along this section.

Kansas

Numerous stream crossings are proposed along the Cushing Extension route in Kansas. Some of the major stream crossings in Kansas, along with many of their associated tributaries, include the Little Blue River, West Fancy Creek, the Republican River, the Smokey Hill River, the Cottonwood River, the East Branch Whitewater and Whitewater rivers, and the Arkansas River. The Big Blue River will not be crossed along the Cushing Extension but several of its tributaries will be crossed.

Additionally, several large reservoirs are located within a few miles of some of the major waterbody crossings. Turtle Creek Lake and its associated wildlife area, located in Riley County, lie within 10 miles downstream of the proposed West Fancy Creek crossing. The crossing of the Republican River in Clay County passes through the Milford Wildlife Area, just upstream of Milford Lake. In Marion County, the proposed route crosses the Cottonwood River below Marion Dam. The Marion Reservoir and the Marion Wildlife Area are located within approximately one mile upstream of this crossing. Finally, the crossing of the Arkansas River in Cowley County occurs within approximately 10 miles upstream of Kaw Lake, located in north central Oklahoma. The Kaw Wildlife Management Area also is associated with the reservoir and begins just south of Arkansas City, Kansas. It extends down through Oklahoma along the Arkansas River and ends around Kaw Lake.

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
KEYSTONE MAINLINE					
NORTH DAKOTA[1]	Pembina River	Fish and Other Aquatic Biota	Fully Supporting but Threatened	Sedimentation / Siltation	2
		Recreation	Fully Supporting but Threatened	Total Fecal Coliform	2
	Tongue River	Fish and Other Aquatic Biota	Fully Supporting but Threatened	Sedimentation / Siltation	1B
	North Branch, Middle Branch, South Branch Park River	Fish and Other Aquatic Biota (Designation for Park River)	Fully Supporting but Threatened	Sedimentation / Siltation, Total Dissolved Solids (TDS) and Organic Enrichment	2
	North Branch, Middle Branch, South Branch, Forest River	Fish and Other Aquatic Biota (Designation for Forest River)	Not Supporting	Biological Indicators, Sedimentation / Siltation, TDS	2
	North Branch Turtle River	Fish and Other Aquatic Biota (Designation for Turtle River)	Not Supporting	Cadmium, Sedimentation / Siltation, Selenium, TDS	2
	Goose River	Fish and Other Aquatic Biota	Not Supporting	Sedimentation / Siltation	2
		Recreation	Fully Supporting but Threatened	Total Fecal Coliform	
	Sheyenne River	Fish and Other Aquatic Biota	Fully Supporting but Threatened	Sedimentation / Siltation	2
		Recreation	Fully Supporting but Threatened / Not Supporting	Total Fecal Coliform	
SOUTH DAKOTA[2]	No Data For Streams Crossed				
NEBRASKA[3]	Missouri River	Primary Contact Recreation	Inhibited	Fecal Coliform	5
		Aquatic Life Use	Inhibited	Dieldrin, polychlorinated biphenyls (PCBs)	
		Agriculture Water Supply	Supported		
		Industrial Water Supply	Supported		
	Antelope Creek	N/A	N/A	N/A	3
	West Bow Creek	N/A	N/A	N/A	3
	Norwegian Bow Creek	N/A	N/A	N/A	3
	Bow Creek	N/A	N/A	N/A	3
	Middle Logan Creek	N/A	N/A	N/A	3

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	Elkhorn River	Primary Contact Recreation	Inhibited	Fecal Coliform	5
		Aquatic Life Use	Supported		
	Shell Creek	N/A	N/A	N/A	3
	Lost Creek	N/A	N/A	N/A	3
	Platte River	Primary Contact Recreation	Inhibited	Fecal Coliform	5
		Aquatic Life Use	Inhibited	PCBs	
		Agriculture Water Supply	Supported		
	Deer Creek	N/A	N/A	N/A	3
	Little Blue River	N/A	N/A	N/A	3
	Big Blue River	Aquatic Life Use	Inhibited	DO	5
		Agriculture Water Supply	Supported		
	Lincoln Creek	Aquatic Life Use	Inhibited	Selenium	5
		Agriculture Water Supply	Supported		
	Crooked Creek	N/A	N/A	N/A	3
	West Fork Big Blue River	Primary Contact Recreation	Inhibited	E. Coli, Fecal coliform	5
		Aquatic Life Use	Inhibited	Selenium, Dieldrin	
		Agriculture Water Supply	Supported		
	Turkey Creek	N/A	N/A	N/A	3
	Swan Creek	Aquatic Life Use	Supported		2
		Agriculture Water Supply	Supported		
	Cub Creek	N/A	N/A	N/A	3
KANSAS[4]	Meadow Creek	N/A			
	Indian Creek	N/A		Biological Impairment	1
	Deer Creek	GP, AL-E, CR-b		Atrazine, Berillium, Copper, pH	2 & 3
	Big Blue River	N/A		Atrazine, Berillium, Copper, pH	2 & 3

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	North Elm Creek	GP, AL-E, CR-b		Atrazine, Berillium, Copper, pH	1
	Robidoux Creek	GP, AL-E, CR-B			
	Negro Creek	GP, AL-E, CR-b			
	North Fork Wildcat Creek	N/A			
	Wildcat Creek	GP, AL-S, CR-C, DS, FP, GR, IW, IR, LW or GP, E		Biological Impairment	1
	South Fork Big Nemaha River	GP, AL-S, CR-C, DS, FP, GR, IW, IR, LW		Biological Impairment	1
	Harris Creek	GP, AL-E		Biological Impairment	1
	Craig Creek	N/A			
	Delaware River	N/A		Beryllium, Biological Impairment	1
	Walnut Creek	GP, AL-E		Atrazine	1
	Middle Fork Wolf River	GP, AL-E, DS, FP, GR, IW, IR, LW		Atrazine, Biological Impariment	2
	Buttermilk Creek	GP, AL-E, CR-b		Atrazine, Copper	2
	South Fork Wolf River	GP, AL-E, DS, FP, GR, IW, IR, LW		Atrazine, Biological Impariment	2
	Squaw Creek	GP, AL-E, CR-b			
	Halling Creek	GP, AL-E		Atrazine, Biological Impairment	2
	Jordan Creek	GP, AL-E		Copper	3
	Rock Creek	GP, AL-E		Copper	3
	Brush Creek	GP, AL-E			
	Missouri River	GP, AL-S, CR-B, DS, FP, GR, IW, IR, LW			

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
MISSOURI[5]	Missouri River	IRR, LWW, AQL, WBC-B, SCR, DWS, IND	N/A	Chlorodane, PCBs	M
	Contrary Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Platte River	IRR, LWW, AQL, WBC-B, SCR, DWS	N/A	N/A	N/A
	Malden Creek	N/A	N/A	N/A	N/A
	Wolfpen Creek	N/A	N/A	N/A	N/A
	Jenkins Branch	N/A	N/A	N/A	N/A
	Horse Fork Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Little Platte River	LWW, AQL, WBC-B, SCR	N/A	N/A	N/A
	Shoal Creek	LWW, AQL, WBC-B, SCR		Fecal Coliform	M
	Little Shoal Creek	N/A	N/A	N/A	N/A
	Deer Creek	N/A	N/A	N/A	N/A
	Plum Creek	N/A	N/A	N/A	N/A
	Log Creek	LWW, AQL, WBC-B, SCR	N/A	N/A	N/A
	Brush Creek	N/A	N/A	BOD, VSS	H
	Crabapple Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Mud Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Willow Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Big Creek	LWW, AQL, WBC-B	N/A	Metals, Sediment	H/M
	Grand River	IRR, LWW, AQL, WBC-A, SCR, DWS	N/A	N/A	N/A
	Potter Slough	N/A	N/A	N/A	N/A
	Salt Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Brush Creek	LWW, AQL, WBC-B	N/A	BOD, VSS	H
	Lake Creek	LWW, AQL, WBC-B		Sediment	M

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	Palmer Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Mussel Fork Creek	LWW, AQL, WBC-B	N/A	Sediment	M
	Chariton River	IRR, LWW, AQL, WBC-A, SCR	N/A	N/A	N/A
	Puzzle Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Middle Fork Little Chariton River	LWW, AQL, WBC-B (classifications for Little Chariton River)	N/A	N/A	N/A
	East Fork Little Chariton River	LWW, AQL, WBC-B (classifications for Little Chariton River)	N/A	N/A	N/A
	Big Creek	N/A	N/A	Metals, Sediment	H/M
	Saling Creek	N/A	N/A	N/A	N/A
	Long Branch Creek	LWW, AQL, WBC-B	N/A	Unknown	M
	Goodwater Creek	N/A	N/A	N/A	N/A
	Youngs Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Skull Lick Creek	N/A	N/A	N/A	N/A
	South Fork Salt River	N/A	N/A	N/A	N/A
	Bean Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Littleby Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	West Fork Cuivre River	LWW, AQL, WBC-B	N/A	N/A	N/A
	Coon Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Long Branch Creek	N/A	N/A	N/A	N/A
	Elkhorn Creek	LWW, AQL, WBC-B	N/A	BOD, VSS	H
	Brush Creek	LWW, AQL, WBC-B	N/A	BOD, VSS	H
	Bear Creek	LWW, AQL, WBC-B	N/A	Unknown	M
	Camp East Creek	N/A	N/A	N/A	N/A

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	Culvre River	LWW, AQL, WBC-B/A, SCR	N/A	N/A	N/A
	Whiles Branch Creek	N/A	N/A	N/A	N/A
	Peruque Creek	LWW, AQL, WBC-B/A, SCR		NVSS	M
	Belleau Creek	LWW, AQL, WBC-B	N/A	N/A	N/A
	Dardenne Creek	LWW, AQL, WBC-B/A, SCR		Unknown	M
	Trinity Channel	N/A	N/A	N/A	N/A
	Grand Lake	N/A	N/A	N/A	N/A
	Mississippi River	IRR, LWW, AQL, WBC-B, SCR, DWS, IND		Chlordane, PCBs	M
ILLINOIS[6]	Mississippi River				
	Indian Creek	Aquatic Life	Not Supporting	Habitat Assessment	(Category) 4C
		Fish Consumption	Fully Supporting		
		Primary Contact	Not Assessed		
		Secondary Contact			
		Aesthetic Quality			
	Cahokia Creek	Aquatic Life	Fully Supporting		2 & 5
		Fish Consumption			
		Primary Contact	Not Supporting	Fecal Coliform	
		Secondary Contact	Not Assessed		
		Aesthetic Quality			
	Burrough's Branch (N. loop)	Aquatic Life	Not Assessed	N/A	3
		Fish Consumption			
		Primary Contact			
		Secondary Contact			
		Aesthetic Quality			

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	Mooney Creek (S. loop)	Aquatic Life	Not Assessed	N/A	3
		Fish Consumption			
		Primary Contact			
		Secondary Contact			
		Aesthetic Quality			
	Sugar Creek	Aquatic Life	Not Assessed	N/A	3
		Fish Consumption			
		Primary Contact			
		Secondary Contact			
		Aesthetic Quality			
	Silver Creek	Aquatic Life	Not Supporting/Fully Supporting	Dissolved Oxygen, Sedimentation/Siltation, TSS, pH, Total Nitrogen, TPH	2 & 5
		Fish Consumption	Fully Supporting		
		Secondary Contact	Not Assessed		
		Aesthetic Quality			
	Sugar Fork	Aquatic Life	Not Assessed	N/A	3
		Fish Consumption			
		Primary Contact			
		Secondary Contact			
		Aesthetic Quality			
	Sand Creek	Aquatic Life	Not Assessed	N/A	3
		Fish Consumption			
		Primary Contact			
		Secondary Contact			
		Aesthetic Quality			

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	Highland Silver Lake	Aquatic Life	Not Supporting	Dissolved Oxygen, Sedimentation/Siltation, TSS, TPH, Aldrin	5
		Fish Consumption	Not Supporting	Chlordane	
		Public Food and Processing Water Supplies	Not Supporting	Manganese	
		Primary Contact	Not Assessed		
		Secondary Contact			
		Aesthetic Quality	Not Supporting	Aquatic Algae	
	Shoal Creek	Aquatic Life	Not Supporting/Fully Supporting	Dissolved Oxygen, Sedimentation/Siltation, TSS, TPH, Unknown Impairment	2 & 5
		Fish Consumption	Fully Supporting/Not Assessed		
		Public and Food Processing Water Supplies	Not Supporting	Manganese	
		Primary Contact	Not Supporting/Not Assessed	Fecal Coliform	
		Secondary Contact	Not Assessed		
		Aesthetic Quality			
	Little Beaver Creek	Aquatic Life	Not Assessed	N/A	3
		Fish Consumption			
		Primary Contact			
		Secondary Contact			
		Aesthetic Quality			
	Kaskaskia River	Aquatic Life	Not Supporting/Not Assessed	Dissolved Oxygen, Silver, pH, TSS, TPH, Unknown Impairment	2 & 5
		Fish Consumption	Fully Supporting		

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
		Public Food and Processing Water Supplies	Not Supporting	Manganese	
		Primary Contact	Not Supporting/Fully Supporting/Not Assessed	Fecal Coliform	
		Secondary Contact	Fully Supporting/ Not Assessed		
		Aesthetic Quality	Not Assessed		
	Bear Creek	Aquatic Life	Not Assessed	N/A	3
		Fish Consumption			
		Primary Contact			
		Secondary Contact			
		Aesthetic Quality			
CUSHING EXTENSION					
KANSAS	Little Blue River	GP, AL-E, CR-C, CR-b, DS, FP, GR, IW, IR, LW	Supporting	Copper, Biology	2
	Mill Creek	GP, AL-E, CR-b, FP	Supporting	Atrazine	3
	Coon Creek	GP, AL-E, CR-C, FP	Supporting	No Data	No Data
	Carter Creek	GP, AL-E, CR-b	Supporting	No Data	No Data
	West Fancy Creek	GP, AL-E, CR-b, FP	Supporting	No Data	No Data
	Lincoln Creek	GP, AL-E, CR-b	Supporting	Biology	2
	Republican River	GP, AL-S, CR-C, DS, FP, GR, IW, IR, LW	Supporting	Biology	2
	Chapman Creek	GP, AL-E, CR-C, DS, FP, GR, IW, IR, LW	Supporting	Fecal Coliform; Sulfate	1
	Smoky Hill River	GP, AL-E, CR-C, DS, FP, GR, IW, IR, LW	Supporting	Chloride; Fecal Coliform; Sulfate; Biology	1
	Carry Creek	GP, AL-S, FP	Supporting	Sulfates	1
	West Branch Lyon Creek	GP, AL-S, FP	Supporting	Fecal Coliform	1
	Mud Creek	GP, AL-S, DS, FP	Supporting	Chloride; Fecal Coliform; Sulfate	1

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	Cottonwood River	GP, AL-E, CR-C, DS, FP, GR, IW, IR, LW	Supporting	Zinc	3
	Spring Branch	GP, AL-E	Supporting	No Data	No Data
	Catlin Creek	GP, AL-S, FP	Supporting	No Data	No Data
	Doyle Creek	GP, AL-E, DS, FP, GR, IW, IR, LW	Supporting	No Data	No Data
	East Branch Whitewater River	GP, AL-E, DS, FP, GR, IW, IR, LW	Supporting	Atrazine	2
	Diamond Creek	No Data	Supporting	No Data	No Data
	Brush Creek	No Data	Supporting	No Data	No Data
	Fourmile Creek	GP, AL-E, FP	Supporting	Atrazine	2
	Rock Creek	GP, AL-E	Supporting	Atrazine	2
	Spring Branch	GP, AL-E	Supporting	No Data	No Data
	Whitewater River	GP, AL-E, DS, FP, GR, IW, IR, LW	Supporting	Atrazine	2
	Badger Creek	GP, AL-E, DS	Supporting	Atrazine	2
	Dry Creek	GP, AL-E	Supporting	Atrazine	2
	Fourmile Creek	GP, AL-E, CR-C, DS, FP, GR, IW, IR, LW	Supporting	Atrazine	2
	Eightmile Creek	GP, AL-E, DS, FP, GR, IW, IR, LW	Supporting	No Data	No Data
	Polecat Creek	GP, AL-E, FP	Supporting	No Data	No Data
	Stewart Creek	GP, AL-E	Supporting	No Data	No Data
	Crooked Creek	GP, AL-E	Supporting	No Data	No Data
	Spring Creek	GP, AL-E	Supporting	Chloride; pH; Fecal Coliform; Sulfate	1; 2; 2; 4
	Arkansas River	GP, AL-S, CR-B, DS, FP, GR, IW, IR, LW	Supporting	pH; Chloride	2;1

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
OKLAHOMA	Chilocco Creek	No Data	No Data	No Data	No Data
	Bois d'Arc Creek	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting	Sulfates, Pathogens, Turbidity	High
	Cowskin Creek	No Data	No Data	No Data	No Data
	Salt Fork Arkansas River	Aesthetics; Agriculture; WW Aquatic Community; Industrial and Municipal Process and Cooling Water; Primary Contact Recreation; Public and Private water supply; Fish Consumption	Insufficient Data; Fully Supporting/Not Assessed; Not Supporting, Fully Supporting; Not Supporting; Not Assessed; Not Assessed	Pathogens, Turbidity	High
	Deadman Creek	Aesthetics; Agriculture; Warm Water Aquatic Community; Industrial and Municipal Process Cooling Water; Primary Contact Recreation; Fish Consumption	Insufficient Data; Insufficient Data; Insufficient Data; Insufficient Data; Not Assessed; Not Assessed	No Data	No Data
	Red Rock Creek	Aesthetics; Agriculture; Warm Water Aquatic Community; Industrial and Municipal Process Cooling Water; Primary Contact Recreation; Fish Consumption	Fully Supporting; Fully Supporting; Not Supporting; Fully Supporting; Not Supporting; Not Assessed	Turbidity	High
	Long Branch	Aesthetics; Agriculture; Warm Water Aquatic Community; Industrial and Municipal Process Cooling Water; Primary Contact Recreation; Fish Consumption	Not Assessed	No Data	No Data
	Greasy Creek	No Data	No Data	No Data	No Data
	Black Bear Creek	Aesthetics; Agriculture; Warm Water Aquatic Community; Industrial and Municipal Process Cooling Water; Primary Contact Recreation; Fish Consumption	Fully Supporting; Fully Supporting; Fully Supporting/Not Supporting; Fully Supporting; Not Supporting; Insufficient Data; Insufficient Data	Unknown Toxicity, Lead, Pathogens, Turbidity	High
	East Brush Creek	Aesthetics; Agriculture; Warm Water Aquatic Community; Industrial and Municipal Process Cooling Water; Primary Contact Recreation; Fish Consumption	Not Assessed	No Data	No Data

Table 3.5-3 Impaired Waterbodies

State	Waterbody Name	Designated Use	Use Support/ Attainment	Impairment	TMDL Priority
	Little Stillwater Creek	No Data	No Data	Nitrates	High
	Cimarron River	Aesthetics; Agriculture; Emergency Water Supply; Warm Water Aquatic Community; Industrial and Municipal Process Colling Water; Primary Contact Recreation; Fish Consumption	Fully Supporting; Fully Supporting; Fully Supporting; Insufficient Information; Fully Supporting; Not Assessed; Not Assessed	Sulfates, Pathogens, Turbidity	High
	Cabin Creek	Aesthetics; Agriculture; Warm Water Aquatic Community; Industrial and Municipal Process Colling Water; Primary Contact Recreation; Fish Consumption	Not Assessed	No Data	No Data

[1]Source: NDDH 2004.

1A = TMDLs are scheduled for completion in the next two years.

1B = TMDL activities (e.g., monitoring or modeling) are scheduled to begin in the next two years.

2 = scheduled for TMDL development in the next 10 years.

3 = impaired for fish consumption due to methyl mercury (low priority for state due to complexities related to fate and transport of methyl mercury and due to interstate and international nature of atmospheric mercury sources.

[2]Source: SDDENR 2004.

[3]Source: Nebraska Department of Environmental Quality (NEDEQ) 2004.

Category 2 = Some of the designated uses are met but there is insufficient information to determine if all uses are being met; Category 3 = Insufficient data to determine if any beneficial uses are being met; Category 5 = One or more beneficial uses are determined to be impaired by one or more pollutants and all of the TMDLs have not been developed. Category 5 waters constitute the Section 303(d) list subject to EPA approval/disapproval.

[4]Source: KDHE 2004.

AL-E = expected aquatic life use.
AL-S = special aquatic life use.
CR-B = primary contact recreation segment is by law or written permission of the landowner open to and accessible to the public.
CR-b = secondary contact recreational segment is not open to and accessible by the public under Kansas law.
CR-C = primary contact recreation segment is not open to and accessible by the public under Kansas law.
DS = domestic water supply use.
FP = food procurement use.
GP = general purpose waters.
GR = groundwater recharge.
IR = irrigation use.
IW = industrial water supply use.
LW = livestock watering use.

Priority Levels – unknown.

[5]Source: MODNR 2004.

AQL = protection of warmwater aquatic life and human health-fish consumption.
BOD = biological oxygen demand (mg/l).
DWS = drinking water supply.
IND = industrial water supply.
IRR = irrigation water supply.
LWW = livestock and wildlife watering.
SCR = secondary contact recreation.
THP = total petroleum hydrocarbons (mg/l).
VSS = volatile (organic) suspended solids (mg/l).
WBC-A = whole body contact recreation open to public with whole body contact recreational use(s).
WBC-B = whole body contact recreation waters not contained within Category A.

Priority M – Medium.

Priority H – High.

[6]Source: ILEPA 2006.

Table 3.5-4 Crossing Locations within 10 Stream-Miles of USEPA Tier 1 or Tier 2 Sediment Sampling Sites

Surface Waterbody Associated with Sampling Site[1]	County	State	Waterbody Crossing Closest to Sampling Site (MP)[2]	USEPA Sediment Quality Category
KEYSTONE MAINLINE				
Pembina River	Pembina	ND	7	Tier 3
Lewis and Clark Lake	Knox	SD	436	Tier 3
Lake Yankton	Cedar	NE	436	Tier 2
Chalkrock Lake	Cedar	NE	441	Tier 2
Maskenthine Reservoir	Stanton	NE	499	Tier 2
Elkhorn River	Madison	NE	502	Tier 2
Lake Babcock	Platte	NE	535	Tier 3
Loup River	Platte	NE	540	Tier 1
Shell Creek	Colfax	NE	532	Tier 2
Platte River	Butler	NE	542	Tier 1
Lincoln Creek	Seward	NE	574	Tier 2
Big Blue River	Seward	NE	575	Tier 2
Big Blue River	Seward	NE	578	Tier 2, Tier 3
Big Blue River	Seward	NE	582	Tier 1
West Fk., Big Blue River	Seward	NE	591	Tier 1, Tier 2
Turkey Creek	Saline	NE	597	Tier 2
Swan Creek	Saline	NE	613	Tier 2
Big Blue River	Marshall	KS	659	Tier 1, Tier 2 (3)
Missouri River	Buchanan	MO	750	Tier 1, Tier 2 (4)
Platte River	Buchanan	MO	762	Tier 1, Tier 2 (2)
Grand River	Chariton	MO	841	Tier 1, Tier 2 (2)
Chariton River	Chariton	MO	862	Tier 2
Middle Fork, Little Chariton River	Randolph	MO	868	Tier 2
East Fork, Little Chariton River	Randolph	MO	872	Tier 2
South Fork, Salt River	Audrain	MO	918	Tier 2
Cottonwood Branch	Lincoln	MO	964	Tier 1
North Fork, Cuivre River	Lincoln	MO	967	Tier 1
Cuivre River	Lincoln	MO	971	Tier 1
Mississippi River	Calhoun	MO	987	Tier 1
Mississippi River	Calhoun	MO	1002	Tier 1
Mississippi River	Jersey	IL	1007, 1009	Tier 1, Tier 2
Mississippi River	Madison	IL	1014	Tier 3
Cahokia Diversion Channel	Madison	IL	1015	Tier 1, Tier 2
Mississippi River	Madison	IL	1015-1021	Tier 1, Tier 2
East Fork, Wood River	Madison	IL	1024	Tier 2
Wood River	Madison	IL	1026	Tier 2

Table 3.5-4 Crossing Locations within 10 Stream-Miles of USEPA Tier 1 or Tier 2 Sediment Sampling Sites

Surface Waterbody Associated with Sampling Site[1]	County	State	Waterbody Crossing Closest to Sampling Site (MP)[2]	USEPA Sediment Quality Category
Indian Creek	Madison	IL	1026	Tier 2
Cahokia Creek	Madison	IL	1027	Tier 1, Tier 2
CUSHING EXTENSION				
Little Blue River	Jefferson	NE	0	Tier 1
Rose Creek	Jefferson	NE	0	Tier 2
Little Blue River	Washington	NE	3	Tier 2
Milford Lake	Geary	KS	67	Tier 2
Smoky Hill River	Dickinson	KS	79	Tier 1
Herington Reservoir	Dickinson	KS	95	Tier 3
Prairie Creek	Sedgwick	KS	152	Tier 3
West Branch Whitewater River	Butler	KS	154	Tier 1
Walnut River	Butler	KS	158	Tier 1
Walnut River	Butler	KS	170	Tier 1
Little Walnut River	Butler	KS	171	Tier 2
Arkansas River	Sumner	KS	192	Tier 3
Arkansas River	Cowley	KS	212	Tier 3
Kaw Lake	Kay	OK	218	Tier 1

[1]Indicates waterbody associated with the sediment sampling location. Waterbody may not be directly impacted by the proposed project.

[2]Indicates the approximate waterbody crossing point that might lead to the USEPA Tier 1 or Tier 2 sampling site. The waterbody, which is crossed by the project, may be a tributary to the waterbody associated with the sampling site. Refer to Appendix F for names and classifications of the crossed waterbodies.

Oklahoma

The major water drainages crossed by the proposed Cushing Extension route in Oklahoma include the Salt Fork Arkansas River in the southeastern corner of Kay County, several of its tributaries, the Cimarron River in southeastern Payne County near Cushing, Oklahoma, and many of its smaller tributaries. The Arkansas River is not crossed in Oklahoma but the river is crossed by the route just above the northern state border in Kansas. However, tributaries to the Arkansas River are crossed throughout Kay County. The proposed route also crosses or intersects the Bois d'Arc Creek nearly a dozen times in Kay County. Additionally, the crossing of Chiloco Creek near the northern Oklahoma boarder occurs several miles upstream of Kaw Lake and its associated Wildlife Management Area.

3.5.3 Groundwater

For this assessment, groundwater resources were investigated by collection and review of existing literature, with additional guidance and assistance provided by state agency personnel. The following descriptions and subsequent assessment of potential impacts are based on the level of detail presented in the existing data and information that was collected for the proposed route. Uncertainty always exists in water resource inventories, due to the locations and intensities of investigations, the number of variables involved, and the nature of the resources themselves. Unconsolidated aquifers generally do not begin or end clearly. Rather, zones thin out, become discontinuous, are not mapped across civil boundaries, do not provide enough water to wells for a desired purpose, or are simply not discovered. Aquifer boundaries are defined arbitrarily under these conditions.

Similarly, solution fissures and other underground features of limestone-dominated terrain are described here in a general fashion where this type of landscape occurs along the project route. As permitting efforts proceed, local expertise will provide additional information and guidance to further address site-specific groundwater issues.

KEYSTONE MAINLINE

The proposed Keystone Mainline route lies almost entirely within the glaciated Central Lowlands physiographic province (Thornbury 1965). Repeated continental glaciations left a complex dispersal of buried stream channels and sand and gravel deposits, frequently covered by subsequent layers of glacial till. Deposits of glacial drift, ancient buried stream courses, and recent stream alluvium generally form the shallowest sources of groundwater in the project region. These are extensively used for agricultural, domestic, and industrial purposes. In locations where such favorable zones are absent or unsaturated, deeper wells have been constructed into bedrock aquifers. However, these are much less common than wells supplied by glacial drift and alluvial sources and generally will be isolated from the proposed pipeline by greater than 100 feet of glacial till overlying sedimentary bedrock.

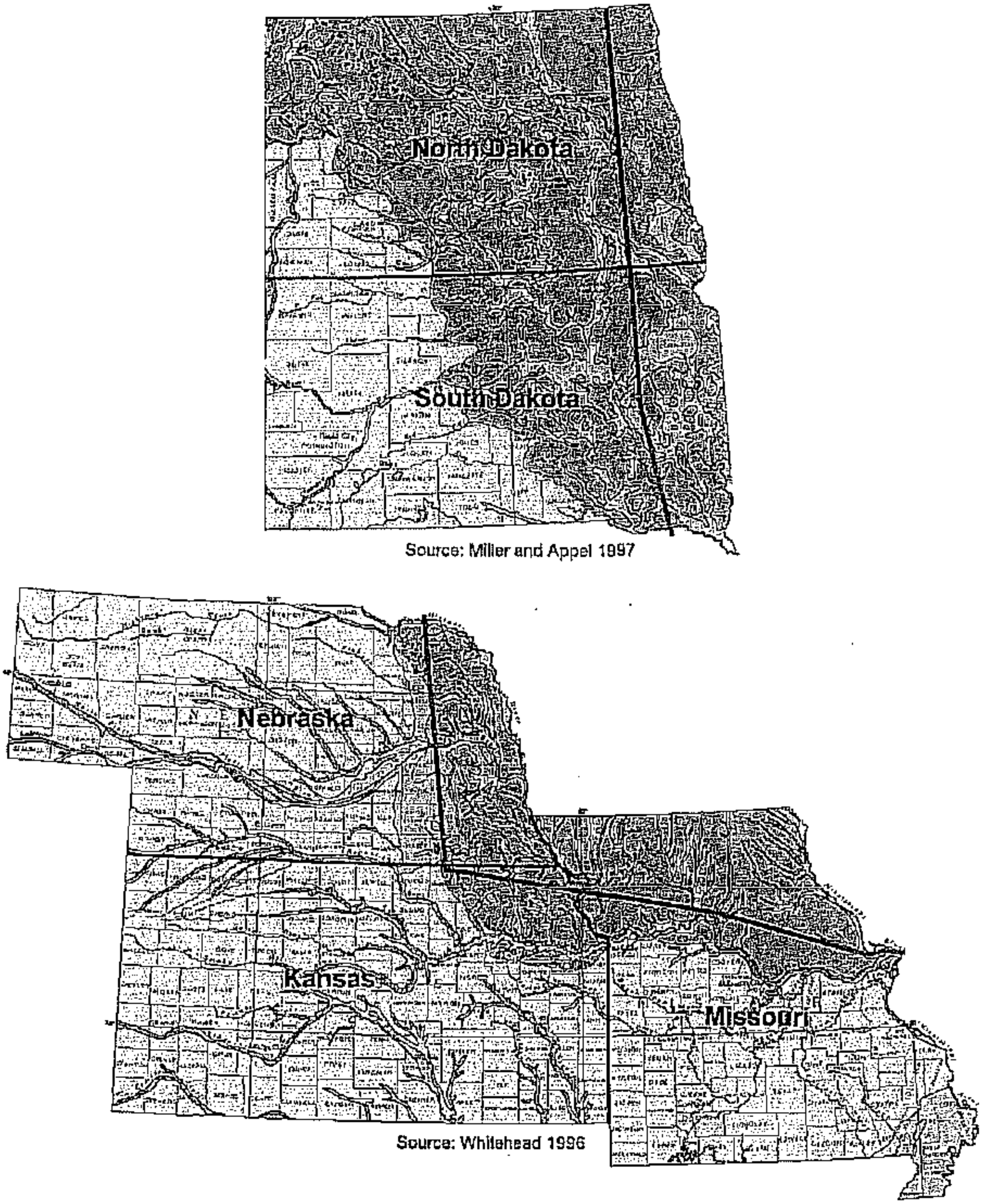
The general locations of coarse-grained deposits in the project region are shown in **Figure 3.5-2**. Not all of these areas contain saturated zones that provide suitable water to wells. It should be noted that the extent and productivity of aquifer zones in these depositional environments vary widely and this complicates the precision and accuracy with which they can be mapped. Small discontinuous lenses of water-bearing materials may occur away from the primary source zone, yet still be hydraulically connected.

North Dakota

In North Dakota, the proposed route crosses the Pembina River Aquifer and the Pembina Delta Aquifer (Hutchinson 1977). The Pembina River Aquifer is potentially one of the most productive zones in eastern Cavalier and western Pembina counties. It occupies about 20 square miles in Pembina and Cavalier counties. Nearby surface water resources (the Pembina River) and the aquifer are closely interrelated through recharge and discharge. The groundwater/surface water interface is at the surface along most of the floodplain across the proposed route.

The proposed route will cross approximately 3 miles of the Pembina Delta Aquifer where well yields are on the order of 10 to 50 gallons per minute, and 4 miles where well yields are 0 to 10 gallons per minute (Hutchinson 1997). Depth to the saturated zone of this aquifer is approximately 50 feet. Groundwater from the Pembina River and the Pembina Delta aquifers near the proposed route tends to be of the calcium-magnesium bicarbonate type, with total dissolved solids (TDS) concentrations of about 625 milligrams per liter (mg/l) and 340 mg/l, respectively (Hutchinson 1977).

Southward into Walsh County, North Dakota, the proposed route will intersect the Edinburg Aquifer near the county line. The aquifer occupies about 13 square miles and depths to water range from about 20 to 40 feet near the project route (Downey 1973). TDS concentrations range from about 450 to 900 mg/l. The proposed route will pass about three to four miles west of the Fordville and Medford aquifers. The Fordville Aquifer is the largest and most extensively used glacial drift aquifer in Walsh County. Most recharge to the aquifer is from



Legend

- Coarse-grained glacial deposits, stream-valley alluvium, or basin fill (may be aquifers)
- Till, loess, and fine-grained glacial-lake deposits (not aquifers)
- Southern extent of continental glacial deposits
- State boundaries
- Proposed Keystone pipeline route (approximate)

TransCanada
In business to deliver

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W E
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0 25 50 100 Miles

Keystone Pipeline Project

Figure 3.5-2

Quaternary Deposits in Eastern North and South Dakota, Nebraska, Kansas, and Missouri

03/20/2008

precipitation and snowmelt. The land surface above the aquifer generally is lacking in drainage features. The Fordville aquifer partially recharges from losing reaches of the Forest River system and discharges back into gaining reaches of the drainage. TDS concentrations range from about 300 to 600 mg/l (Downey 1973).

No major aquifer zones will be intersected by the route through Nelson County (Downey 1973). Most of the proposed route through Steele County is located several miles east of the McVille Aquifer. This aquifer lies in a buried river valley and has significant potential for development. In the extreme southern part of the county, the route lies adjacent to the McVille aquifer for about 6 miles before crossing it one mile south of the Barnes County line. Depth to water in this location is generally 70 to 100 feet, although shallower depths have been recorded (Downey and Armstrong 1977).

The McVille Aquifer and associated waterbearing zones occur for several miles along the proposed route in northern Barnes County, near Lake Ashtabula, in the vicinity of Sibley, North Dakota. This aquifer is readily recharged by precipitation. During an aquifer pumping test in which about two inches of rain fell from isolated thunderstorms, many observation wells underwent rapid water level rises. TDS concentrations in this area are about 2,200 mg/l (Downey and Armstrong 1977). Through most of Barnes County, the route will be located at least four miles east of the McVille aquifer (Kelly 1966).

Just inside Ransom County, the route will pass over the McVille aquifer and trend alongside the Sand Prairie Aquifer. The proposed route will then cross the north-south trend of the Sand Prairie/Englevale aquifers in northwest Ransom County. Both aquifers formed in buried channel deposits. The Englevale Aquifer consists of two (locally three) sand deposits that follow the ancestral course of the Sheyenne River and are mantled by sand and gravel deposits (Armstrong 1982). The depth to water in the aquifer ranges from the land surface near river sloughs to as much as 81 feet where shallower channels do not occur. The aggregate thickness of sand and gravel averages 40 feet but ranges from about five to 140 feet.

The proposed route will cross a branch of the Englevale Aquifer in southern Ransom County and will cross the Spiritwood Aquifer system, the Brampton Aquifer, and the Oakes Aquifer along the western edge of Sargent County (Armstrong 1982). The route will be nearly continuously located over aquifer zones through Sargent County. The Engelvale and Spiritwood aquifers are considered to be hydraulically connected (Armstrong 1982) and the Brampton aquifer is an alluvial tributary of the Spiritwood aquifer. All three formed in coarse-grained alluvial channels formed at different times before subsequently being buried by glacial till. The total area occupied by these aquifer zones is estimated to be approximately 450 square miles and hydraulic connections with similar aquifer zones probably extend well into South Dakota (Armstrong 1982). Localty, however, connectivity may be limited by fine grained materials between aquifer lenses. In the project vicinity, depths to water range from about 10 to 30 feet, with aquifer thicknesses on the order of 100 to 200 feet.

Water in the Englevale Aquifer is dominantly a calcium bicarbonate type but, locally, sodium may be the dominant cation. Sampled TDS concentrations ranged from 255 to 4,670 mg/l, with a mean of 595 mg/l (Armstrong 1982). Water quality in the Brampton Aquifer is mixed, varying with location and depth. Either calcium or sodium is the dominant cation and either bicarbonate or sulfate is the dominant anion. Sampled TDS concentrations ranged from 532 to 1,290 mg/l, with a mean of 948 mg/l (Armstrong 1982). The Spiritwood Aquifer system is extensive, heavily used, and hydrologically connected with other aquifers in North Dakota and probably South Dakota. TDS concentrations in the proposed project area range from about 625 to 2,260 mg/l, with the better water quality (lower constituent concentrations) occurring along the proposed route west of the town of Nicholson (Armstrong 1982).

In southwestern Sargent County and southeastern Dickey County, the proposed ROW will pass through the Oakes Aquifer. This is a water-table aquifer, with its upper boundary at the land surface (Armstrong 1980; Koch and Bradford 1976). It is bounded on the west by the James River. The Oakes Aquifer consists of valley fill, deltaic and lacustrine deposits of sand and gravel interbedded with silt and clay. In general, over 40 feet of silt, clay or glacial till separated the Oakes Aquifer from the underlying Spiritwood aquifer system, but in some places the two are hydraulically connected by downward leakage from the Oakes Aquifer (Armstrong 1980).

The mean saturated thickness is about 30 feet, but ranges from 2 to 100 feet. Yields from wells built in the Oakes Aquifer range from a few gallons per minute to about 1,500 gallons per minute. Water in the Oakes Aquifer is generally a calcium-bicarbonate type. Dissolved solids concentrations generally range from about 300 to 800 mg/l, with an average concentration of about 470 mg/l. In some locations, nitrogen concentrations may be elevated, apparently as a result of contamination from agricultural fertilizers (Armstrong 1980).

South Dakota

Near-surface aquifers in South Dakota consist primarily of sands and gravels deposited by glaciers or within glacially associated features such as lakes and buried channels. Additional aquifers occur in narrow bands of alluvium along stream channels. The Oakes Aquifer underlies the proposed route in Brown County, South Dakota, where it ranges from about 20 to 100 feet thick in the pipeline locale (Koch and Bradford 1976). Along the proposed pipeline route its upper boundary is within 50 feet of the land surface (Koch and Bradford 1976; Jensen 2001a). In South Dakota, this water-bearing zone is typically confined beneath surficial silts and clays. However, permeable eolian sands overlie the aquifer materials along the proposed route in extreme northeastern Brown County, and this cover transitions to sands and gravels as the proposed route trends into Marshall County. The aquifer follows the trend of ancient Lake Dakota in the James River basin, and has been named the "Middle James" aquifer in some existing studies (Koch and Bradford 1976). In Brown County overall, water quality varies widely in this water-bearing zone. Salinity is likely in most locations, with specific conductance ranging from about 700 to 3,000 micromhos per centimeter and averaging about 2,150 micromhos per centimeter (Koch and Bradford 1976). The proposed route overlies both the Brampton and the Oakes aquifers throughout Marshall County. The Brampton or similar aquifer deposits are dominant, with depths to water generally less than 50 feet (Jensen 2001b).

In the rest of South Dakota, the proposed route will largely avoid major aquifer zones, generally crossing the state between the main bodies of the Tulare and Vermillion aquifers and their associated groundwater management units (Geological Survey Program 2001). Through Day County and into Clark County, near-surface aquifer materials are sparse in the glacial drift. A number of small stream deposits will be crossed by the proposed route in northwestern Day County. Near-surface groundwater may occur at these crossings and may be more extensive if suitable coarse-textured glacial drift occurs along or near the drainage. Southward into Clark County and near the Spink County line, the route will cross the Altamont Aquifer north of Raymond, and south of Raymond along Foster Creek. This is another buried channel system. Groundwater is held in two zones. The top of the upper zone is commonly within about two to 10 feet of the ground surface. Depth to the more extensive lower layer ranges from 35 to 80 feet (Hamilton and Howells 1996). The average thickness of the Altamont Aquifer is about 22 feet. Dissolved solids concentrations (by sum of constituents) in samples range from about 500 to 1,400 mg/l, with a mean of 1,000 mg/l (Hamilton and Howells 1996). South of Raymond in west-central Clark County, glacial aquifers are mostly absent except for a branch of the Altamont Aquifer along Foster Creek. The first (shallowest) notable waterbearing zone is in sandstones of the Dakota Formation (Jensen 2001c). This aquifer is typically at depths of 900 to 1,100 feet below the land surface, and is isolated from the surface by thick deposits of glacial till and/or shale beds (Hamilton 1986). In addition, a small buried channel extension of the Tulare Aquifer will be crossed in extreme southern Clark County and into Beadle County for about two miles. The depth to water is likely greater than 50 feet (Schulz 2003).

In extreme southwestern Clark County and further south through Beadle County, near-surface aquifers are absent except for isolated tongues of the Tulare and Floyd aquifers (Howells and Stephens 1968). Generally the uppermost aquifer along the proposed route through northeastern Beadle County is the Codell Sandstone Member of the Carlile Shale, at depths of 350 to 500 feet. This unit is isolated from the surface by overlying glacial till and Niobrara Formation marlstones (Howells and Stephens 1968; Schulz 2003). Aquifers in southwestern Kingsbury County generally are deep below the land surface and are bedrock formations under hundreds of feet of clayey Pierre Shale (Hamilton 1989; Emmons 1988). An isolated branch of the Floyd Aquifer does occur at a depth of about 100 feet near the Miner County line. In Miner County, the uppermost aquifer along the route is generally the Floyd Aquifer, which will be crossed for several miles southwest of Carthage and again south of Roswell through the rest of the county. Dominant chemical constituents in the

Floyd Aquifer are sodium, calcium, and sulfate. TDS concentrations range from about 1,500 to 3,200 mg/l (Koch and McGarvie 1988). Thickness of the Floyd Aquifer ranges from about 20 to 45 feet and depth to the top of the zone ranges from the land surface to about 50 feet in the Carthage vicinity (Koch and McGarvie 1988). In the southern part of Miner County, depth to the aquifer is on the order of 100 feet. Between these areas, the first aquifer materials occur in the Niobrara Formation, an upper Cretaceous marine bedrock consisting of thinly bedded chalk and limestone interbedded with shale. Depths to this zone are generally on the order of 100 feet or more (Jensen 2002). Narrow bands of stream alluvium and associated sand and gravel deposits will be crossed in northwestern Miner County and again in the extreme southern Miner/northern Hanson county area.

The Floyd Aquifer underlies much of the proposed route through Hanson County and nearby studies generally indicate that isolated branches of this or other aquifer zones may occur at depths generally greater than 100 feet in southern McCook County (Cripe and Barari 1977). The Dolton Aquifer generally lies east of the proposed route. The Lower James – Missouri Aquifer occurs beneath the proposed route in southern McCook County and for about two miles at both the extreme northern and southern ends of Hutchinson County (Lindgren and Hansen 1990). This aquifer is approximately 50 to 75 feet thick in northern Hutchinson County and its upper contact is isolated from the surface by about 150 feet of till. The aquifer thickness is highly variable in southern Hutchinson County (reaching a thickness of 130 feet) but the upper contact is still about 150 feet below the surface (Lindgren and Hansen 1990). Dominant chemical constituents are calcium and sulfate. Sampled TDS concentrations range from about 775 to 3,300 mg/l, with an average of 920 mg/l (Lindgren and Hansen 1990). The proposed route continues over the Lower James – Missouri aquifer system through Yankton County. Depths to the aquifer are generally 50 to more than 100 feet. Shallower depths, from less than 50 feet to the land surface, occur at the James River, Beaver Creek, and along the Missouri River at Yankton (McCormick 2003). Groundwater is at or near the surface in the alluvial aquifer along the Missouri River and surface water and groundwater interact extensively there. Along the river, alluvium typically overlies thick deposits of glacial outwash (Johnson and McCormick 2005).

Nebraska

In Nebraska, glacial drift and alluvium continue to form the uppermost groundwater-bearing zones along the proposed ROW. The hydrologic connectivity between surface and groundwater resources in Nebraska was formally recognized by the state legislature with the passage of LB108 in 1996. The subsequent passage of LB962 in 2004 further enacted integrated water resource management in the state. This legislation requires Nebraska's Natural Resource Districts (NRD) annually to evaluate their overall water appropriations relative to sustainable supplies. Several NRDs in western and central Nebraska have determined that they are fully appropriated. In effect, this finding places a hold on new permits for surface water use, groundwater wells, and new irrigated acres until an Integrated Management Plan is jointly developed between the NRD and the Nebraska Department of Natural Resources (NEDNR) and implemented. None of the basin areas (or their respective NRDs) along the proposed route have been determined to be fully appropriated at present (NEDNR 2005).

In Cedar and Wayne counties, undifferentiated Quaternary sands and gravels form part of the High Plains Aquifer. Along the route, these waterbearing zones lie east of thinning sections of the Tertiary-aged Ogallala Formation, a major aquifer in the Great Plains (Miller and Appel 1997). In Stanton County, groundwater seepage provides much of the flow in the Elkhorn River (Newport and Kreiger 1957). Aquifer withdrawals are used mainly for irrigation, municipal supplies, and domestic and livestock water supplies. Norfolk and Stanton are towns near the proposed route using groundwater supplies. In upland settings, depth to Quaternary sands and gravels is on the order of 30 to 60 feet. The water table may be at or near the land surface in stream valleys near waterbody crossings. TDS concentrations are generally between 200 and 600 mg/l.

Quaternary aquifers in Platte and western Colfax counties are similar to those further north. Depth to water is generally 50 to 100 feet in the northern two-thirds of Platte and Colfax counties. This decreases to depths of five to 15 feet as uplands transition into the Platte River valley about 10 miles north of the river itself

(Conservation and Survey Division [C&SD] 1958). Low river terraces and bottomlands continue along the route for about four miles into Butler County. Shallow alluvial groundwater may occur in depressional areas and the headwaters of the Big Blue River near Garrison and Ulysses, Nebraska.

Glacial drift and alluvial aquifers continue through Nebraska in Butler, Seward, Saline, Jefferson, and Gage counties. The glacial aquifers are generally isolated into upper and lower zones by bedrock or clayey and silty glacial till (Verstraeten et al. 1998). Southward through Butler County, watertable depths increase to between 50 and 100 feet as the land surface rises from the Platte River valley. Deep, buried channel systems are cut into the bedrock in parts of Butler, Seward, and Saline counties (Verstraeten et al. 1998). Thick deposits of sand and gravel are more extensive across Saline County (C&SD 1946). These thin considerably to the east of the proposed route and southward from Saline County. The older buried sand and gravel deposits cross the proposed route from west to east and wells are constructed in them to depths of 400 feet or more (C&SD 1955). Sedimentary bedrock formations of Cretaceous age underlie the Quaternary deposits. They consist of the Greenhorn Limestone, Graneros Shale, and the Dakota Group sandstones. The latter occasionally are used for water supply. Depths to water in the glacial drift generally reflect the surface topography, varying from less than 50 to about 100 feet. Groundwater occurs closer to the surface along the Little Blue and Big Blue river valleys. Regionally, underlying Cretaceous formations transition to Permian-aged bedrock in southern Nebraska and northeastern Kansas.

Waters from the unconsolidated Quaternary deposits and Cretaceous bedrock sources generally appear to be of similar quality (Verstraeten et al. 1998). **Table 3.5-5** indicates selected water quality characteristics for major aquifers along this portion of the proposed route. Irrigation is the probable source of the wider variation and higher upper ranges of characteristics in the shallower waterbearing zones.

Table 3.5-5 Selected Groundwater Quality Characteristics in Southeastern Nebraska

Aquifer Zone	pH Range, standard units	pH Mean, standard units	Specific Conductance, Range, µS/cm	Specific Conductance, Mean, µS/cm	Dissolved Nitrate and Nitrite as N, Mean, mg/l
Shallow High Plains	6.1 – 8.8	6.9	320 - 920	620	7.6
Deeper High Plains	6.5 – 8.3	7.0	400 - 960	620	4.2
Undifferentiated High Plains	6.6 – 6.8	6.7	550 - 730	620	6.4
Dakota	7.0 - 7.4	7.3	550 - 570	560	0.26

Source: (Verstraeten et al. 1998).

µS/cm = microSiemens per centimeter; a measure of conductivity.

Kansas

In northern Marshall County, Kansas, the principal saturated zones are alluvium, terrace deposits, glacial drift zones, and the Barneston Limestone (Walters 1954). Sampled water quality from the Barneston Limestone vary widely, with TDS concentrations ranging from about 410 to 2,500 mg/l, and sulfate concentrations ranging from about 30 to 1,540 mg/l. Water quality from terrace deposits also vary considerably. Glacial deposits ranged in TDS from about 190 to 1,070 mg/l, with sulfate ranging from about 20 to 320 mg/l and nitrate ranging from 0.40 to 97 mg/l (Walters 1954). Groundwater from alluvial deposits had more consistent quality, with TDS ranging from about 470 to 650 mg/l and sulfates ranging from about 40 to 60 mg/l. Overall water supplies in Marshall County depend on both surface water and groundwater resources. Marysville, which had depended on Blue River surface water, now obtains its water supply from a relatively new (1990) wellfield southeast of town along a tributary about 10 miles south of the proposed Blue River crossing. Oketo obtains municipal water from a well on the Big Blue River floodplain. Summerfield and Axtell also are supplied by wells (Walters 1954).

Unconsolidated Pleistocene deposits of glacial drift are the best potential sources of groundwater to the east in Nemaha County (Ward 1974). The most favorable waterbearing zones consist of buried channel deposits overlying bedrock. Several sizeable springs flow from the glacial deposits in the region along the proposed route in Kansas. These include Maxwell Spring (near Seneca, Nemaha County) and Sycamore Springs and Sun Springs in Brown County (Buchanan et al. 1998). More recent terrace and alluvial deposits are primarily silt and clay throughout the county and provide little water to wells. Geologic structural deformations lead to Permian sedimentary rocks such as the Barneston, Wreford, Beattie, Foraker, and Grenola limestones forming deep groundwater supplies in Kansas and eastward. In the Permian limestones, TDS values range from about 1,000 to 3,000 mg/l (Walters 1954). The Grenola Limestone generally has high sulfate concentrations (Ward 1974). These formations generally yield on the order of 50 gallons per minute (gpm) to wells where fracture zones occur. Glacial drift aquifers yielding up to 50 or 100 gpm remain the most significant source of water supply eastward through the Missouri River basin in Brown and Doniphan counties, Kansas.

Unconsolidated deposits of sand and gravel along major streams are locally used as water supply sources. Examples of where these aquifers occur include the Big Blue River and the Missouri River drainages. Depth to groundwater is typically less than 10 feet. TDS concentrations are typically between 250 and 600 mg/l (Ward 1974; Walters 1954). Water levels in the Missouri River floodplain depend on seasonal river fluctuations, large floods, and releases from Gavins Point Dam near Yankton, South Dakota, TDS concentrations in groundwater from Missouri River alluvium are on the order of 500 to 700 mg/l (USGS 2006jbb).

Missouri

Glacial waterbearing zones in Missouri also are extensive as a result of the sequence of continental glaciations that affected the state north of the Missouri River. The deposits generally are similar to those described above for Nebraska and Kansas. On the margins of glaciation, drift deposits and buried streamchannel aquifers may be thinner than deposits to the north and west. Waterbearing zones in the drift consist of isolated lenses of sand and gravel or similarly coarse-textured materials that fill pre-glacial valleys cut into the underlying bedrock surfaces. As a result, many of the glacial drift aquifers in this area are isolated by deep valleys and drain to nearby surface waterbodies and/or adjacent alluvium. The depth to groundwater is highly influenced by topography, generally being deeper along ridges and shallower (e.g., 15 to 20 feet) toward the valley floors. TDS concentrations from the drift aquifers range from about 350 to 800 mg/l (Fuller et al. 1957a,b,c).

Unconsolidated deposits of sand and gravel along stream channels are used locally as water supply sources. Examples of where these aquifers occur include the Platte River, the Grand River, and the Chariton River drainages. Depth to groundwater is typically less than 10 feet.

Bedrock aquifers along the proposed ROW in western and central Missouri consist of sandstones and limestones having a wide variety of geologic ages. Examples include the Mississipian-aged Burlington-Keokuk formation and the Ste. Genevieve formation, the Ordovician-aged Cotter and Kimmswick formations, and the Pennsylvanian Ardmore Formation (Fuller et al. 1957a,b,c). Water from the bedrock formations, particularly the Ordovician and older rocks, is typically poor in quality, with TDS concentrations over 10,000 mg/l. This limits the suitability of these aquifers as sources of drinking water and for other uses. As a result, stream alluvium and glacial zones are the focus of most water supply investigations in the area.

Carbonate rocks that may form karst features (sinkholes, dissolution cavities, caves, and fissures) generally are isolated under 10 to 200 feet of glacial till in southeastern South Dakota, northeastern Nebraska and Kansas, up to where the proposed route crosses central Missouri (Veni 2002). There are potential karst development areas characterized as fissures, tubes, and caves usually less than 1,000 feet long and less than 50 feet deep in Caldwell, Lincoln, and St. Charles counties in Missouri (Davies et al. 1984). Groundwater resources in these areas may be exposed to a wide variety of contaminant sources. The dominant bedrock sequence is Mississippian in age and the dominant water-bearing formations below the glacial drift in eastern Missouri are the Keokuk and Burlington limestones. These supply water to wells primarily from solution cavities (Miller and Appel 1997). A number of springs may occur along the proposed route through Missouri. In southern Carroll and Chariton counties, the Mississippian system contains poor quality water, with TDS concentrations greater than 10,000 mg/l. Eastward from central Randolph County to the St. Charles area along the Mississippi River, TDS concentrations are generally 1,000 mg/l or less and the aquifer is more suitable for use (Miller and Appel 1997).

Illinois

Shallow wells are constructed in the broad floodplain alluvium in the vicinity of the confluence of the Missouri and Mississippi rivers. In Illinois, wells withdraw large quantities of groundwater from terrace deposits of the Cahokia Formation, a Quaternary deposit of river sand, gravel and silt. In Madison County, this extends inland from the Mississippi River approximately 12 miles (Wehrman et al. 2003). Additional shallow sand and gravel aquifers occur in east-central Madison County, in central Bond County, and all along the Kaskaskia River alluvium in Fayette County (Wehrman et al. 2003). Karst features are not present along the project route in westernmost Illinois (Davies et al. 1984). Away from the river, most of the surficial geology along the proposed route in Illinois is composed of end moraine and till plain glacial deposits underlying loess deposits from five to 20 feet thick (Illinois State Geological Survey 2004). Underlying bedrock consists mainly of the Pennsylvanian-aged Shelburn Formation. This consists of interbedded shale, siltstone, limestone, sandstone and coal (Devera and Denny 2003). Aquifer zones less than 15 meters below the land surface are scattered all along the proposed route in Illinois (Berg, no date). Springs occur along or in the vicinity of the proposed route in eastern Madison County, in southwestern Bond County, and in Fayette County (Wetzel and Webb 2004).

CUSHING EXTENSION

Nebraska

Glacial deposits and alluvium form the uppermost groundwater-bearing zones along the Cushing Extension route in Jefferson County. The pipeline also will pass over a portion of the Great Plains aquifer system that lies under these glacial deposits and alluvium or is exposed at the surface (Miller and Appel 1997). Additionally, a series of important natural springs and wells occur near Fairbury, Nebraska. Fairbury's main water supply comes from Crystal Springs, located west of Fairbury, approximately 12 miles northwest of the start of the Cushing Extension ROW and approximately 10 miles west of the mainline ROW. These groundwater supplies make up the Little Blue Public Water Project, which serves several hundred domestic, livestock, and business water supply hookups in Thayer and Jefferson counties, including the villages of Gilead and Gladstone. The Little Blue River intersects the locale, further separating the proposed pipeline from this important water supply. In addition, six wells further west of Fairbury also provide much of the city's water supply. An additional water source for Fairbury comes from three wells located one-half mile east of the town. This latter location is still approximately 11 miles west of the proposed ROW.

Kansas

Several major surface waters in Kansas supply water for municipal, private, irrigational, and other uses. However, groundwater is a major supplier for many of the water demands in the state. Part of the Great Plains aquifer, composed of semi-consolidated or consolidated sedimentary rock, underlies the surficial aquifer system or is exposed at the surface, in Washington and Clay counties (Miller and Appel 1997). This aquifer system is present at the land surface in a band that extends northeastward from south-central Kansas. The pipeline will cross over this aquifer almost the entirety of its route in Washington County. The Great Plains aquifer system consists of two sandstone aquifers in Cretaceous rocks, separated by a shale confining unit (Miller and Appel 1997). The aquifer system extends into the subsurface throughout Kansas and Nebraska, however, the water is often saline in many locations northward and westward from the area where it is exposed. Water with dissolved solid ranges of 1,000 to 10,000 mg/l is fairly typical of the aquifer. Freshwater is withdrawn in Kansas mostly along the southern and eastern margins of this aquifer (Miller and Appel 1997). These are the sections of the aquifer system that are nearest to land surface and contain most of the freshwater. A thick confining unit composed of Cretaceous shale, chalk, and limestone formations overlies the Great Plains aquifer system and separates it from the High Plains aquifer in most places (Miller and Appel 1997).

Further south along the Cushing Extension, primary surficial aquifer zones consist of stream-valley aquifers. These unconsolidated sand and gravel deposits are thickest and most productive in the valleys of large rivers (Miller and Appel 1997). These larger stream-valley aquifers will be crossed in Clay, Dickinson, Marion, and Cowley counties with the crossing of the Republican, Smokey Hill, Cottonwood, and Arkansas rivers. The stream-valley aquifer along the Smoky Hill River can range in width from three to five miles. The upland areas adjacent to this river are underlain by sandstone shale and limestone of Cretaceous to Permian age and are much less permeable than the alluvium (Miller and Appel 1997). The aquifer contains mostly freshwater in its upper 30 to 50 feet. Wells along the Smokey Hill commonly yield 200 to 900 gpm in this region. From Salina eastward, the aquifer contains saline water. As the water moves eastward through the Wellington aquifer, it partially dissolves rock salt and evaporate minerals in the Wellington Formation, increasing chloride and dissolved solids concentrations (Miller and Appel 1997).

Typically, the water in the stream-valley aquifers is under unconfined or water-table conditions. These stream-valley aquifers are in direct hydraulic connectivity with the adjacent streams and water levels in the aquifers closely mimic water levels in their related streams. Productivity close to 3,000 gpm has been reported from stream valley aquifers in Kansas, although more typical yields range from 100 to 1,000 gpm (Miller and Appel 1997). These aquifers are fairly reliable sources of ground water due to their coarse grained composition and high permeability. Water quality in the stream-valley aquifers is generally suitable for most uses, with higher calcium bicarbonate levels producing a hard water. Dissolved solids typically measure less than 500 mg/l, but can vary from location to location by as much as 7,000 mg/l (Miller and Appel 1997).

The Flint Hills aquifer system, extending north to south across east-central Kansas, consists of Permian limestones in the Chase and Council Grove groups. The Flint Hills aquifer lies beneath most of the route from Clay County to Cowley County. It is the source of water for many small springs and public water supplies. The principal limestones in this region are the Nolands, Winifield, and Barneston Limestones (Aber 2004). Some wells yield up to 1,000 gpm from these limestones (Macfarlane 2000). The continued movement of groundwater through the limestones in the region has created a network of solution-widened fractures and conduits of varying size. These features vary widely in size from fractures that are several millimeters wide up to one meter in diameter (Macfarlane et al. 2005). Sinkholes also are common where these formations crop out in uplands and springs emerge from these units in valleys and stream channels (Aber 2004).

The proposed Cushing Extension route will cross close to or through regions, mainly in Dickinson, Marion, and Butler counties that contain sinkholes and springs, however, these features are scattered throughout the entire region crossed in Kansas. In Marion County, the proposed Cushing Extension follows a route through the middle of the county, running just west of the eastern third of the county that is heavily dotted with sinkholes and springs. In central Butler County, the Cushing Extension route may pass through a section of scattered sinkholes and several springs. In Clay County, the ROW runs through the western third of the county, avoiding most of the sinkholes and springs, which are more centrally located in the county. Groundwater of the Flint Hills region generally has high TDS and high hardness concentrations (Aber 2004).

Regional groundwater evaluations have not been performed in much of eastern and central Kansas, however, it is believed that the Flint Hills aquifer is most appropriate for domestic and stock wells and other isolated, low volume uses (Macfarlane et al. 2000). The freshwater portion of the Flint Hills aquifer is assumed to be unconfined throughout its extent, with marginal water quality existing in the deeper parts of this aquifer. The Flint Hills aquifer also may have a role in providing short term backup sources for small to medium sized suppliers in drought situations (Macfarlane et al. 2000).

The Wellington aquifer consists of extensively fractured shales of the Permian Wellington Formation, resulting from the dissolution of the underlying halite and gypsum and anhydrite near the updip edge of the Hutchinson Salt Member of the Wellington Formation (Macfarlane 2000). This aquifer extends southward from Saline County to the Kansas-Oklahoma border. The formation of sinkholes and subsidence features at the surface continues to develop naturally in this region (Macfarlane et al. 2005). The proposed Cushing Extension route parallels the Wellington aquifer several miles east of its approximate boundary through the majority of Kansas. A small branch of this aquifer may be crossed in the southwest corner of Cowley County.

Small segments of the pipeline in Dickinson, Marion, Butler, and Cowley counties also may traverse through a large confining unit that stretches across the whole eastern third of Kansas. Only small to moderate amounts of water can be obtained from wells completed in these confining units, which have no principal aquifer (Miller and Appel 1997).

Oklahoma

Throughout its route in Kay, Noble, Pawnee, and Payne counties, the pipeline will predominantly pass over a large region with no principal aquifer. The main aquifers to consider will be those small and large stream valley alluvial terraces crossed along the route. Two alluvial aquifers of significant importance will be intersected along the Cushing Extension route in Oklahoma. The first is the Salt Fork Arkansas River, which will be crossed in Kay County, and the second is the Cimarron River, which will be crossed in Payne County. The Arkansas River, another significant alluvial aquifer will be crossed just north of the Oklahoma state border in Nebraska. These alluvial aquifers consist mainly of Quaternary age deposits of unconfined sand and gravel, like those seen in Kansas. Some of these deposits may be more than 100 feet thick and several miles wide. Often their total thickness is saturated throughout the year, yielding large quantities of water. These alluvial aquifers are very important sources of water in Oklahoma (Ryder 1996).

The Salt Fork Arkansas River originates in the gypsum hill of southern Kansas. The river contains saline water and is unsuitable for most uses. Alluvium and alluvial terrace deposits up to ten miles wide and 150 feet thick are located along the entire length of the river. Water contained in the alluvium often resembles the chemical quality of the water in the river (Ryder 1996).

The Arkansas River also enters Oklahoma from Kansas. The alluvium and alluvial terraces along the Arkansas can be up to five miles wide and 45 feet thick. Wells constructed within the alluvial beds in the northern portion of the aquifer are used primarily for irrigational use and can yield up to 600 gpm (Ryder 1996).

The Cimarron River contains alluvial terraces on its northeastern side that compose one of the best aquifers in Oklahoma. These highly productive alluvial terraces stretch for 110 miles starting in southern Woods County and ending in Logan County (Ryder 1996). This region lies east of the pipeline route and will not be crossed. However, smaller alluvial terraces along the Cimarron River will be crossed by the pipeline near Cushing, Oklahoma. Water in the Cimarron River alluvial terraces is a calcium-magnesium bicarbonate type with dissolved-solids concentrations of about 400 mg/l or less. Hardness is generally less than 200 mg/l. The water is suitable for municipal purposes as well as for domestic and irrigational supplies (Ryder 1996).

3.5.4 Water Supplies and Wells

KEYSTONE MAINLINE

Along the proposed ROW from the U.S. border to about Jefferson County, Nebraska, municipal water supplies are largely withdrawn from groundwater sources. Along the proposed route from Jefferson County eastward, a mixture of surface water reservoirs and groundwater wells serve municipal supply requirements. St. Joseph, Missouri, is supplied by a groundwater wellfield several miles north of the City in Andrew County (Water-Technology-net 2006). This facility will not be crossed by the proposed pipeline, which will be routed south of the city. Other municipalities are served by Highland Silver Lake and Carlyle Lake in Illinois. Municipal wells in the vicinity of the proposed route are indicated in **Table 3.5-6**. Large numbers of private wells also are located along the proposed route.

CUSHING EXTENSION

Information on locations of water supplies and wells along the Cushing Extension has been requested from appropriate federal, state, and local agencies, and will be analyzed as the project progresses.

3.5.5 Floodplains

From a geomorphic perspective, floodplains are relatively low, flat areas of land that surround waterbodies and hold overflows during flood events. Floodplains are often associated with rivers and streams, where they consist of stream deposited sediments forming levels (or "terraces") deposited at different times along the watercourse.

From a policy perspective, Federal Emergency Management Agency (FEMA) defines a floodplain as being any land area susceptible to being inundated by waters from any source (FEMA 2005). Much of the basic inventory, regulation, and mitigation effort for floodplains and flood mitigation (including the National Flood Insurance Program [NFIP]) has been led by FEMA. EO11988, Floodplain Management, states that actions by federal agencies shall avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplain development wherever there is a practicable alternative. Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for 1) acquiring, managing, and disposing of federal lands, and facilities; 2) providing federally undertaken, financed, or assisted construction and improvements; and 3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

KEYSTONE MAINLINE

Within the project area, low terraces occur at nearly every stream crossing. For smaller intermittent and ephemeral drainages, these are typically narrow and infrequently flooded. At crossings of rivers and larger perennial streams, floodplains are wider and may be more frequently flooded to a particular elevation depending on the magnitude of a given flood. Zones of major interest from a regulatory floodplain perspective are indicated on **Table 3.5-7**.

CUSHING EXTENSION

Floodplain settings associated with the Cushing Extension are similar to that for the Keystone Mainline. Significant floodplain crossings are indicated in **Table 3.5-7**.

3.5.6 Wetlands and Riparian Areas

Wetlands and riparian areas were identified along the Keystone Mainline and Cushing Extension by completing field surveys and reviewing aerial photographs for areas where reroutes have been developed. Wetlands and waters of the U.S. along the proposed route were delineated in accordance with the direction provided by the USACE – Omaha, Kansas City, St. Louis, and Tulsa districts. Specific information regarding discussions with the USACE districts' personnel, level of effort, wetland and other waters of the U.S. delineation methodology, and permitting requirements was submitted to the Department of State on September 16, 2006. Keystone coordinated with USACE representatives regarding features that needed to be field-checked and delineated.

Table 3.5-6 Public Water Supplies (PWS) within 1 mile of the Proposed Keystone Centerline

State	County	Approximate Mile Post Marker (mi)	Distance From CL (mi)	Cardinal Direction from CL	PWS Name	Well ID
KEYSTONE MAINLINE						
North Dakota	Pembina	20.24	0.99	east	Cavalier	ND5000201
	Pembina	30.67	0.48	east	North Val	ND3401129
	Pembina	30.71	0.46	east	North Val	ND3401129
	Pembina	30.72	0.40	east	North Val	ND3401129
	Pembina	30.72	0.56	east	North Val	ND3401129
	Walsh	30.73	0.51	east	North Val	ND3401129
South Dakota	Marshall	235.8-236.2	< 0.04	west	Marshal County Source Water Area	unk
	Kingsbury	326.7	0	crosses CL	Zone B Aquifer Protection Area	none
Nebraska	Wayne	488.1	< 1.0	unk	Hoskins, Village of	NE3118101
	Colfax	518	< 1.0	unk	Leigh, Village of	NE3103705
	Seward	577.05	0	crosses CL	Seward Co. SID #2	NE3115904
	Seward	577.55	0	crosses CL	Seward, City of	NE3115905
	Seward	580.58	0	crosses CL	Glenhaven Village Subdivision	NE3110929
	Seward	584.20	0	crosses CL	Milford, City of	NE3115907
	Seward	585.86	0	crosses CL	Milford, City of	NE3115907
	Jefferson	618.88	0	crosses CL	Plymouth, Village of	NE3109503
	Jefferson	636.3	< 1.0	unk	Steele City, Village of	NE3109502
Kansas	Doniphan	736.7	< 1.0	north	Bendena	unk
Missouri	Chariton	859.01	0.96	south	Keytesville	14616
	Chariton	859.04	0.92	south	Keytesville	14615
	Chariton	862.55	0.06	south	Salisbury	14630
	Chariton	862.63	0.05	north	Salisbury	14629
	Chariton	862.86	0.38	north	Salisbury	14628
	Audrain	919.68	0.56	south	National Refractories & Mineral	12790
	Audrain	931.60	0.84	north	Community R-VI School	12791
	Lincoln	961.30	0.46	north	Lincoln Co. Egg Farm	13014
	Lincoln	961.34	0.50	north	Lincoln Co. Egg Farm	10124
	Lincoln	961.35	0.51	north	Lincoln Co. Egg Farm	10123

Table 3.5-6 Public Water Supplies (PWS) within 1 mile of the Proposed Keystone Centerline

State	County	Approximate Mile Post Marker (mi)	Distance From CL (mi)	Cardinal Direction from CL	PWS Name	Well ID
	Lincoln	970.57	0.73	north	Glenmeadows Subd.	16726
	Lincoln	972.79	0.89	north	Lincoln Co. PWSD #1	12706
	Lincoln	974.96	0.78	south	Moscow Mills	10131
	Lincoln	975.30	0.46	north	Lincoln Co. PWSD #1	16983
	Lincoln	976.75	0.91	south	Majestic Lakes	16955
	Lincoln	980.26	0.30	north	Autumn Hills MHP	12875
	Lincoln	980.26	0.29	north	Autumn Hills MHP	12874
	Lincoln	981.18	0.25	south	Joan's Chain of Events	11866
	St Charles	1001.40	0.55	south	Trinity Lutheran	13538
	St Charles	1014.42	0.62	south	West Alton Elem. School	10932
Illinois	Madison	1030	< 0.04	unk	County Highway 1 over Cahokia	26512
	Madison	1030	< 0.04	unk	County Highway 1 over Cahokia	26511
	Madison	1032	< 0.04	unk	IL 157 over Mooney Creek	27998
	Madison	1032	< 0.04	unk	IL 157 over Mooney Creek	27997
	Madison	1032	< 0.04	unk	IL 157 over Mooney Creek	27999
	Madison	1035	< 0.04	unk	N.Y.C. & St. L. RR. Overhead	27222
	Madison	1035	< 0.04	unk	N.Y.C. & St. L. RR. Overhead	27223
	Madison	1035	< 0.04	unk	N.Y.C. & St. L. RR. Overhead	27226
	Madison	1035	< 0.04	unk	N.Y.C. & St. L. RR. Overhead	27228
	Madison	1035	< 0.04	unk	N.Y.C. & St. L. RR. Overhead	27227
	Madison	1035	< 0.04	unk	N.Y.C. & St. L. RR. Overhead	27229
	Madison	1035	< 0.04	unk	N.Y.C. & St. L. RR. Overhead	27225
			CUSHING EXTENSION			
Nebraska	Jefferson	N/A	N/A	N/A	NONE	NONE
Kansas	Washington	3.75	0.32	east	Hollenberg	unk
	Washington	20.80	0.20	west	Greenleaf Well #7	unk
	Washington	21.06	0.27	east	Greenleaf Well #8	unk
	Washington	21.67	0.70	east	Greenleaf	unk
	Washington	21.70	0.67	east	Standby Well #5	unk

Table 3.5-6 Public Water Supplies (PWS) within 1 mile of the Proposed Keystone Centerline

State	County	Approximate Mile Post Marker (mi)	Distance From CL (mi)	Cardinal Direction from CL	PWS Name	Well ID
	Washington	21.77	0.71	east	Greenleaf	unk
	Washington	21.78	0.71	east	Greenleaf	unk
	Washington	21.83	0.67	east	Standby Well #6	unk
	Dickinson	73.79	0.37	east	Chapman	unk
	Dickinson	73.80	0.40	east	Chapman	unk
	Dickinson	73.80	0.42	east	Chapman	unk
	Butler	146.13	0.37	west	Potwin	unk
	Butler	146.16	0.38	west	Potwin	unk
	Butler	146.16	0.38	west	Potwin	unk
	Butler	146.20	0.24	west	Potwin	unk
	Butler	146.38	0.02	east	Potwin	unk
	Butler	146.41	0.05	west	Potwin	unk
	Butler	155.27	0.27	west	Towanda	unk
	Butler	155.50	0.78	west	Towanda	unk
	Butler	155.63	0.65	west	Towanda	unk
	Butler	155.78	0.02	west	Towanda	unk
	Butler	155.78	0.02	west	Towanda	unk
	Butler	155.90	0.05	west	Towanda	unk
	Butler	155.90	0.05	west	Towanda	unk
	Cowley	194.81	0.04	west	Winifield	unk
	Cowley	207.25	1.00	east	Arkansas City, Well #4	unk
	Cowley	207.42	1.00	east	Arkansas City, Well #3	unk
	Cowley	207.51	1.00	east	Arkansas City, Well #2	unk
	Cowley	207.57	0.99	east	Arkansas City, Well #1	unk
	Cowley	207.58	0.98	east	Arkansas City, Well #9	unk
Oklahoma	Kay	240.04	0.25	east	Marland	OK2005204
	Kay	240.02	0.26	east	Marland	OK2005204
	Kay	240.00	0.28	east	Marland	OK2005204
	Payne	290.17	0.04	west	Linclon Co RW & Sewer Dist	OK2004105

Table 3.5-7 Significant Floodplains Along the Proposed Route

State	Approximate Milepost	Watercourse Associated with Floodplain
	KEYSTONE MAINLINE	
North Dakota	7.1 - 7.2	Pembina River
	168.0 – 168.5	Sheyenne River
South Dakota	228.4 – 228.8	Crow Creek
	390.9 – 391.1	Wolf Creek
	420.9 – 421.9	James River
South Dakota/Nebraska	435.2 – 438.1	Missouri River
Nebraska	502.0 – 503.0	Elkhorn River
	503.5 – 503.6	Union Creek
	541.9 – 542.3	Platte River
	573.1 – 573.3	Big Blue River
	590.9 – 591.0	West Fork, Big Blue River
Kansas	658.6 – 659.0	Big Blue River
Kansas/Missouri	747.8 – 752.7	Missouri River
Missouri	762.2 – 762.3	Platte River
	812.1 – 812.3	Mud Creek
	840.5 – 840.9	Grand River
	862.3 – 862.5	Chariton River
	867.8 – 868.2	Middle Fork, Chariton River
	871.6 – 871.8	East Fork, Chariton River
	918.4 – 918.5	South Fork, Salt River
	928.4 – 928.7	West Fork, Cuivre River
	971.0 – 971.3	Cuivre River
Missouri/Illinois	985.0 – 1022.1	Mississippi/Missouri River
Illinois	1037.0 – 1037.2	Silver Creek
	1045.9 – 1046.1	East Fork, Silver Creek
	1055.0 – 1055.5	Shoal Creek
	1070.2 – 1073.5	Carlyle Lake (Kaskaskia River)
	CUSHING EXTENSION	
Nebraska	None	None
Kansas	4.0 – 4.5	Little Blue River
Oklahoma	9.1 – 14.4	Mill Creek
	49.9 – 51.2	Republican River
	68.5 – 72.0	Chapman Creek
	74.1 – 77.0	Smoky Hill River
	116.4 – 119.0	Cottonwood River
	154.5 – 161.7	Whitewater River
	189.5 – 191.5	Walnut River
	205.0 – 206.2	Arkansas River
	237.0 – 241.0	Salt Fork Arkansas River
	284.0 – 285.0	Cimarron River

In addition to collecting sufficient data for "routine on-site delineations" as per the Corps of Engineers Wetlands Delineation Manual (USACE 1987) and channel characteristics data for drainage crossings, wetland survey teams collected sufficient data (e.g., defined bed and bank and connectivity to navigable waters) for the USACE to make jurisdictional determinations for all wetlands and drainage crossings surveyed in the field.

Wetland and riverine communities crossed by the proposed pipeline are summarized in **Table 3.5-8**. Wetlands and riverine habitats occupy less than five percent of the proposed pipeline route. Of this, the majority occurs in North Dakota, South Dakota, and Missouri. Approximately 86 percent of the wetlands crossed are characterized as palustrine, which includes classifications such as marshes, bogs, and prairie potholes. The remaining 14 percent are riverine or areas that are contained within a channel. A portion of the palustrine wetlands potentially crossed by the ROW is identified as farmed wetlands. A number of wetland areas are located in actively grazed rangeland. Detailed tables that identify all of the wetlands crossed by the proposed ROW by state are provided in Appendix F.

The most common types of wetlands found along the proposed ROW are palustrine emergent and palustrine forested wetlands. Palustrine emergent wetlands are dominated by perennial rooted herbaceous vegetation, while palustrine forested wetlands are dominated by woody species greater than 20 feet in height. Common wetland species identified along the pipeline route are included in Section 3.6, **Table 3.6-1**.

Table 3.5-8 Miles of Wetlands Crossed by the Keystone Pipeline Project

State	Wetland Types Crossed (miles)				
	Palustrine Emergent	Palustrine Forested	Riverine/ Open Water/	Palustrine Scrub Shrub	TOTALS
NWI Codes	PEM	PFO	ROW	PSS	
KEYSTONE MAINLINE					
ND	16.7	0.4	0.6	1.0	18.7
SD	18.6	0.0	0.7	0.3	19.6
NE	2.0	0.4	1.3	0.1	3.8
KS	0.5	0.4	1.3	0.0	2.2
MO	1.9	3.3	4.1	0.3	9.6
IL	0.9	0.8	1.1	0.6	3.4
Keystone Mainline Total	**40.6**	**5.3**	**9.1**	**2.3**	**57.3**
CUSHING EXTENSION					
NE	0.0	0.0	0.0	0.0	0.0
KS	2.6	2.8	0.6	0.0	6.0
OK	3.1	1.1	0.2	0.0	4.4
Cushing Extension Subtotal	**5.6**	**3.8**	**0.8**	**0.0**	**10.4**
PROJECT TOTAL	46.2	9.1	9.9	2.3	67.7

Table 3.5-8 Miles of Wetlands Crossed by the Keystone Pipeline Project

State	Wetland Types Crossed (miles)				
	Palustrine Emergent	Palustrine Forested	Riverine/ Open Water/	Palustrine Scrub Shrub	TOTALS
NWI Codes	PEM	PFO	ROW	PSS	

[1]Delineations were completed for key wetlands and waters of the U.S.; key wetlands and waters of U.S. along a reroute in southeastern North Dakota were identified based on the review of aerial photographs.

[2]Delineations were completed for key wetlands and waters of the U.S.; key wetlands and waters of U.S. along a reroute in northeastern South Dakota were identified based on the review of aerial photographs.

[3]Delineations were completed for key wetlands and waters of the U.S.; key wetlands and waters of U.S. along a reroute in the state were identified based on the review of aerial photographs.

[4]Delineations were completed for wetlands and waters of the U.S. crossed by the Keystone Pipeline Project, excluding land tracts where access had been denied by private landowners.

[5]Delineations were completed for wetlands and waters of the U.S. crossed by the Project, excluding land tracts where access had been denied by private landowners.

[6]Illinois: Delineations were completed for all wetlands and waters of the U.S. from the Mississippi River to the Patoka Terminal.

[7]Preliminary identification of wetlands and waters of the U.S. was based on the review of aerial photographs.

3.6 Terrestrial Vegetation

3.6.1 Vegetative Types

Vegetation types crossed by the Keystone Pipeline Project were delineated based on the review of aerial photographs, general observations made during field reconnaissance activities, and detailed information collected during wetland and waters of the U.S. delineation activities and grassland assessment surveys. Thirteen vegetation types or general land use categories are crossed by the proposed route including cropland, pivot-irrigated cropland, grassland/rangeland, upland forest, palustrine emergent wetland, palustrine shrub/scrub wetland, palustrine forested wetland, streams, open water, ROW, residential, commercial/industrial, and special designation areas (Table 3.6-1). Subclasses associated with these vegetation types or general land use categories also have been provided in **Table 3.6-1**. Grassland/rangeland, upland forest, palustrine emergent wetland, palustrine shrub/scrub wetland, palustrine forested wetland, streams, and open water areas support naturally occurring terrestrial and aquatic vegetation whereas residential, commercial/industrial, and special designation areas (e.g., schools, parks, recreational facilities) primarily include artificially created landscapes with minimal naturally occurring vegetation. Cropland and pivot-irrigated cropland areas primarily include introduced crop species, which provide forage and grain for livestock and human consumption. ROW areas consist of previously disturbed areas associated with pipelines and other utilities that have been reclaimed primarily with native herbaceous species and may include some introduced species. Dominant species commonly associated with these vegetation types and general land use categories have been included in **Table 3.6-1**. **Table 3.6-2** provides the approximate mileages of the various vegetation types crossed by the proposed route.

Grasslands that occur along the Keystone Mainline and Cushing Extension were identified via the review of aerial photographs and completion of a grassland assessment survey. Grasslands that occur along the proposed route in southeastern North Dakota and eastern South Dakota were identified during a grassland assessment survey conducted in August 2006. Grasslands in these areas primarily support native grass and forb species typically associated with the mixed grass prairie and are considered important habitat areas for special status plant and wildlife species. Existing grassland mapping completed for the REX West Pipeline Project was used for portions of northeastern Kansas and northwestern and central Missouri where the two pipeline ROWs would be co-located. Grasslands that occur along the remainder of the Keystone Mainline and the Cushing Extension were identified via the review of aerial photographs. **Table 3.6-3** provides a list of the primary grasslands crossed by the Keystone Mainline and Cushing Extension, including the state and county in which they occurred; types, quality, number of grasslands; and approximate MPs.

3.6.2 Sensitive Plant Species

The information presented in this section reflects responses received from appropriate state and federal agencies at the time this document was prepared. This information will continue to be updated throughout the pre-construction process based on continued consultations.

Information on sensitive plant species potentially found along the proposed ROW was obtained from the USFWS, the various state Natural Heritage Programs (NHPs), state wildlife agencies, and field surveys. Federal agencies provided information on special status species. Data on species of special concern or species of concern were provided by the various state wildlife departments. The NHPs provided information on the global status of various plant populations. Surveys were conducted in 2006 in North Dakota and South Dakota along the proposed Keystone Pipeline Project construction ROW for native grassland habitat and for native grassland species. Based upon these information sources, a total of 63 sensitive plants (nine special status species and 54 species of special concern) were identified as potentially occurring within the project area. These species, their associated habitats, and their potential for occurrence along the pipeline ROW are listed and summarized in Appendix G. Occurrence potential along the ROW was evaluated for each plant species based on its habitat requirements and/or known distribution. Based on these evaluations, six sensitive plant species (one special status species and five species of special concern) were eliminated from detailed analysis. The remaining 57 sensitive plant species are analyzed in further detail. Eight are special status species and 49 are species of special concern. The potential occurrences of these species along each segment of the pipeline ROW are presented **Table 3.7-6** and **Table 3.7-7**.

3.6.3 Noxious and Invasive Weeds

After disturbances of the soil, vegetation communities may be susceptible to infestations of noxious species. These species are most prevalent in areas of prior surface disturbance, such as agricultural areas, roadsides, existing utility ROWs, and wildlife concentration areas. The prevention of the introduction or spread of noxious and invasive weeds is a high priority for nearby communities. Under EO 13112 of February 3, 1999 – Invasive Species, federal agencies shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the U.S. or elsewhere unless it has been determined that the benefits of such actions outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize the risk of harm will be taken in conjunction with the actions.

The terms "noxious weed," and "invasive weed" are often used interchangeably to describe any plant that is unwanted and grows or spreads aggressively. The term "noxious weed" is legally defined under both federal and state laws. Under the Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974 [7 USC SS 2801-2814]), a noxious weed is defined as "any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment" (USDA Agriculture, Animal, and Plant Health Inspection Service [APHIS] 2000; Institute of Public Law [IPL] 1994). Under EO 13112 of February 3, 1999, an "invasive species" is defined as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (APHIS 1999). The Federal Plant Protection Act contains a list of 137 federally restricted and regulated federal noxious weeds, including 19 aquatic and wetland weeds, 62 parasitic weeds, and 56 terrestrial weeds (7 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 to federally listed noxious weeds, each state crossed by the proposed route maintains a list of regulated and prohibited noxious and invasive weed species. County weed control boards or districts are present in most counties crossed by the pipeline route. These county weed control boards monitor local weed infestations and provide guidance on weed control. **Table 3.6-4** provides a summary of noxious and invasive weeds by state that are known to occur or have the potential to occur along the proposed pipeline route. Noxious weeds that occur widely in areas crossed by the proposed route 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*) (**Table 3.6-4**).

Table 3.6-1 Vegetation Types Crossed by the Keystone Pipeline

General Designation	Subclass Designations	General Description	Common Species	Occurrence Along ROW by State								
				Keystone Mainline						Cushing Extension		
				ND	SD	NE	KS	MO	IL	NE	KS	OK
Cropland	N/A	• Agricultural fields	Wheat, barley, oats, sorghum, corn, beans, hay	X	X	X	X	X	X			X
		• Horticulturally cultivated species										
		• Planted perennials										
		• Hay meadows										
Urban/Built Up Areas	Commercial/ Residential	• Suburban residential areas	Ornamental trees, shrubs	X	X	X	X	X	X			X
	Urban	• Commercial development areas										
	Impervious/No Vegetation	• Paved areas (roadways, parking lots)										
	Barren/Sand/ Outcrop	• Gravel quarries • Rock outcrops	None	X	X	X	X	X	X			X
Herbaceous Rangeland	Tall Grass Prairie	• Grassland community dominated by tall grasses 3 to 6 feet tall	Big Bluestem (*Andropogon gerardii*), Little Bluestem (*Schizachyrium scoparium*), Indian Grass (*Sorghastrum nutans*)	X	X	X	X	X	X	X	X	X
	Mid-Grass Prairie	• Grassland community dominated by grasses approximately 1 to 2 feet tall	Blue Grama (*Bouteloua gracilis*), Needle and Thread (*Hesperostipa comata*), Green Needlegrass (*Nassella viridula*), Western Wheatgrass (*Pascopyrum smithii*)	X								
	Short Grass Prairie	• Grassland community generally dominated by grasses less than 1 foot tall	Blue Grama (*Bouteloua gracilis*), Buffalograss (*Buchloe dactyloides*)			X						

Table 3.6-1 Vegetation Types Crossed by the Keystone Pipeline

General Designation	Subclass Designations	General Description	Common Species	Occurrence Along ROW by State								
				Keystone Mainline						Cushing Extension		
				ND	SD	NE	KS	MO	IL	NE	KS	OK
	Sand Prairie	• Grassland community on sand or gravel soils, dominated by mid to tall grasses	Sand Bluestem (*Andropogon hallii*), Blue Grama (*Bouteloua gracilis*), Prairie Sandreed (*Calamovilfa longifolia*), Needle and Thread (*Hesperostipa comata*)	X	X	X						
	Non-native Grassland	• Pasturelands planted with non-native cool-season grasses	Fescue (*Festuca* spp.), Smooth Brome (*Bromus inermis*), and other seed pasture grasses				X	X				
	Deciduous Shrubland	• Upland or lowland communities dominated by shrubs	Chokecherry (*Prunus virginia*), Sandbar Willow (*Salix interior*), Silver Buffaloberry (*Shepherdia argentea*), Western Snowberry (*Symphoricarpos occidentalis*)	X	X							
	Conservation Reserve Program	• Mixed native and non-native grasses and forbs. May include shrubs. Land is fallow	A variety of native and introduced grass species	X	X	X	X					
	Mixed Prairie	• Prairie grasses of mixed heights	Grama (*Bouteloua* spp.), Little Bluestem (*Schizachyrium scoparium*)	X	X	X	X					
Upland Forest	Deciduous Woodland	• Woodlands dominated by a wide variety of mixed native and non-native deciduous species	Green Ash (*Fraxinus pennsylvanica*), Quaking Aspen (*Populus tremuloides*), Bur Oak (*Quercus macrocarpa*), American Elm (*Ulmus americana*)	X		X		X				
	Maple-Basswood Forest	• Community dominated by sugar maple and basswood, found in valley slopes and bottoms	Sugar Maple (*Acer saccharum*), Red Oak (*Quercus rubra*), American Basswood (*Tilia americana*)				X					

Table 3.6-1 Vegetation Types Crossed by the Keystone Pipeline

General Designation	Subclass Designations	General Description	Common Species	Occurrence Along ROW by State								
				Keystone Mainline						Cushing Extension		
				ND	SD	NE	KS	MO	IL	NE	KS	OK
	Oak-Hickory Forest	• Upland community dominated by multiple oak and hickory species	Bitternut Hickory (*Carya cordiformis*), Shagbark Hickory (*C. ovata*), White Oak (*Quercus alba*), Black Oak (*Q. velutina*)				X	X	X		X	
	Green Ash Woodland	• Community dominated by green ash, occurs in floodplains and mesic slopes	Boxelder (*Acer negundo*), Green Ash (*Fraxinus pennsylvanica*), American Elm (*Ulmus americana*)	X								
	Aspen Woodland	• Woodlands dominated by aspen species	Green Ash (*Fraxinus pennsylvanica*), Quaking Aspen (*Populus tremuloides*), Bur Oak *Quercus macrocarpa*)	X								
	Bur Oak Woodland	• Woodlands dominated by bur oak, generally in ravines and well-drained uplands	Green Ash (*Fraxinus pennsylvanica*), Quaking Aspen (*Populus tremuloides*), Bur Oak (*Quercus macrocarpa*)	X								
	Evergreen Forest	• Forest with greater than 60% evergreen trees	Shortleaf Pine (*Pinus echinata*)					X				
	Mixed Oak Ravine	• Oak forest with multiple species on moderate to steep slopes of ravines and river valleys	Big Bluestem (*Andropogon gerardii*), Bur Oak (*Quercus macrocarpa*), *Chinquapin* Oak (*Q. muhlenbergii*)			X	X	X		X	X	
	Deciduous	• Native deciduous forest communities	Bur Oak (*Quercus macrocarpa*), Post Oak (*Q. stellata*)					X				
Riverine/ Open Water	Open Water	• Open water, sometimes associated with wetland habitat	N/A			X						
	Riverine Wetlands	• Wetlands contained within a channel		X								

Table 3.6-1 Vegetation Types Crossed by the Keystone Pipeline

General Designation	Subclass Designations	General Description	Common Species	Occurrence Along ROW by State								
				Keystone Mainline						Cushing Extension		
				ND	SD	NE	KS	MO	IL	NE	KS	OK
Palustrine Forested Wetlands	Floodplain Woodland	▪ Wooded communities in floodplains	Green Ash (*Fraxinus pennsylvanica*), Eastern Cottonwood (*Populus deltoides*), Bur Oak (*Quercus macrocarpa*), American Elm (*Ulmus americana*)	X								
	Riparian or Floodplain Woodland	▪ Temporarily flooded woodlands				X						
	Mixed Oak Floodplain Forest	▪ Oak-dominated forests with temporary flooding in floodplains	Bitternut Hickory (*Carya cordiformis*), Indian Woodoats (*Chasmanthium latifolium*), Bur Oak (*Quercus macrocarpa*), Shumard Oak (*Q. shumardii*)				X					
	Ash-Elm-Hackberry Floodplain Forest	▪ Forest in floodplains and upland ravine bottoms; dominated by ash, elm, and hackberry	Common Hackberry (*Celtis occidentalis*), Green Ash (*Fraxinus pennsylvanica*), Elm (*Ulmus* spp.)				X					
	Woody-dominated Wetland	▪ Semi-permanently or permanently flooded forest community	Maple (*Acer* spp.), Hickory (*Carya* spp.), Oak (*Quercus* spp.)					X				
	Cottonwood Floodplain Woodland	▪ Floodplain forest dominated by cottonwood species	Green Ash (*Fraxinus pennsylvanicus*), Eastern Cottonwood (*Populus deltoides*), Willow (*Salix* spp.)				X					
Palustrine Emergent/ Scrub-Shrub Wetlands	Palustrine or Emergent Wetlands	▪ Temporary, seasonal, or semipermanent wetlands dominated by persistent emergent vegetation	Common Spikerush (*Eleocharis palustrisi*), Rush (*Juncus* spp.), Rice Cutgrass (*Leersia oryzoides*), Bulrush (*Schoenoplectus* spp.), Bur-reed (*Sparganium* spp.), Cattail (*Typha* spp.)	X	X	X	X	X	X	X	X	X

Table 3.6-1 **Vegetation Types Crossed by the Keystone Pipeline**

General Designation	Subclass Designations	General Description	Common Species	Occurrence Along ROW by State								
				Keystone Mainline						Cushing Extension		
				ND	SD	NE	KS	MO	IL	NE	KS	OK
	Riparian Shrubland	• Temporarily flood shrub community	Sedge (*Carex* spp.), Willow (*Salix* spp.), Bulrush (*Schoenoplectus* spp.), Western Snowberry (*Symphoricarpos occidentalis*)	X	X	X						
	Aquatic Bed Wetland	• Intermittently, temporarily, or permanently flooded wetlands	Inland Saltgrass (*Distichlis spicata*), Western Wheatgrass (*Pascopyrum smithii*), Smartweed and Knotweed (*Polygonum* spp.), Pondweed (*Potamogeton* spp.)			X						
	Cattail or Freshwater Marsh	• Shallow to deep emergent marshes	Rush (*Juncus* spp.), Bulrush (*Schoenoplectus* spp.), Bur-reed (*Sparganium* spp.), Cattail (*Typha* spp.)	X	X	X	X					
	Herbaceous-dominated Wetland	• Semi-permanently or permanently flooded wetland	Rush (*Juncus* spp.), Bulrush (*Schoenoplectus* spp.), Cattail (*Typha* spp.), Sedge (*Carex* spp.)					X				
Right-of-Way	N/A	• Pipeline and other utilities	Mixture of grasses and forbs				X	X				

Table 3.6-2 Miles of Vegetative Communities Crossed by the Keystone Pipeline ROW

State	Vegetative Communities Crossed (miles)								TOTAL
	Urban or Built-up land	Cropland	Grassland/ Rangeland	Upland Forest Land	Riverine/ Open Water	Palustrine Forested Wetlands	Palustrine Emergent/ Scrub-Shrub	ROW	
KEYSTONE MAINLINE									
ND	0.2	167.6	26.3	3.0	0.6	0.4	17.7	1.1	216.9
SD	1.2	158.6	37.7	0.2	0.7	0.0	18.9	1.6	218.9
NE	0.3	181.0	24.8	2.1	1.3	0.4	2.1	1.7	213.7
KS	0.1	70.5	18.5	7.5	1.3	0.4	0.5	0.0	98.8
MO	2.9	148.3	72.5	35.9	4.1	3.3	2.2	3.9	273.1
IL	0.8	44.4	1.7	4.7	1.1	0.8	1.5	1.6	56.5
Subtotal	5.5	70.4	181.5	53.4	9.1	5.3	42.9	9.8	1,077.9
CUSHING EXTENSION									
NE	0.0	0.8	1.2	0.4	0.0	0.0	0.0	0.0	2.4
KS	0.1	136.6	58.9	5.9	0.6	2.8	2.6	2.2	209.7
OK	0.6	27.7	41.6	2.3	0.2	1.1	3.1	3.2	79.7
Subtotal	0.7	165.1	101.7	8.6	0.8	3.9	5.7	5.4	291.8
PROJECT TOTAL	6.3	935.5	283.1	61.9	9.9	9.2	48.5	15.3	1,369.7

Table 3.6-3 Grasslands Crossed by the Keystone Pipeline ROW

State	County	Grassland Types	Quality of Grasslands	Number of Grasslands	Approximate MPs
KEYSTONE MAINLINE					
North Dakota	Pembina[1]	Native prairie	High	7	6 to 32
	Walsh[1]	Prairie	Medium to high	13	32 to 46
	Nelson[1]	Prairie	High	3	58 to 59
	Barnes[1]	Prairie	Medium	1	124 to 125
	Ransom[1]	Prairie	High	2	167 to 169
	Sargent[2]	Wet lowland, native prairie, pasture and wetland mosaic	Low to high	4	200 to 205
	Dickey[2]	Wet meadows	Medium to high	2	207 to 213
Subtotal				*32*	
South Dakota	Day[2]	Native prairie, grazed pasture, and riparian area	Low to high	7	258 to 272
	Clark[2]	Pasture/wetland mosaic, grassland/wetland, riparian meadow, wetland	Low to medium	8	272 to 298
	Kingsbury[2]	Grassland	Medium/high	1	325 to 326
	Miner[2]	Pasture with isolated wetlands	Low	2	342 to 360
	McCook[2]	Native grassland with wetlands	Medium/high	1	384 to 385
	Hutchinson[2]	Native prairie and pasture	Low and high	2	390 to 392
	Yankton[2]	Native grassland and pasture	Low to high	6	419 to 429
Subtotal				*27*	
Nebraska	Cedar[1]	Grassland	High	1	436 to 437
	Stanton[1]	Grassland	High	1	503 to 504
	Colfax[1]	Grassland	High	1	540 to 541
	Butler[1]	Grassland	High	2	548 to 565
	Saline[1]	Grassland	High	1	606 to 607
	Jefferson[1]	Grassland	High	3	622 to 638
Subtotal				*9*	
Kansas	Nemaha[2]	Mixed grass prairie	Unknown	2	693 to 695
	Brown[2]	Mixed grass prairie	Unknown	2	714 to 715

Table 3.6-3 **Grasslands Crossed by the Keystone Pipeline ROW**

State	County	Grassland Types	Quality of Grasslands	Number of Grasslands	Approximate MPs
	Doniphan[2]	Mixed grass prairie	Unknown	2	740 to 742
Subtotal				*6*	
Missouri	Clinton[2]	Mixed grass prairie	Unknown	6	770 to 790
	Chariton[2]	Mixed grass prairie	Unknown	3	849 to 866
	Randolph[2]	Mixed grass prairie	Unknown	22	881 to 894
	Audrain[2]	Mixed grass prairie	Unknown	14	904 to 920
Subtotal				*45*	
Illinois	No grasslands observed within the state.	NA	NA	0	NA
MAINLINE TOTAL				119	
		CUSHING EXTENSION			
Nebraska	Jefferson[1]	Grassland	Unknown	7	0 to 2.5
Subtotal				*7*	
Kansas	Washington[1]	Grassland	Unknown	22	3 to 31
	Clay[1]	Grassland	Unknown	26	33 to 59
	Dickinson[1]	Grassland	Unknown	49	63 to 98
	Marion[1]	Grassland	Unknown	50	100 to 132
	Butler[1]	Grassland	Unknown	59	136 to 177
	Cowley[1]	Grassland	Unknown	23	181 to 209
Subtotal				*229*	
Oklahoma	Kay[1]	Grassland	Unknown	49	212 to 238
	Noble[1]	Grassland	Unknown	53	240 to 264
	Payne[1]	Grassland	Unknown	76	266 to 291
Subtotal				*178*	
CUSHING EXTENSION TOTAL				414	
PROJECT TOTAL				533	

[1]Grasslands identified via the review of aerial photography only.

[2]Grasslands identified via the review of aerial photography and field verification.

Table 3.6-4 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Pipeline Route

Common Name[1]	Scientific Name[1]	Habitat	Keystone Mainline						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
Russian knapweed	*Acroptilon repens*	Upland	X[2]	X[3,4]	—	X[5]	—		—	X[5]	—
Crested wheatgrass	*Agropyron cristatum*	Upland	X[6]	—	—	—	—	—	—	—	—
Garlic mustard	*Alliaria petiolata*	Upland	X[7]	—	—	—	—	—	—	—	—
Annual ragweed	*Ambrosia artemisiifolia*	Upland	—	—	—	—	—	X[8]	—	—	—
Woolyleaf burr ragweed	*Ambrosia grayi*	Upland	—	—	—	X[5]	—	—	—	X[5]	—
Great ragweed	*Ambrosia trifida*	Upland	—	—	—	—	—	X[8]	—	—	—
Corn chamomile	*Anthemis arvensis*	Upland	X[7]	—	—	—	—	—	—	—	—
Lesser burdock	*Arctium minus*	Upland	—	X[9]	—	—	—	—	—	—	—
Absinthium	*Artemisia absinthium*	Upland	X[2]	X[9]	—	—	—	—	—	—	—
Smooth brome	*Bromus inermis*	Upland	X[6]	—	—	—	—	—	—	—	—
Japanese brome	*Bromus japonicus*	Upland	X[7]	—	—	—	—	—	—	—	—
Cheatgrass Downy brome	*Bromus tectorum*	Upland	X[7]	—	—	—	—	—	—	—	—
Marijuana	*Cannabis sativa*	Upland	—	—	—	—	X[10]	X[8]	—	—	—
Siberian peashrub	*Caragana arborescens*	Upland	X[6]	—	—	—	—	—	—	—	—
Whitetop	*Cardaria draba*	Upland	X[7]	X[3,4]	—	X[5]	—	—	—	X[5]	—
Spiny plumeless thistle	*Carduus acanthoides*	Upland	X[7]	X[9,4]	X[11]	—	—	—	X[11]	—	—
Nodding plumeless thistle	*Carduus nutans*	Upland	X[2]	X[9,4]	X[11]	X[5]	X[10]	X[8]	X[11]	X[5]	X[12]
Meadow knapweed	*Centaurea debeauxii*	Upland	X[7]	—	—	—	—	—	—	—	—

Table 3.6-4 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Pipeline Route

Common Name[1]	Scientific Name[1]	Habitat	Keystone Mainline						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
White knapweed	*Centaurea diffusa*	Upland	X[2]	X[9,4]	X[11]	–	–	–	X[11]	–	–
Big-head knapweed	*Centaurea macrocephala*	Upland	X[7]	–	–	–	–	–	–	–	–
Spotted knapweed	*Centaurea maculosa*	Upland	X[2]	X[9,4]	X[11]	–	–	–	X[11]	–	–
Yellow star-thistle	*Centaurea solstitialis*	Upland	X[2]	X[4]	–	–	–	–	–	–	–
Rush skeleton weed	*Chondrilla juncea*	Upland	–	X[4]	–	–	–	–	–	–	–
Chickory	*Cichorium intybus*	Upland	–	X[9]	–	–	–	–	–	–	–
Canada thistle	*Cirsium arvense*	Upland, Wetland	X[2]	X[3,4]	X[11]	X[5]	X[10]	X[8]	X[11]	X[5]	X[12]
Bull thistle	*Cirsium vulgare*	Upland	X[7]	X[9]	–	X[5]	–	–	–	X[5]	–
Poison Hemlock	*Conium maculatum*	Upland	–	X[9]	–	–	–	–	–	–	–
Field bindweed	*Convolvulus arvensis*	Upland	X[2]	X[9,4]	–	X[5]	X[10]	–	–	X[5]	–
Common crupina	*Crupina vulgaris*	Upland	–	X[4]	–	–	–	–	–	–	–
Dodder	*Cuscuta* spp.	Upland	–	X[4]	–	–	–	–	–	–	–
Gypsyflower	*Cynoglossum officinale*	Upland, Woodland	X[7]	X[9]	–	–	–	–	–	–	–
Fuller's teasel	*Dipsacus fullonum*	Upland	–	–	–	–	X[10]	–	–	–	–
Cutleaf teasel	*Dipsacus laciniatus*	Upland	–	–	–	–	X[10]	–	–	–	–
Brazilian waterweed	*Egeria densa*	Aquatic	X[7]	–	–	–	–	–	–	–	–
Russian olive	*Elaeagnus angustifolia*	Upland, Wetland, Woodland	X[6]	–	–	–	–	–	–	–	–
Quackgrass	*Elymus repens*	Upland	X[7]	–	–	X[5]	–	–	–	X[5]	–

Table 3.6-4 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Pipeline Route

Common Name[1]	Scientific Name[1]	Habitat	Keystone Mainline						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
Leafy spurge	*Euphorbia esula*	Upland	X[2]	X[3,4]	X[11]	X[5]	–	–	X[11]	X[5]	–
Orange hawkweed	*Hieracium aurantiacum*	Upland	X[7]	–	–	–	–	–	–	–	–
Meadow hawkweed	*Hieracium pratense*	Upland	X[7]	–	–	–	–	–	–	–	–
Indian rushpea	*Hoffmannseggia densiflora*	Upland	–	–	–	X[5]	–	–	–	X[5]	–
Black henbane	*Hyoscyamus niger*	Upland	X[7]	–	–	–	–	–	–	–	–
Common St. Johnswort	*Hypericum perforatum*	Upland	–	X[9,4]	–	–	–	–	–	–	–
Broadleaffed pepperweed	*Lepidium latifolium*	Upland	–	X[4]	–	–	–	–	–	–	–
Chinese lespedeza	*Lespedeza cuneata*	Upland	–	–	–	X[5]	–	–	–	X[5]	–
Dalmatian toadflax	*Linaria dalmatica*	Upland	X[2]	X[9,4]	–	–	–	–	–	–	–
Butter-and-eggs	*Linaria vulgaris*	Upland	X[7]	X[9,4]	–	–	–	–	–	–	–
Purple loosestrife	*Lythrum salicaria*	Wetland	X[2]	X[3,4]	X[11]	–	X[10]	–	X[11]	–	–
Black medick	*Medicago lupulina*	Upland	X[6]	–	–	–	–	–	–	–	–
Yellow sweetclover	*Melilotus officinalis*	Upland	X[6]	–	–	–	–	–	–	–	–
Twoleaf watermilfoil	*Myriophyllum heterophyllum*	Aquatic	X[7]	–	–	–	–	–	–	–	–
Spike watermilfoil	*Myriophyllum spicatum*	Aquatic	X[7]	X[4]	–	–	–	–	–	–	–
Scotch cottonthistle	*Onopordum acanthium*	Upland	X[7]	X[9]	–	–	X[10]	–	–	–	X[12]
Reed canarygrass	*Phalaris arundinacea*	Wetland	X[6]	–	–	–	–	–	–	–	–
Kentucky bluegrass	*Poa pratensis*	Upland	X[6]	–	–	–	–	–	–	–	–
Japanese knotweed	*Polygonum*	Upland	X[6]	–	–	–	–	–	–	–	–

Table 3.6-4 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Pipeline Route

Common Name[1]	Scientific Name[1]	Habitat	Keystone Mainline						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
	cuspidatum										
Giant knotweed	*Polygonum sachalinense*	Upland	X[7]	X[9]	–	–	–	–	–	–	–
Curly pondweed	*Potamogeton crispus*	Aquatic	X[7]	–	–	–	–	–	–	–	–
Kudzu	*Pueraria lobata*	Upland	–	–	–	X[5]	X[10]	X[8]	–	X[5]	–
Common buckthorn	*Rhamnus cathartica*	Upland, Woodland	X[7]	–	–	–	–	–	–	–	–
Multiflora rose	*Rosa multiflora*	Upland	–	X[4]	–	X[5]	X[10]	–	–	X[5]	–
Field sowthistle	*Sonchus arvensis*	Upland, Wetland	X[7]	X[3,4]	–	–	–	X[8]	–	–	–
Columbus grass	*Sorghum almum*	Upland	–	–	–	–	–	X[8]	–	–	–
Johnsongrass	*Sorghum halepense*	Upland	–	X[4]	–	X[5]	X[10]	X[8]	–	X[5]	–
Tamarisk	*Tamarix aphylla, T. chinensis, T. gallica, T. parviflora, T. ramosissima*	Upland, Wetland, Woodland	X[2]	X[3]	–	–	–	–	–	–	–
Common tansy	*Tanacetum vulgare*	Upland	–	X[9]	–	–	–	–	–	–	–
Puncturevine	*Tribulus terrestris*	Upland	X[7]	X[9]	–	–	–	–	–	–	–
Narrowleaf cattail	*Typha angustifolia*	Wetland	X[7]	–	–	–	–	–	–	–	–
Hybrid cattail	*Typha x. glauca*	Wetland	X[7]	–	–	–	–	–	–	–	–
Siberian elm	*Ulmus pumila*	Upland	X[8]	–	–	–	–	–	–	–	–
Common mullein	*Verbascum thapsus*	Upland	–	X[9]	–	–	–	–	–	–	–

Table 3.6-4 Noxious and Invasive Weeds Potentially Occurring Along the Proposed Pipeline Route

Common Name[1]	Scientific Name[1]	Habitat	Keystone Mainline						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK

[1]Updated common and scientific names of noxious and invasive plants was obtained from the PLANTS database as available at http://plants.usda.gov/ (USDA NRCS 2006).

[2]Noxious weeds as defined by the NDDA. These weeds are required to be controlled in any setting by county, state, or federal law. Distribution of these weeds by any means is not allowed (NDDA 2003).

[3]State noxious weeds as defined by the SDDA. These weeds are non-native plant species that are a concern to South Dakota land owners and managers. They can seriously impact the native plant community by altering or affecting agriculture, recreation, and wildlife (SDDA 2006a).

[4]Nonnative plant species, including all plants, plant parts, and seeds capable of propagation, as defined by the SDDA, which are regulated under the South Dakota Common Law (SDCL) 38-24A-6 (SDDA 2006a,b).

[5]Noxious species declared by KSDA legislative action as being 'noxious' (KSDA 2005).

[6]Invasive Plants to Ecological Locations as defined by the North Dakota Department of Agriculture (NDDA). These are plants which are commonly utilized by society for a variety of accepted uses. They become a concern as invasive plants when they invade native, natural areas which are desired to remain entirely native (NDDA 2003).

[7]Invasive Plants to Agricultural & Ecological Locations as defined by the NDDA. These are plants which will invade any area, regardless of use, and cause damage. Injury degree is partly determined by the intended use of invaded area (NDDA 2003).

[8]Noxious weeds are classified as any plant which is determined by the Director, the Dean of the College of Agriculture of the University of Illinois and the Director of the Agricultural Experiment Station at the University of Illinois, to be injurious to public health, crops, livestock, land or other property.

[9]Local noxious weeds as defined by the South Dakota Department of Agriculture (SDDA) Weed and Pest Commission. Statute requirements for control are the same as for statewide noxious weeds (SDDA 2006a).

[10]Noxious weeds, as defined by the Missouri Department of Agriculture (MDA), are extremely aggressive plants that tend to have a very high reproductive potential. Many have no useful value to humans and can be harmful to livestock, wildlife and wildlife habitat. Plants identified by the state as noxious weeds are required by law to be controlled on all properties.

[11]Noxious weeds as defined by the Nebraska Department of Agriculture (NDA). These are species which are destructive or harmful and pose a serious threat to the economic, social, or aesthetic well-being of the residents of the state (NDA 2006).

[12]Noxious species declared by Oklahoma Agriculture Food and Forestry (OAFF) legislative action as being 'noxious' (OAFF 2006).

3.7 Wildlife and Fisheries

3.7.1 Terrestrial Wildlife

Wildlife habitats along the proposed route consist of cropland, native prairie, range or pasture land, deciduous forest lands, riparian woodland, wetlands, and aquatic and riverine habitats. Descriptions of vegetative communities that will be crossed by the proposed route are discussed in Section 3.6. A majority (over 80 percent) of the route corridor will cross cropland or other agricultural areas. Although cropland is undeveloped land that represents open space, it has limited value as wildlife habitat since vegetative cover and food sources are present primarily on a short-term basis due to seasonal harvesting and cultivation. The primary value of agricultural land as wildlife habitat is that it contributes seasonal food sources for small mammals and avian species during the growing season. Crop residue remaining after harvest provides a food source for small mammals, songbirds, and waterfowl.

In view of the predominance of agricultural areas along the proposed route, remaining undeveloped natural areas such as riparian river bottoms, prairie pothole wetlands and aquatic habitat, grasslands and native prairie play an important role in sustaining native wildlife populations. Prairie pothole wetlands are considered a significant habitat for waterfowl and waterbird production, as well as resting, and foraging habitat for other wildlife species. Both upland and riparian woodlands provide important cover and habitat for game species, nesting areas for songbirds, and migratory stopover areas for forest-associated neotropical migrants. Mixed and tall grass native prairie habitat also provide important habitat for wildlife species. Important undeveloped wildlife habitats that will be crossed by the proposed route, as discussed below, include forests, wetlands, grasslands, and surface water features. Refer to **Tables 3.6-2, 3.8-4,** and **3.8-5** for more detailed information on the following habitats.

North Dakota

Undeveloped wildlife habitat that will be crossed in North Dakota includes approximately 24 miles of USFWS wetland easement areas, 0.3 mile of USFWS Conservation easement, 3.5 miles of deciduous forest, 17.8 miles of non-forested wetlands, 1.2 miles of moderate to high quality, native grassland and 0.6 mile of open water (e.g., rivers, lakes, and ponds). In addition, the project route will cross approximately 0.8 mile of the Tetrault Woods State Forest and four rivers (Pembina, Sheyenne, Tongue, and Branch Forest rivers) that provide important wildlife habitat. Small remnant areas of tall grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

South Dakota

Undeveloped wildlife habitat that will be crossed in South Dakota includes approximately 11.8 miles of USFWS wetland easement areas, 0.5 mile of USFWS Conservation easement, and 1.0 mile of USFWS grassland easement, approximately 18.9 miles of non-forested wetlands, 9.5 miles of moderate to high quality native grassland, and 0.7 mile of open water (e.g., rivers, lakes, and ponds). Important wildlife habitats that will be crossed by the project route approximately 0.5 mile of the project route include a South Dakota Game, Fish, and Parks Department (SDGFD) designated Game Production Area (GPA) and the Missouri River. Small remnant areas of tall grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

Nebraska

Undeveloped wildlife habitat that will be crossed in Nebraska includes approximately 2.5 miles of forest, 0.5 mile of forested wetlands, 2.1 miles of non-forested wetlands, and 1.3 miles of open water (Missouri and Platte rivers). Small remnant areas of tall grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

Kansas

Undeveloped wildlife habitat that will be crossed in Kansas includes approximately 13.4 miles of forest and 1.9 miles of open water. Important wildlife habitats that will be crossed by the project route include approximately 3.6 miles consisting of four crossings of the Milford State WMA and the South Fork Nemaha River and Missouri River. Small remnant areas of tall grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

Missouri

Undeveloped wildlife habitat that will be crossed in Missouri includes approximately 35.9 miles of forest, 3.3 miles of forested wetlands, 2.2 miles of non-forested wetlands, and 4.1 miles of open water. Important wildlife habitats that will be crossed by the project route include two crossings of the Pigeon Hill Conservation Area, approximately 1.1 miles of Nature Conservancy Land, approximately 1.2 miles of Edward "Ted" & Pat Jones-Confluence point State Park, and seven rivers (Missouri, Platte, Grand, Chariton, Cuivre, Salt, and Mississippi rivers). Small remnant areas of tall grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

Illinois

Undeveloped wildlife habitat that will be crossed in Illinois includes approximately 4.7 miles of forest, 0.8 mile of forested wetlands, 1.5 miles of non-forested wetlands, and 1.1 miles of open water. Important wildlife habitats that will be crossed by the project route will include approximately 3.1 miles of the Carlyle WMA. As discussed above, areas of open water also provide important habitat for breeding and migrating waterfowl.

Oklahoma

Undeveloped wildlife habitat that will be crossed in Oklahoma includes approximately 2.3 miles of forest and 0.2 mile of open water. No important wildlife habitats have been identified along the project route in Oklahoma. However, small remnant areas of tall grass prairie and areas of open water (e.g., rivers, lakes, and ponds) also provide important habitat for upland wildlife species and breeding and migrating waterfowl, respectively.

3.7.1.1 Big Game

Habitat preferences and distribution of big game species occurring along or in the region of the proposed route are summarized in **Table 3.7-1**. White-tailed deer is the principal big game species occurring along the proposed route. White-tailed deer are highly adaptable and inhabit a variety of habitats including cropland, grasslands, shrublands, orchards, and woodlands. They can be found in close association with human development. In the northern portions of their range, white-tailed deer "yard up" during severe weather, concentrating along stream bottoms, lakes, or bogs where there is sufficient cover to intercept snow or on south-facing slopes with or without cover where snow accumulations are reduced. White-tailed deer are likely to occur along the entire proposed route corridor. The majority of the proposed route crosses private land that will require landowner permission for hunting privileges; however, two state WMAs crossed by the proposed route provide public hunting opportunities for white-tailed deer as well other small game species. These WMAs include the Pigeon Hill State WMA in Buchanon County, Missouri; and the Carlyle WMA in Fayette County, Illinois.

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area[1]

Species	Sporting Status	Habitat Association	ND	SD	NE	KS	MO	IL	OK
Mammals									
White-tailed deer *Odocoileus virginianus*	game	This species is found in various habitats from forests to fields with adjacent cover. In northern regions, usually requires stands of conifers for winter shelter. In the north and in montane regions, limited ecologically by the depth/duration/quality of snow cover; summer ranges are traditional but winter range may vary with snow conditions.	X	X	X	X	X	X	X
Mule deer *Odocoileus hemionus*	game	This species is found in coniferous forests, desert shrub, chaparral, grasslands with shrubs, and badlands. Often associated with successional vegetation, especially near agricultural lands. Restricted primarily to the western portions of ND, SD, NE, KS, and OK.	X	X	X	X			X
Pronghorn *Antilocapra americana*	game	This species is generally found in grasslands, sagebrush plains, deserts, and foothills. Need for free water varies with succulence of vegetation in the diet. Restricted primarily to the western portions of ND, SD, NE, and KS.	X	X	X	X			
Elk *Cervus canadensis*	game	This species is found over a range of habitats. Uses open areas such as alpine pastures, marshy meadows, river flats, and aspen parkland, as well as coniferous forests, brushy clear cuts or forest edges, and semi-desert areas. Within project area, located only in northeast ND.	X						
Moose *Alces alces*	game	This species prefers mosaic of second-growth forest, openings, swamps, lakes, wetlands. Requires water bodies for foraging and hardwood-conifer forests for winter cover. Avoids hot summer conditions by utilizing dense shade or bodies of water. In project area, restricted to eastern edge of ND.	X						
Black bear *Ursus americanus*	game	This species prefers mixed deciduous-coniferous forests with a thick understory, but may occur in various situations. In project area, restricted to southern and southeast MO.					X		

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area[1]

Species	Sporting Status	Habitat Association	ND	SD	NE	KS	MO	IL	OK
Eastern gray squirrel *Sciurus carolinensis*	game	This species prefers mature deciduous and mixed forests with abundant supplies of mast (e.g., acorns, hickory nuts). A diversity of nut trees is needed to support high densities. Also uses city parks and floodplains. Seldom far from permanent open water. Nests in tree cavities or in leaf nests, usually 25 feet or more aboveground.	X	X	X	X	X	X	X
Eastern fox squirrel *Sciurus niger*	game	Often found in open mixed hardwood forest or mixed pine-hardwood associations, this species has also adapted well to disturbed areas, hedgerows, and city parks. Prefer savannas or open woodlands to dense forests. Western range extensions are associated with riparian corridors of cottonwoods and fencerows of osage orange. Dens are in tree hollows (preferred) or leaf nests (especially in mild weather).	X	X	X	X	X	X	X
Eastern cottontail *Sylvilagus floridanus*	game	This species is generally found in early mid-successional habitats over much of continental U.S. May be found in brushy areas, open woodlands, swampy areas, stream valleys, grasslands, and suburbs. Very adaptable species. Nests usually are in shallow depressions in thick vegetation or in underground burrows.	X	X	X	X	X	X	X
Coyote *Canis latrans*	furbearer	Wide ranging and found in virtually all habitats. Often considered a pest species, especially by the livestock industry. Control programs have been largely ineffective.	X	X	X	X	X	X	X
Red fox *Vulpes vulpes*	furbearer	Found in various open and semi-open habitats. Usually avoids dense forest, although open woodlands frequently are used. Sometimes occurs in suburban areas or even cities. Maternity dens are in burrows dug by fox or abandoned by other mammals, often in open fields or wooded areas, sometimes under rural buildings, in hollow logs, under stumps, etc.	X	X	X	X	X	X	X
Gray fox *Urocyon cinereoargenteus*	furbearer	Found in a variety of habitats including chaparral, rimrock, riparian, old fields, early successional stage woodlands. Usually prefers a diversity of open and wooded areas rather than large tracts of homogeneous habitat.	X	X	X	X	X	X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area[1]

Species	Sporting Status	Habitat Association	ND	SD	NE	KS	MO	IL	OK
Swift fox *Vulpes velox*	furbearer	The swift fox resides in shortgrass and midgrass prairies over most of the Great Plains. The swift fox will also use agricultural lands and irrigated meadows. Its range includes most of ND, SD, and NE but not eastern KS and OK or MO and IL.	X	X	X				
Raccoon *Procyon lotor*	furbearer	Found in a variety of habitats but prefers riparian and edges of wetlands, ponds, and lakes.	X	X	X	X	X	X	X
Ermine *Mustela erminea*	furbearer	Inhabits agricultural lowlands, woodlands, and meadows. Range within project area includes only eastern ND.	X						
Long-tailed weasel *Mustela frenata*	furbearer	This is the most widespread weasel. It is found in all habitats within the project area but prefers brushland, open woodlands, and habitats near water.	X	X	X	X	X	X	X
Least weasel *Mustela nivalis*	furbearer	Inhabits cultivated fields, brushy areas, open woods, wetland edges, and meadows.	X	X	X				
Mink *Mustela vison*	furbearer	Wetlands; riparian woodlands; edges of lakes, rivers, and ponds.	X	X	X	X	X	X	X
Striped skunk *Mephitis mephitis*	furbearer	This species prefers semi-open country with woodland and meadows interspersed, brushy areas, bottomland woods. Frequently found in suburban areas. Dens often under rocks, log, or building. May excavate burrow or use burrow abandoned by other mammal.	X	X	X	X	X	X	X
Eastern spotted skunk *Spilogale putorius*	furbearer	Found in forested areas or habitats with significant cover. Also open and brushy areas, rocky canyons and outcrops in woodlands and prairies. When inactive or bearing young, occupies den in burrow abandoned by other mammal, under brushpile, in hollow log or tree, in rock crevice, under building, or in similar protected site.	X	X	X	X	X		X
American badger *Taxidea taxus*	furbearer	This species prefers open grasslands and fields and may also frequent brushlands with little groundcover. When inactive, occupies underground burrow.	X	X	X	X	X	X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area[1]

Species	Sporting Status	Habitat Association	ND	SD	NE	KS	MO	IL	OK
Bobcat *Felis rufus*	furbearer	Found in woodlands, brushlands, and wooded swampy areas. Range includes ND, NE, KS, and OK but not project area portions of SD, MO, or IL.	X		X	X			X
American beaver *Castor canadensis*	furbearer	Beavers inhabit permanent sources of water of almost any type in their range, which extends from arctic North America to the Gulf of Mexico and arid Southwest, and from sea level to over 6,800 feet in the mountains. They prefer low gradient streams (which they modify), ponds, and small mud-bottomed lakes with dammable outlets. Beavers are associated with deciduous tree and shrub communities.	X	X	X	X	X	X	X
Birds									
Dark Geese: **Canada goose** *Branta canadensis* **White-fronted goose** *Anser albifrons* **Brant** *Branta bernicla*	game	Found in various habitats near water, from temperate regions to tundra. Breed and feed in areas usually near lakes, ponds, large streams, inland and coastal marshes. Forage in pastures, cultivated lands, grasslands, and flooded fields. All but Canada goose present in project area only during migration.	X	X	X	X	X	X	X
Light Geese: **Snow goose** *Chen caerulescens* **Ross' goose** *Chen rossii*	game	Found in various habitats near water, from temperate regions to tundra. Winters in both freshwater and coastal wetlands, wet prairies and extensive sandbars, foraging also in pastures, cultivated lands and flooded fields. Present in project area only during migration.	X	X	X	X	X	X	X
Tundra swan *Cygnus columbianus*	game	Generally found in lakes, sloughs, rivers, sometimes fields, in migration. Open marshy lakes and ponds and sluggish streams in summer. Present in project area only during migration. Considered a game animal only in ND and SD.	X	X	X	X	X	X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area[1]

Species	Sporting Status	Habitat Association	ND	SD	NE	KS	MO	IL	OK
Sandhill crane *Grus canadensis*	game	In n-breeding habitats this species roosts at night along river channels, on alluvial islands of braided rivers, or natural basin wetlands. A communal roost site consisting of an open expanse of shallow water is a key feature of wintering habitat. Considered a game species only in ND, SD, and OK.	X	X	X	X			X
Dabbling ducks: includes a number of species such as mallard and teal	game	Primarily found in shallow waters such as ponds, lakes, marshes, and flooded fields; in migration and in winter mostly in fresh water and cultivated fields, less commonly in brackish situations.	X	X	X	X	X	X	X
Diving ducks: Includes a number of species such as canvasback and redhead	game	Commonly found on marshes, ponds, lakes, rivers and bays.	X	X	X	X	X	X	X
Mergansers and Coot	game	Commonly found on marshes, ponds, lakes, rivers and bays.	X	X	X	X	X	X	X
Woodcock *Scolopax mir* **Snipe** *Gallinago gallinago*	game	Wetlands, marshes, moist woodlands and thickets.	X	X	X	X	X	X	X
Mourning dove *Zenaida macrora*	game	Inhabits open woodland, forest edge, cultivated lands with scattered trees and bushes, arid, and desert country.	X	X	X	X	X	X	X
Ring-necked pheasant *Phasianus colchicus*	game	Non-native game bird. Inhabits open country (especially cultivated areas, scrubby wastes, open woodland and edges of woods), grassy steppe, desert oases, riverside thickets, swamps and open mountain forest. Winter shelter includes bushes and trees along streams, shelterbelts, and fencerows. Usually nests in fields, brushy edges, or pastures, also along road ROWs. Nest is shallow depression scratched out by female.	X	X	X	X	X	X	X

Table 3.7-1 Game and Furbearer Wildlife Species Potentially Occurring Within the Project Area[1]

Species	Sporting Status	Habitat Association	ND	SD	NE	KS	MO	IL	OK
Wild turkey *Meleagris gallopavo*	game	Found in forest and open woodland, scrub oak, deciduous or mixed deciduous-coniferous areas. Also agricultural areas in some regions, which may provide important food resources in winter. Roosts in trees at night. Nests normally on the ground, usually in open areas at the edge of woods.	X	X	X	X	X	X	X
Greater prairie chicken *Tympanus cupido*	game	Inhabits tall grassland prairies and occasionally croplands. Nests in grasslands, prairies, pastures, and hayfields. Within the project area present only in ND, KS, OK, and possibly in MO.	X			X			X
Sharp-tailed grouse *Tympanuchus phasianellus*	game	Inhabits short to tall grasslands intermixed with cropland and shrublands.	X	X	X				
Northern bobwhite *Colinus virginianus*	game	Inhabits a wide variety of vegetation types, particularly early successional stages. Occurs in croplands, grasslands, pastures, fallow fields, grass-brush rangelands, open pinelands, open mixed pine-hardwood forests, and habitat mosaics. In the Midwest and Northeast, associated principally with heterogeneous, patchy landscapes comprised of moderate amounts of row crops and grasslands and abundant woody edge. Nests on the ground, in a scrape lined with grasses and/or other dead vegetation.		X	X	X	X	X	X
Gray partridge (Hun) *Perdix perdix*	game	Non-native game bird. Inhabits cultivated land, hedgerows, brushy pastures, and meadows.	X	X	X				
Ruffed grouse *Bonasa umbellus*	game	Inhabits mixed and deciduous woodlands. Not common in project area but occurs in isolated areas of ND and SD.	X	X					

[1]Listing and habitat descriptions based on Chapman and Feldhamer 1982; Burt and Grossenheider 1980; Terres 1980; National Geographic Society 1987; and Ehrlich et al. 1988.

Mule deer and pronghorn inhabit primarily the western portions of North Dakota, South Dakota, and Nebraska, although small isolated populations of pronghorn extend into eastern South Dakota. Neither species is likely to occur along the proposed route. Elk have been extirpated from the Great Plains but small populations have been reintroduced into small, isolated wildlife areas. The northeast corner of North Dakota is the only area along the proposed route where elk may be present. Moose could occur along the proposed route only in the northeast portion of North Dakota, while black bear only will be found along the proposed route near the eastern Missouri border (Wild Mammals of North America 1982).

3.7.1.2 Small Game Species

Small game species that could occur along the proposed route and possible alternatives include upland gamebirds, waterfowl, furbearers, and small mammals. Specific species could include mourning dove, northern bobwhite, ring-necked pheasant, greater prairie chicken, sharp-tailed grouse, ruffed grouse, gray partridge, wild turkey, eastern fox squirrel, eastern gray squirrel, red squirrel, eastern cottontail, sandhill crane, and a number of migratory waterfowl. Furbearers include beaver, bobcat, red fox, gray fox, swift fox, raccoon, badger, ermine, least weasel, long-tailed weasel, and mink. Habitat preferences and distribution of small game and furbearer species occurring along or in the region of the proposed route are summarized in **Table 3.7-1.**

Greater prairie chicken is a native small game species with the greatest population viability concern in the vicinity of the proposed route. Populations of other small game species are relatively stable within the proposed route region. Greater prairie chicken is listed as endangered by the State of Missouri and hunting of this species is not permitted in the state. It remains a legally hunted bird in all of the other states crossed by the proposed route; however, it is a species of management concern in those areas. Greater prairie chickens occur in association with tall grass prairie habitats and their populations in the Northern Great Plains have been severely reduced by conversion of tall grass prairie to croplands. Populations in the region of the proposed route are now restricted to small remnant areas of tall grass prairie primarily in eastern North Dakota, central South Dakota and Nebraska, eastern Kansas, and northern Missouri and Oklahoma. The proposed route crosses known occupied ranges of this species in North Dakota, South Dakota, Kansas, Oklahoma, and possibly Missouri.

3.7.1.3 Nongame Species

The proposed route traverses various regions which are inhabited by a diversity of nongame species (e.g., small mammals, raptors, songbirds, amphibian, and reptiles). Nongame mammals include shrews, bats, squirrels, prairie dogs, pocket gophers, pocket mice, voles, and, mice. These small mammals provide an important prey base for the region's predators including, coyote, badger, skunk, raptors (eagles, buteos, accipiters, owls), and snakes.

Nongame birds include a variety of songbirds and raptor species, most being species associated with open, grassland habitat, although woodland species also are represented along woodland riparian corridors as well as in upland, deciduous woodlands which become more prevalent near the southeastern end of the proposed route in Missouri. Raptors likely to be present in open habitats include turkey vulture, burrowing owl, golden eagle, red-tailed hawk, Swainson's hawk, northern harrier, American kestrel, short-eared owl, and great horned owl. Woodland associated raptor species likely to be present include sharp-shinned hawk, Cooper's hawk, broad-winged hawk, long-eared owl, and eastern screech owl. Most of these species, including the open-country raptors, require some type of tree or tree cavity for a nest site. Northern harrier and short-eared owl are the only ground nesters.

The majority of the songbirds inhabiting the region, particularly in woodland areas, are neotropical migrants. These are birds that breed in North America but winter in the neotropical region of Central and South America. Examples of neotropical migrants that potentially could occur in the area of the proposed route include lark bunting, kingbird, and various vireos and warbler species. Eastern kingbird, American crow, western and eastern meadowlark, horned lark, and sparrows are common open-country inhabitants, while woodpeckers, blue jay, chickadees, wrens, vireos, warblers, and cardinal are typical summer or year-long residents of shrublands and woodlands.

Aerial raptor surveys were conducted between April 26 and May 2, 2006, to identify active and inactive nest sites along the project ROW. Raptor surveys were not surveyed from MP 0 to MP 34 due to poor weather conditions. In addition, raptor surveys were not conducted from MP 580, east to the project terminus in eastern Illinois, or along the Cushing Extension in Kansas and Oklahoma.

A total of 165 nests or breeding territories were documented within 0.25 mile of the project ROW. Of these 165 nest sites, 116 were determined to be active by raptor species including 85 red-tailed hawk nests, 16 great-horned owl nests, seven Swainson hawk nests, two American kestrel nests, two bald eagle nests, and four occupied nests of unknown species.

3.7.2 Aquatic Resources

Aquatic biology resources are defined in this study as fish and invertebrate communities that inhabit perennial streams and pond/lake environments. The description of aquatic communities focuses on important fisheries, which are defined as species with recreational or commercial value or threatened, endangered, or sensitive status (i.e., special status). This section of the document describes recreationally or commercially important fisheries that occur at or immediately downstream of the proposed crossings. Special status aquatic species are discussed in Section 3.7.3. The study area for aquatic resources includes the perennial streams, rivers, and ponds/lakes that will be crossed by the proposed pipeline route. Other waterbodies are included if they are located within approximately 0.5 mile of the proposed crossing and support recreationally or commercially important game fish or special status aquatic species.

KEYSTONE MAINLINE

Invertebrate communities that occur in waterbodies along the proposed route include a mixture of worms, immature and adult insect groups, clams and mussels, and numerous other groups. The composition can vary depending on flowing or standing water and other physical characteristics of the waterbody. Invertebrates serve important roles in the aquatic environment through their food web dynamics. They represent important food sources for fish and also are used as indicators of water quality conditions. For the purpose of describing aquatic resources, it is assumed that invertebrates are present in all project area waterbodies.

Over 20 recreationally important fish species or groups occur in waterbodies crossed by the proposed Keystone Mainline route (**Table 3.7-2**). These include shovelnose sturgeon, paddlefish, bass, sunfish, walleye, Northern pike, catfish, and perch. The following information describes game and commercial fish species occurrence, fishery classifications, and characteristics of fishery management in each of the states traversed by the proposed Keystone Mainline route. Sources of fish occurrence information are identified at the end of **Table 3.7-2**. Fishery classification definitions are provided in **Table 3.7-3**. General spawning periods for the primary game and commercial fish species are identified in **Table 3.7-4**. Waterbodies crossed by the Cushing Extension are discussed separately at the end of this section.

North Dakota

The North Dakota portion of the proposed route will cross four perennial streams and numerous unnamed ponds. Two of these streams (Pembina and Sheyenne Rivers) are considered Class I or IA waters that support suitable habitat for warmwater fisheries. The Tongue and Middle Branch Forest rivers (Class II) provide limited fish habitat due to an abundance of intermittent flows within the drainages. The Sheyenne River supports the most diverse composition of game fish species with nine species or groups. The other waterbodies contain two to four game fish species. Northern pike, yellow perch, and bass species represent the primary species in terms of management or game fish harvests. The only known recent stocking effort in

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Keystone Pipeline Project

State/Waterbody	County	Fishery Class[1]	Number of Crossings
KEYSTONE MAINLINE			
NORTH DAKOTA			
Pembina River	Pembina	Class I	1
Tongue River	Pembina	Class II	1
Middle Branch Forest River	Walsh	Class II	1
Sheyenne River	Ransom	Class IA	1
SOUTH DAKOTA			
Amsden Lake and unnamed tributary	Day	None	1
Mud Creek	Day	None	1
Foster Creek	Day	None	1
Wolf Creek	Hutchinson/ Hanson	WW Marginal	1
James River	Yankton	WW Semipermanent	1
Beaver Creek	Yankton	WW Marginal	1
Missouri River	Yankton	WW Permanent	1
NEBRASKA			
Missouri River	Cedar	WW Class A	1
Antelope Creek	Cedar	WW Class B	1
West Bow Creek	Cedar	WW Class B	1
Norwegian Bow Creek	Cedar	WW Class B	1
Bow Creek	Cedar	WW Class B	1
Middle Logan Creek	Cedar	WW Class B	1
Elkhorn River	Stanton	WW Class A	1
Union Creek	Stanton	WW Class B	
Shell Creek	Colfax	WW Class A	1
Lost Creek	Colfax	WW Class B	1
Platte River	Colfax	WW Class A	1
Unnamed tributary to Platte River	Colfax	WW Class B	2
Deer Creek	Butler	WW Class B	1
Unnamed Pond	Butler	None	1
Unnamed Pond	Seward	None	1
Big Blue River	Seward	WW Class B	1
Lincoln Creek	Seward	WW Class B	1
Crooked Creek	Seward	WW Class B	1
West Fork Big Blue River	Saline	WW Class A	1
Turkey Creek	Saline	WW Class A	1
Swan Creek	Saline	WW Class A	1
Cub Creek	Jefferson	WW Class A	1
Cole Creek	Jefferson	WW Class B	1
Unnamed tributary to Cole Creek	Jefferson	None	1
KANSAS			
Indian Creek	Marshall	Expected Use	1
Deer Creek	Marshall	Expected Use	1
Big Blue River	Marshall	Expected Use	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Keystone Pipeline Project

State/Waterbody	County	Fishery Class[1]	Number of Crossings
North Elm Creek	Marshall	Expected Use	2
Unnamed tributary to North Elm Creek	Marshall	None	2
Unnamed tributary to North Elm Creek	Marshall	None	4
Robidoux Creek	Marshall	Expected Use	1
Negro Creek	Nemaha	Expected Use	1
North Fork Wildcat Creek	Nemaha	Unknown	1
Wildcat Creek	Nemaha	Expected Use	1
South Fork Nemaha River	Nemaha	Special Use	1
Unnamed tributary to Harris Creek	Nemaha	Unknown	1
Harris River	Nemaha	Expected Use	2
Unnamed tributary to Harris Creek	Nemaha	Unknown	1
Craig Creek	Nemaha	Unknown	1
Delaware River	Brown	Expected Use	1
Unnamed tributary to Delaware River	Brown		2
Walnut Creek	Brown	Expected Use	1
Wolf River	Brown	Expected Use	1
Middle Fork Wolf River	Brown	Expected Use	1
Buttermilk Creek	Brown	Expected Use	1
South Fork Wolf River	Brown	Expected Use	1
Squaw Creek	Brown	Expected Use	1
Halling Creek	Doniphan	Expected Use	1
Three unnamed tributaries to N. Branch Independence Creek	Doniphan	Unknown	1 each
Two unnamed tributaries to Jordan Creek	Doniphan	Expected Use	1 and 2
Jordan Creek	Doniphan	Expected Use	1
Rock Creek	Doniphan	Expected Use	1
Unnamed tributary to Missouri River	Doniphan	Expected Use	1
Missouri River	Buchanan	Special Use	1
MISSOURI			
Missouri River	Buchanan	WW	1
Contrary Creek	Buchanan	WW	1
Unnamed tributary to Little Platte River	Buchanan	WW	3
Pigeon Creek	Buchanan	WW	3
Platte River	Buchanan	WW	1
Three unnamed tributaries to Platte River	Buchanan	WW	1 each
Malden Creek	Buchanan	WW	1
Wolfpen Creek	Clinton	WW	1
Jenkins Branch	Clinton	WW	1
Castile Creek	Clinton	WW	1
Horse Fork Creek	Clinton	WW	1
Little Platte River	Clinton	WW	1
Unnamed tributary to Little Platte River	Clinton	WW	2
Shoal Creek	Clinton	WW	1
Little Shoal Creek	Clinton	WW	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Keystone Pipeline Project

State/Waterbody	County	Fishery Class[1]	Number of Crossings
Deer Creek	Clinton	WW	1
Plum Creek	Clinton	WW	1
Unnamed tributary to Plum Creek	Caldwell	WW	1
Log Creek	Caldwell	WW	2
Unnamed tributary to Log Creek	Caldwell	WW	2
Long Creek	Caldwell	WW	1
Unnamed tributary to Long Creek	Caldwell	WW	2
Brush Creek and unnamed tributary	Caldwell	WW	1 each
Crabapple Creek	Caldwell	WW	1
Unnamed tributaries to Mud Creek	Caldwell	WW	8
Mud Creek	Caldwell	WW	1
Willow Creek	Caldwell	WW	1
Turkey Creek	Caldwell	WW	1
Big Creek	Caldwell	WW	1
Unnamed tributaries to Big Creek	Carroll	WW	10
Wolf Branch Creek	Carroll	WW	1
Grand River	Carroll/Chariton	WW	1
Unnamed Slough	Chariton	WW	1
Salt Creek	Chariton	WW	1
Lake Creek	Chariton	WW	1
Palmer Creek	Chariton	WW	1
Unnamed tributaries	Chariton	WW	2
Mussel Fork Creek	Chariton	WW	1
Long Creek	Chariton	WW	1
Chariton River	Chariton	WW	1
Puzzle Creek	Chariton	WW	1
Middle Fork Little Chariton River	Chariton	WW	1
East Fork Little Chariton River	Chariton	WW	1
Unnamed tributary	Rand	WW	2
Unnamed lake	Rand	None	1
Unnamed ponds	Rand	None	2
Big Creek	Randolph	WW	1
Saline Creek	Audrain	WW	1
Long Branch Creek	Audrain	WW	1
Goodwater Creek	Audrain	WW	1
Youngs Creek	Audrain	WW	1
Skull Lick Creek	Audrain	WW	1
Salt Creek	Audrain	WW	1
South Fork Salt River	Audrain	WW	1
Bean Branch Creek	Audrain	WW	1
Unnamed tributary to Bean Branch Creek	Audrain	WW2	1
Littleby Creek	Audrain	WW	1
West Fork Cuivre River	Audrain	WW	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Keystone Pipeline Project

State/Waterbody	County	Fishery Class[1]	Number of Crossings
Unnamed tributary to West Fork Cuivre River	Audrain	WW2	1
Coon Creek	Montgomery	WW	1
Elkhorn Creek	Montgomery	WW	1
Brush Creek	Montgomery	WW	1
Bear Creek	Montgomery	WW	1
Camp Creek	Lincoln	WW	1
Cuivre River	Lincoln	WW	2
Turkey Creek	Lincoln	WW	
Sugar Creek	Lincoln	WW	
Unnamed tributary to Glassy Lake	St. Charles	WW	2
Peruque Creek	St. Charles	WW	1
Belleau Creek	St. Charles	WW	2
Dardenne Creek	St. Charles	WW	1
Mississippi River	St. Charles	WW	1
ILLINOIS			
Mississippi River	Madison	Fully Supporting	2
Indian Creek	Madison	Partially Supporting	1
Cahokia Canal	Madison	Fully Supporting or Not Assessed	3
Mooney Creek	Madison	Not Assessed	1
Unnamed tributaries to Sugar Creek	Madison	Partially Supporting	3
Silver Creek	Madison	Partially Supporting	1
Sugar Fork	Madison	Partially Supporting	4
Sand Creek	Madison	Not Assessed	1
Silver Lake	Madison	Not Assessed	1
Unnamed tributary to Shoal Creek	Fayette	Not Assessed	3
Shoal Creek	Fayette	Fully Supporting or Partially Supporting	1
Beaver Creek	Fayette	Not Assessed	1
Tributary to Little Beaver Creek	Fayette	Not Assessed	4
Little Beaver Creek	Fayette	Not Assessed	1
Spring Branch	Fayette	Unknown	1
Hurricane Creek	Bond	Not Assessed	1
Kaskaskia River	Bond	Fully Supporting or Partially Supporting	1
CUSHING EXTENSION			
KANSAS			
Coon Creek	Washington	Expected	1
Carter Creek	Clay	Expected	1
West Fancy Creek	Clay	Expected	1
Lincoln Creek	Clay	Expected	1
Republican River	Clay	Special	1
Chapman Creek	Dickinson	Expected	1
Smokey Hill River	Dickinson	Expected	1

Table 3.7-2 Game Fisheries in Waterbodies Crossed or Downstream of the Proposed Keystone Pipeline Project

State/Waterbody	County	Fishery Class[1]	Number of Crossings
Carry Creek	Dickinson	Special	1
West Branch Lyon Creek	Dickinson	Special	1
Mud Creek	Marion	Special	1
Cottonwood River	Marion	Expected	1
Spring Branch	Marion	None	1
Catlin Creek	Marion	Special	1
Doyle Creek	Marion	Expected	1
East Branch Whitewater River	Butler	Expected	1
Diamond Creek	Butler	None	1
Brush Creek	Butler	None	1
Fourmile Creek	Butler	Expected	1
Rock Creek	Butler	Expected	1
Spring Branch	Butler	Expected	1
Whitewater River	Butler	Expected	1
Badger Creek	Butler	Expected	1
Dry Creek	Butler	Expected	1
Fourmile Creek	Butler	Expected	1
Eightmile Creek	Butler	Expected	1
Polecat Creek	Cowley	Expected	1
Stewart Creek	Cowley	Expected	1
Crooked Creek	Cowley	Expected	1
Spring Creek	Cowley	Expected	1
Arkansas River	Cowley	Special	1
OKLAHOMA			
Bois d' Arc Creek	Kay	WW Aquatic Life	8
Salt Fork Arkansas River Creek	Kay	WW Aquatic Life	1
Red Rock Creek	Noble	WW Aquatic Life	1
Black Bear Creek	Noble	WW Aquatic Life	1
Cimarron River	Payne	WW Aquatic Life	1

[1]Fishery classifications, as part of surface water classifications, are defined in Table 3.7-3.

Sources for fish occurrence: Bayless and Travnichek (2001); Berry et al. (2004); Cashatt and Neuswanger (2002); Dames and Todd (2004); Illinois Department of Natural Resources (2005); Kansas Department of Wildlife and Parks (2006); Missouri Department of Conservation 2005; Pitchford and Kems (2005); North Dakota Department of Health (2005); SDGFD (2005); Nebraska Department of Environmental Quality (2005); Illinois Department of Natural Resources (2005); Stark (2006b); and Weirich (2002); Parham (2006).

Table 3.7-3 Surface Water Classification

State	Classification	Definition
North Dakota	I	Quality of waters shall be suitable for propagation and/or protection of resident fish species and other aquatic biota.
	IA	Same as Class I except that treatment for municipal use.
	II	Same quality as Class I except that additional treatment may be required for drinking water requirements. Streams may be intermittent which makes these waters limited for fish life.
	III	Streams have low average flows or no flows. Waters are of limited seasonal value for fish and aquatic biota.
South Dakota	WW Permanent	Warmwater permanent fish life propagation waters.
	WW Semipermanent	Warmwater semipermanent fish life propagation waters.
	WW Marginal	Warmwater marginal fish life propagation waters.
Nebraska	Class A - Warmwater	Waters provide, or could provide, a habitat suitable for maintaining one or more identified key species on a year-round basis. Waters also are capable of maintaining year-round populations of a variety of other warmwater fish and associated vertebrate and invertebrate organisms and plants.
	Class B - Warmwater	Waters where the variety of warmwater biota is presently limited by water volume or flow, water quality (natural or irretrievable human-induced conditions), substrate composition, or other habitat conditions. These waters are only capable of maintaining year-round populations of tolerant warmwater fish and associated vertebrate and invertebrate organisms and plants. Key species may be supported on a seasonal or intermittent basis (e.g., during high flows) but year-round populations cannot be maintained.
Kansas	Special Aquatic Life Use (S)	Surface waters that contain unique habitats or biota that are not commonly found in the state. Surface waters that contain populations of threatened or endangered species will be designated as special aquatic life use waters. Kansas Department of Wildlife and Parks and the USFWS have been consulted in order to determine the presence of threatened and endangered species.
	Expected Aquatic Life Use (E)	Surface waters that contain habitats or biota found commonly in the state.
	Restricted Aquatic Life Use (R)	Surface waters that contain biota in a limited abundance or diversity due to the physical quality or availability of habitat compared to more productive habitats in adjacent waters.

Table 3.7-3 Surface Water Classification

State	Classification	Definition
Missouri	WW Aquatic Life	General warmwater fishery in waters that provide naturally occurring water quality and habitat conditions to allow maintenance of aquatic biota including recreationally important species.
	WW Limited Aquatic Life	Limited warmwater fishery in waters with naturally occurring water quality and habitat conditions that prevent maintenance of aquatic biota including recreationally important species.
Illinois	Fully Supporting (F)	The waterbody attains the designated aquatic life use, and is considered to have "good" resource quality.
	Partially Supporting (P)	The waterbody attains the designated use at a reduced level and is considered to have "fair" resource quality.
	Not Assessed (X)	The waterbody has not been assessed.
Oklahoma	WW Aquatic Life	The waterbody is able to support warmwater aquatic communities.

Table 3.7-4 Game and Commercial Fish Spawning Periods and Habitat

Species or Group[1]	J	F	M	A	M	J	J	A	S	O	N	D	Habitat
	Months[2]												
Burbot	X	X	X									X	Eggs are scattered over sand or gravel substrates.
Basses					X	X							Shallow areas over clean gravel and sand bottoms.
Brown bullhead				X	X								Spawn in shallow areas by building nests in mud substrate.
Bullheads (yellow and black)					X	X							Usually spawn in weedy or muddy shallow areas by building nests.
Buffalos				X	X	X							Spawn at depths of four to 10 feet over gravel or sand substrates.
Carp				X	X	X							Adhesive eggs scattered in shallow water over vegetation, debris, logs, or rocks.
Catfishes (flathead and blue)						X	X						Nest builders with habitat similar to channel catfish.
Channel catfish					X	X	X						Prefers areas with structure such as rock ledges, undercut banks, logs, or other structure where it builds nests.
Crappies					X	X							Eggs deposited in depressions on bottom in cove or embayments.
Freshwater drum					X	X							Buoyant eggs drift in river currents during development.
Muskellunge					X	X							Spawn in tributary streams and shallow lake channels.
Northern pike					X	X							Small streams or margins of lakes over submerged vegetation.
Paddlefish				X	X								Moves into rivers and spawns over flooded gravel bars.
Sauger				X	X								Moves into tributary streams or backwaters where they spawn over rock substrates.
Shovelnose sturgeon					X	X							Spawning occurs in open water channels of large rivers over rocky or gravelly bottoms.
Sunfishes					X	X	X	X					Nest builders in diverse substrates and shallow depths.
Walleye				X	X								Spawn in lakes and streams in shallow water over rock substrates.
White bass				X	X	X							Egg masses deposited over sand bars, submerged vegetation, or other instream debris.
Yellow perch				X	X	X							Shallow open water over weedy areas.

[1]Rainbow trout is not included because the species does not spawn in streams crossed by the pipeline route.

[2]Spawning periods are approximate and could occur in only a portion of a particular month.

Sources: Eddy and Underhill (1974); Harlan et al. (1987); and Pflieger (1975).

these waters includes northern pike in the Sheyenne River in 2005 (North Dakota Game and Fish Department [NDGFD] 2005). No information is available on possible fish occurrence in Crow Lake or the numerous small ponds located within the proposed route.

South Dakota

Four perennial streams and one lake (Amsden) are located within the South Dakota portion of the proposed pipeline route. The Missouri River is the largest waterbody and is classified as a warmwater permanent fishery. Of the other streams that have been classified, habitat is considered more limited as indicated by a warmwater semi-permanent (James River) or warmwater marginal (Wolf and Beaver Creeks) classification. However, the proposed crossing areas for Wolf Creek and the James River show flow levels that appeared to be perennial in nature. The Missouri River contains the most diverse list of game fish with 19 species or groups, while the James River contains five game species. The Missouri River is approximately 2,000 feet wide at the crossing with deep water habitat and two channels adjacent to an island. The other smaller streams support two to six game fish species. The most popular game fish species include catfish, northern pike, and bass species. State record catfish have been caught in the Missouri and James River. The only known stocking efforts in these waterbodies consist of paddlefish in the Missouri River (SDGFP 2003). This indicates that game fish populations are sustained by natural reproduction. No information is available on possible fish occurrence in Amsden Lake or the numerous small ponds located within the proposed route.

Nebraska

Of the 22 perennial streams crossed in the Nebraska portion of the proposed route, eight are considered Class A warmwater fisheries that support one or more key species on a year-round basis (**Table 3.7-2**). Thirteen of the other 14 streams are Class B warmwater fisheries that support key species on a seasonal or intermittent basis. The highest number of game fish species occurs in the Missouri River with 19 species or groups. Habitat at the Missouri River crossing is described above for the South Dakota segment. The primary game fish species in the Missouri River include catfishes, yellow perch, sauger, walleye, northern pike, and basses. The other streams contain one to five game fish species, with primary game fish species consisting of catfishes, bass, or sunfishes. Forage fish species in the Platte River also are considered an important food source for the interior least tern, a federally listed bird species. Channels at the Missouri and Platte River crossings are the widest (approximately 1,500 feet each) but the wetted width usually is considerably less in the Platte River where braided, meandering channels shift in response to flows and sand bottoms. Widths at the other crossings vary from less than 20 feet to approximately 400 feet. The most diverse types of fish habitat are present in the Elkhorn River, Shell Creek, and the West Fork Big Blue River and its tributaries, where a mixture of pools, riffles, and runs with riparian vegetation along the channel. Two unnamed ponds also are located within the pipeline ROW, but no information is available on possible fish presence.

Kansas

The Kansas portion of the proposed route crosses 33 perennial streams, most of which are classified as warmwater fisheries with "expected use" for common species in the state. Two streams, the South Fork Nemaha River and Missouri River, are classified as "special use" waters due to the presence of special status species (see Section 3.7.3). Based on available fish occurrence information, all of the streams contain at least four game fish species or species groups. The number of game fish species in these streams ranges from one to 18 species or groups, with the highest number occurring in the Missouri River. The Missouri River supports both warmwater game and commercial fish species (catfishes, buffalofishes, carp, freshwater drum, and shovelnose sturgeon) (Pflieger 1975). Channel catfish and flathead catfish are the primary species in the Big Blue River, Robidoux Creek, Delaware River, and Missouri River. Walleye also are important in the Middle Fork Wolf River.

Missouri

Approximately 113 perennial streams and four unnamed perennial lakes or ponds are crossed by the Missouri portion of the proposed route. Stream classifications for these streams do not distinguish differences in habitat quality, as they all are considered warmwater fisheries. The larger streams crossed in Missouri include the Missouri River, Platte River, Grand River, Chariton River, Cuivre River, and the Mississippi River. The other smaller streams are tributaries of these drainages. The highest number of game fish species occurs in the Mississippi and Missouri Rivers with 17 and 18, respectively, followed by the Grand River with 12. The other rivers and streams contain one to nine game fish species or groups (e.g., sunfishes). The most popular game fish species include catfishes, walleye, sauger, largemouth bass, and white bass. In addition, the pipeline route crosses the Jentell Brees Access in Buchanan County, which was developed with Sport Fish Restoration federal monies.

The Missouri and Mississippi River crossings also contain commercial fish species. Channel catfish, blue catfish, flathead catfish, paddlefish, and shovelnose sturgeon are primary commercial species in both rivers. Freshwater drum, black buffalo, smallmouth buffalo, bigmouth buffalo, common carp, and carpsuckers also are commercially harvested in the Mississippi River. A commercial fishing permit is required for the shovelnose sturgeon.

The Missouri Department of Conservation has inventoried a number of the watersheds crossed by the proposed route. These studies provide information on habitat quality, as summarized below.

- Platte River – Habitat throughout the drainage has been degraded as a result of channelization and erosion. Exceptions include Castile Creek, which is considered an exceptional prairie stream due to relatively clear water and abundance of gravel substrates (Bayless and Travnichek 2001).
- Grand River – Although much of the Grand River Basin has been degraded through channelization and impoundments, some unique habitats still exist such as the upper 35 miles of the Grand River, Sugar Creek, Shoal Creek, and Crabapple Creek (Pitchford and Kerns 2005).
- Chariton River – Most of the Chariton River is channelized from Putnam County to its confluence with the Missouri River in Clariton County. Widespread channelization has led to unstable channels and most tributary streams have been impacted by head cuts originating in the mainstem portion of the river. No unique habitat is located at or downstream of the proposed crossing (Cashatt and Neuswanger 2002).
- Cuivre River – The lower reaches of the Cuivre River were substantially altered by channelization prior to 1927. No unique habitat is located at or downstream of the proposed crossing (Weirich 2002).
- Salt River – Relatively short channelized reaches are scattered throughout the basin especially in the lower portion. The most prevalent habitat problem is erosion, which is the result of agriculture land. No unique habitat is located at or downstream of the proposed crossing (Dames and Todd 2004).

Illinois

The Illinois portion of the proposed route crosses 36 perennial streams (including the Kaskaskia River) plus Silver Lake. The portion of the Kaskaskia River that is crossed by the proposed route is located in the headwaters of Carlyle Lake, which is a flooded impoundment. The stream classifications for Illinois are based on an assessment of aquatic biology and habitat parameters to determine if a stream is fully or partially supporting aquatic life. One stream, the Mississippi River, is considered to be fully supporting aquatic life. Two of the waterbodies, Shoal Creek and the Kaskaskia River, contain both fully and partially supporting segments at or downstream of the proposed pipeline crossings. The other streams that have been assessed are considered partially supporting aquatic life (**Table 3.7-3**). Index of Integrity (IBI) scores, which evaluate 10 aquatic biotic metrics, have been determined for some of the streams crossed by the pipeline route. Scores can range from 0 to 60, with values over 50 representing high quality streams (Smogor 2000). Mean IBI scores for project area streams were 32 for Silver Creek, 49 for Shoal Creek, 45 for Beaver Creek, and 54 for Cahokia Canal.

The most diverse fishery exists in the Mississippi River, based on the presence of 19 game fish species or groups and commercial species represented by three buffalo species, common carp, carpsuckers, and catfishes (see Missouri River discussion) (Illinois DNR 2005). Mussel harvests have occurred in the past, but the area has been closed due to concerns with the nuisance zebra mussel.

Recreational fisheries also occur in Cahokia Canal and Shoal and Silver Creeks, but fishing pressure is considerably lower than the Mississippi River. Catfishes are the primary game fish species in these streams. Sauger and bass also are present in Cahokia Canal.

CUSHING EXTENSION

The Cushing Extension will cross 48 perennial streams in Kansas and 10 perennial streams in Oklahoma. No perennial streams are crossed in the Nebraska portion of this route. The Kansas portion of the route will cross five larger rivers, the Little Blue, Republican, Smokey Hill, Whitewater, and Arkansas. The remaining streams are relatively small in terms of width. Stream classifications for the Kansas portion of the proposed route include six "special" waters (Republican River, Cary Creek, West Branch Lyon Creek, Mud Creek, Catlin Creek, and the Arkansas River), which contain unique habitat for aquatic species (**Tables 3.7-2** and **3.7-3**). The other Kansas streams are classified as "expected" (i.e., common aquatic species). Game fish species in the Kansas streams consist of a variety of warmwater species or groups (**Table 3.7-2**). The most diverse game fisheries exist in the larger streams listed above. Streams crossed by the Oklahoma portion of the proposed route are relatively small in size except for the Cimarron River. Those streams that have been classified are considered warmwater aquatic life (**Tables 3.7-2** and **3.7-3**).

3.7.3 Sensitive Terrestrial and Aquatic Wildlife Species

Coordination with state wildlife agencies (i.e., North Dakota Game and Fish Department [NDGFD], South Dakota Game, Fish, and Parks [SDGFP], Nebraska Game and Parks Commission [NGPC], Kansas Department of Wildlife and Parks [KDWP] Missouri Department of Conservation [MDC], Illinois Department of Natural Resources [IDNR]), and the USFWS was initiated in January 2006, in a project overview and information request letter. A similar letter was sent to Oklahoma Department of Wildlife Conservation in October 2006. A species list and occurrence data was obtained from state and federal agencies, state natural heritage programs, agency websites, and other applicable websites (e.g., NatureServe). State agency meetings were held in February and March of 2006. Following consideration of agency comments and compilation of available data, biological packages summarizing potential habitat for special status species and species of special concern were sent to state and federal agencies for their review and input in June 2006. Follow-up agency meetings were held in July and October 2006.

Based on the input from the USFWS as well as state agencies, work plans were developed for surveys in North Dakota, South Dakota, Nebraska, Kansas, Missouri, and Illinois. The work plans for each state include the species to be surveyed, locations (mileposts and maps), survey periods, and survey requirements. Proposed surveys are described for 2006, 2007, and pre-construction in 2008.

USFWS Consultation

The USFWS provided a draft project comment letter followed by a final project letter dated April 28, 2006. John Cochnar of the Nebraska, Grand Island USFWS Field Office was named as the USFWS project point of contact for the Keystone Project. A follow-up meeting with the USFWS was held on July 19, 2006.

On June 8, the USFWS provided a letter regarding several segments of the proposed pipeline route that cross USFWS grassland and wetland easements in North and South Dakota. The letter included maps and descriptions of potential reroute recommendations that would reduce the extent of wetland and grassland impacts. Proposed reroute areas included the Hecla Sandhills, Raymond Prairie Chicken Leks, Nelson and Steele County Wetlands, Miner County Grassland Easement, and Day County Grassland Easements. The USFWS indicated that crossing USFWS refuge lands and easements would require right-of-way permits, and that cultural resources surveys would be required across lands where the USFWS has purchased easement interests.

In response to the USFWS June 8 letter, a reroute proposal was developed and presented to the USFWS refuge staff in a meeting in Fargo on July 18. The results of the meeting were: 1) Keystone would further refine a route west of the Hecla Sandhills to avoid the grassland easements; 2) Keystone would further refine its route in Nelson and Steele County to reduce the number and extent of wetland crossings; 3) Keystone would refine its route to move the route onto farmlands away from the Day County Grasslands and Raymond Chicken Leks; and 4) Keystone would make a minor reroute to avoid the Miner County Grassland. On September 11, Keystone provided revised route maps for the entire segment in southern North Dakota and South Dakota to the USFWS for its review and comment. These reroutes are described in Section 2.4.1.4.

3.7.3.1 Terrestrial Species

Based upon data obtained from agency websites and agency contacts, a total of 69 terrestrial wildlife species (29 special status species and 40 species of special concern) were identified as potentially occurring within the project area. These species, their associated habitats, and their potential for occurrence along the proposed route are listed and summarized in Appendix G, Tables G-1 and G-2. Occurrence potential along the proposed route was evaluated for each species based on its habitat requirements and/or known distribution. Based on these evaluations, eight terrestrial species (five special status species and three species of special concern were eliminated from detailed analysis. Of the remaining 61 terrestrial species that are analyzed in detail, 24 are special status species and 37 are species of special concern. The habitat requirements of a majority of these species are satisfied by wetland, aquatic, woodland, or native prairie habitats. The potential occurrences of these species along each state segment of the proposed route are presented in **Table 3.7-5** and **Table 3.7-6.** A summary of sensitive species that could occur along the proposed route are provided below by state.

North Dakota

A total of five special status wildlife species (gray wolf, bald eagle, greater prairie chicken, whooping crane, and Dakota skipper) and four wildlife species of special concern (Sprague's pipit, Baird's sparrow, swamp sparrow, and northern prairie skink) potentially could occur within suitable habitat along the proposed route in North Dakota.

Based on correspondence and consultations with the NDGFD and the USFWS, respectively, species surveys would only be required for breeding and roosting bald eagles and the Dakota skipper. Keystone submitted documentation of agency coordination to the Department of State on September 15, 2006.

Surveys for nesting and roosting bald eagles would occur at all river crossings, if construction were to occur during the breeding and roosting periods.

Potential Dakota skipper habitat was identified during grassland surveys that were conducted in North Dakota and South Dakota from September 11 to September 16, 2006. A total of 1.2 miles of potential Dakota skipper habitat was identified at two locations in North Dakota (MP 203.6 to MP 203.9 and MP 204.1 to MP 205.0). Occurrence surveys for this species will occur in 2007.

Table 3.7-5 **Special Status Wildlife Species Potentially Occurring Within the Keystone Pipeline Project**

Species	Status	ND	SD	NE	KS	MO	IL	OK
Mammals								
Indiana bat *Myotis sodalis*	FE; MO-E; IL-E					X	X	
Gray wolf *Canis lupus*	FT; ND-SC	X						
Eastern spotted skunk *Spilogale putorius*	KS-T; SD-SC; MO-E		X		X	X		
River otter *Lontra canadensis*	NE-T; IL-E			X			X	
Birds								
Least bittern *Ixobrychus exilis*	MO-SC; IL-T					X	X	
Bald eagle *Haliaeetus leucocephalus*	FT; ND-SC; SD-T; NE-T; KS-T; MO-E; IL-T; OK-T	X	X	X	X	X	X	X
Greater prairie-chicken *Tympanuchus cupido*	MO-E; ND-SC	X				X		
King rail *Rallus elegans*	MO-E; NE-SC			X		X		
Whooping crane *Grus americana*	FE; ND-SC; SD-E; NE-E; OK-E; KS-E	X	X	X	X			X
Snowy plover *Charadrius alexandrinus*	KS-T				X			
Piping plover *Charadrius melodus*	FT; ND-SC; SD-T; NE-T; KS-T		X	X				X
Interior least tern *Sterna antillarum athalassos*	FE; SD-E; NE-E; MO-E; OK-E; KS-E		X	X				X
Barn owl *Tyto alba*	MO-E; IL-E					X	X	
Loggerhead shrike *Lanius ludovicianus*	MO-SC; IL-T	X				X	X	
Henslow's sparrow *Ammodramus henslowii*	KS-SC; MO-SC; IL-E				X	X	X	

Table 3.7-5 Special Status Wildlife Species Potentially Occurring Within the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Yellow-crowned night heron *Nyctanassa violacea*	IL-E						X	
Pied-billed grebe *Podilymbus podiceps*	IL-T						X	
Northern harrier *Cicus cyaneus*	MO-E					X		
Fish								
Chestnut lamprey *Ichthyomyzon castaneus*	KS-T				X			
Pallid sturgeon *Scaphirhynchus albus*	FE; SD-E; NE-E; KS-E; MO-E; IL-E		X	X	X	X	X	
Lake sturgeon *Acipenser fulvescens*	NE-T; MO-E; IL-E		X	X				
Flathead chub *Platygobio gracilis*	KS-T				X			
Silver chub *Macrhybopsis storeriana*	MO-SC KS-E				X	X		
Sturgeon chub *Macrhybopsis gelida*	NE-E; KS-T; MO-SC			X	X	X		
Sicklefin chub *Macrhybopsis meeki*	NE-T; KS-E ; MO-SC			X	X	X		
Western silvery minnow *Hybognathus argyritis*	NE-SC; KS-T; MO-SC				X	X		
Blacknose shiner *Notropis heterolepis*	ND-SC; NE-E; MO-SC	X		X	X			
Silverband shiner *Notropis shumardi*	KS-T							
Topeka shiner *Notropis topeka*	FE; SD-SC; KS-T; MO-E		X	X	X			
Northern redbelly dace *Chrosomus eos*	NE-T			X				
Finescale dace *Phoxinus neogaeus*				X				

Table 3.7-5 Special Status Wildlife Species Potentially Occurring Within the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Amphibians								
Illinois chorus frog *Pseudacris strecheri illino*	IL-T						X	
Reptiles								
Western fox snake *Elaphe vulpine vulpina*	MO-E					X		
Massasauga *Sistrurus catenatus spp.*	FC; MO-E; IL-E			X		X	X	
False map turtle *Graptemys pseudogeo-graphica*	SD-T		X					
Kirtland's snake *Clonophis kirtlandi*	IL-T						X	
Invertebrates								
Dakota skipper *Hesperia dacotae*	FC; SD-SC	X	X					
Spectaclecase *Cumberlandia monodonta*	FC; MO-SC					X		
Scaleshell mussel *Leptodea leptodon*	FE; SD-SC; NE-E		X	X				
Higgins' eye pearlymussel *Lampsilis higginsi*	FE; SD-SC		X				X	
Winged mapleleaf *Quadrula gragosa*	FE; SD-SC		X					
Plants								
Decurrent false aster *Boltonia decurrens*	FT; MO-E; IL-T					X	X	
Small white lady's-slipper *Cypripedium candidum*	NE-T			X				
Eastern prairie fringed orchid *Platanthera leucophaea*	FT; IL-E						X	
Western prairie fringed orchid *Platanthera praeclara*	FT; SD-SC; NE-T	X	X	X	X			X
Prairie bush-clover *Lespedeza leptostachya*	FT; IL-E						X	

Table 3.7-5 Special Status Wildlife Species Potentially Occurring Within the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Running buffalo clover *Trifolium stoloniferum*	FE; MO-E					X		
Royal Catchfly *Silene regia*	IL-E						X	
Prairie Spiderwort *Tradescantia bracteata*	IL-T						X	
Spring Ladies' Tresses *Spiranthes vernalis*	IL-E						X	

FE = Federally endangered.

FT = Federally threatened.

FC = Federal candidate.

ND-SC = North Dakota 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.

MO-E = Missouri endangered.

MO-SC = Missouri species of conservation concern.

IL-E = Illinois endangered.

IL-T = Illinois threatened.

OK-E = Oklahoma endangered.

OK-T = Oklahoma threatened.

Table 3.7-6 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Mammals								
Long-tailed weasel *Mustela frenata*	MO-SC					X		
Southern flying squirrel *Glaucomys volans*	KS-SC				X			
Southern bog lemming *Synaptomys cooperi*	KS-SC				X			
Birds								
Red-necked grebe *Podiceps grisegena*	SD-SC		X					
Pied-billed grebe *Podilymbus podiceps*	MO-SC					X		
American white pelican *Pelecanus erythrorhynchos*	SD-SC		X					
Great egret *Ardea alba*	MO-SC					X		
Cooper's hawk *Accipiter cooperii*	SD-SC MO-SC		X			X		
Red-shouldered hawk *Buteo lineatus*	MO-SC					X		
Broad-winged hawk *Buteo platypterus*	SD-SC		X					
Sora *Porzana carolina*	MO-SC					X		
Black tern *Chlidonias niger*	SD-SC; KS-SC		X					
Common tern *Sterne hirundo*	SD-SC		X					
Short-eared owl *Asio flammeus*	KS-SC; MO-SC				X	X		
Whip-poor-will *Caprimulgus vociferus*	KS-SC				X			

Table 3.7-6 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Sprague's pipit *Anthus spragueii*	ND-SC	X						
Cerulean warbler *Dendroica cerulea*	KS-SC				X			
Baird's sparrow *Ammodramus bairdii*	ND-SC	X						
Bobolink *Dolichonyx oryzivorus*	KS-SC				X			
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	MO-SC					X		
Swamp sparrow *Melospiza georgianan*	ND-SC	X						
Fish								
Hornyhead chub *Nocomis biguttatus*	ND-SC	X						
Spotted sucker *Minytrema melanops*	KS-SC				X			
Blue sucker *Cycleptus elongatus*	KS-SC; MO-SC				X	X		
Pugnose shiner *Notropis anogenus*	ND-SC	X						
River shiner *Notropis blennius*	KS-SC				X			
Ghost shiner *Notropis buchanani*	MO-SC					X		
Brassy minnow *Hybognathus hankinsoni*	KS-SC; MO-SC				X	X		
Plains minnow *Hybognathus placitus*	KS-SC				X	X		
Blacknose dace *Rhinichthys atratulus*	KS-SC				X			
Plains killifish *Fundulus zebrinus*	MO-SC					X		

Table 3.7-6 **Species of Special Concern Identified for the Keystone Pipeline Project**

Species	Status	ND	SD	NE	KS	MO	IL	OK
Western sand darter *Etheostoma clarum*	MO-SC					X		
American eel *Anguilla rostrata*	SD-SC		X					
Trout-perch *Percopsis omiscomaycus*	ND-SC	X						
Rosyface shiner *Notopis rubellus*	ND-SC	X						
Amphibians								
Great Plains toad *Bufo cognatus*	MO-SC					X		
Northern cricket frog *Acris crepitans*	SD-SC		X					
Northern crawfish frog *Rana areolata circulosa*	MO-SC					X		
Reptiles								
Blanding's turtle *Emydoidea blandingii*	SD-SC MO-SC		X			X		
Spiny softshell *Apalone spinifera*	SD-SC		X					
Smooth softshell *Apalone spinifera*	SD-SC		X					
Northern prairie skink *Eumeces septentrionalis*	ND-SC	X						
Eastern hognose snake *Heterodon platirhinos*	KS-SC				X			
Timber rattlesnake *Crotalus horridus*	KS-SC				X			
Ringneck snake *Diadophis punctatus*	SD-SC		X					
Fox snake *Elaphe vulpine*	SD-SC		X					

Table 3.7-6 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Invertebrates								
Ottoe skipper *Hesperia ottoe*	SD-SC		X					
Poweshelk skipperling *Oarisma poweshelk*	SD-SC		X					
Regal fritillary *Speyeria idalia*	MO-SC					X		
Prairie mound ant *Formica montana*	MO-SC					X		
Wallace's deepwater mayfly *Raptoheptagenia cruentata*	KS-SC				X			
Round hickorynut *Obovaria olivaria*	MO-SC					X		
Fat mucket mussel *Lampsilis siliquoidea*	KS-SC				X			
Creeper mussel *Strophitus undulates*	KS-SC				X			
Threeridge *Amblema plicata*	SD-SC		X					
Rock pocketbook *Arcidens confragosus*	SD-SC		X					
Plain pocketbook *Lampsilus cardium*	SD-SC		X					
Black sandshell *Ligumia recta*	SD-SC		X					
Yellow sandshell *Lampsilis teres*	SD-SC		X					
Mapleleaf *Quadrula quadrula*	SD-SC		X					
Deertoe *Truncilla truncata*	SD-SC		X					
Wabash pigtoe *Fusconaia flava*	SD-SC		X					

Table 3.7-6 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Hickorynut *Obovaria olivaria*	SD-SC		X					
Pimpleback *Quadrula pustulosa*	SD-SC		X					
Fawnsfoot *Truncilla doniciformis*	SD-SC		X					
Plants								
Indian rice grass *Achnatherum hymenoides*	KS-SC				X			
Wooley milkweed *Asclepias lanuginosa*	SD-SC		X					
Subarctic lady-fern *Athyrium filix-femina*	ND-SC	X						
Texas bergia *Bergia texana*	MO-SC					X		
Earlyleaf brome *Bromus latiglumis*	MO-SC					X		
Nottoway Valley brome *Bromus nottowayanus*	MO-SC					X		
Bellow-beaked sedge *Carex albicans var. australis*	MO-SC					X		
Bauxbaum's sedge *Carex Buxbaumii*	ND-SC	X						
Creseted sedge *Carex cristatella*	KS-SC				X			
Raven-foot sedge *Carex crus-corvi*	KS-SC				X			
Bristly-stalk sedge *Carex leptalea*	ND-SC	X						
Blue cohosh *Caulophyllum thalictroides*	ND-SC	X						
Coast sandbur *Cenchrus incertus*	KS-SC				X			

Table 3.7-6 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Lanceleaf coreopsis *Coreopsis lanceolata*	KS-SC				X			
American yellow lady's-slipper *Cypripedium parviflorum*	ND-SC	X						
Showy lady's-slipper *Cypripedium reginae*	ND-SC	X						
Spinulose woodfern *Dryopteris carthusiana*	ND-SC	X						
Crested woodfern *Dryopteris cristata*	ND-SC	X						
Walter's barnyard grass *Echinochloa walteri*	MO-SC					X		
Small spikerush *Eleocharis parvula*	ND-SC	X						
Green keeled cottongrass *Eriophorum viridi-carinatum*	ND-SC	X						
Spotted Joe-pye-weed *Eupatorium maculatum* var. *bruneri*	KS-SC				X			
Fringed gentian *Gentianopsis crinita*	ND-SC	X						
Plains frostweed *Helianthemum bicknellii*	ND-SC	X						
Greater Canadian St. John's wort *Hypericum majus*	KS-SC				X			
Narrow leaf morning glory *Ipomoea shumardiana*	KS-SC				X			
Butternut *Juglans cinerea*	MO-SC					X		
Star duckweed *Lemna trisulca*	MO-SC					X		
Loesel's twayblade *Liparis loeselii*	ND-SC	X						
Prairie loosestrife *Lysimachia quadriflora*	SD-SC		X					

Table 3.7-6 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Yellow false mallow *Malvastrum hispidum*	MO-SC					X		
Tender creeping-cucumber *Melothria pendula*	KS-SC				X			
Naked Bishop's cap *Mitella nuda*	ND-SC	X						
Adder's tongue *Ophioglossum vulgatum*	MO-SC					X		
Lanceolateleaf rock moss *Orthotrichum elegans*	MO-SC					X		
Pendant-pod point vetch *Oxytropis deflexa*	ND-SC	X						
Oklahoma phlox *Phlox oklahomensis*	KS-SC				X			
Heart-leaved plantain *Plantago cordata*	MO-SC					X		
Jacon's ladder *Polemonium reptans*	KS-SC				X			
Prickly gooseberry *Ribes cynosbati*	ND-SC	X						
Prairie Willow *Salix humilis*	SD-SC		X					
Rocky Mountain bulrush *Schoenoplectus saximontanus*	MO-SC					X		
Oval ladies' tresses *Spiranthes ovalis* var. *erostellata*	MO-SC					X		
Goat's-rue *Tephrosia virginiana*	NE-SC			X				
Nodding pogonia *Triphora trianthophora*	KS-SC				X			
Rock elm *Ulmus thomasii*	MO-SC					X		
Flatleaf bladderwort *Utricularia intermedia*	ND-SC	X						

Table 3.7-6 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	ND	SD	NE	KS	MO	IL	OK
Lesser bladderwort *Utricularia minor*	ND-SC	X						
Bird's-foot violet *Viola pedata*	NE-SC			X				

ND-SC = North Dakota Species of Conservation Priority.

Level I - Species in greatest need of conservation.

Level II - Species in need of conservation, but that have had support from other wildlife programs.

Level III - Species in moderate need of conservation, but that are on the edge of their range in North Dakota.

SD-SC = South Dakota Species of Concern.

S1 Critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

S2 Imperiled because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

S3 Either very rare and local throughout its range, or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors; in the range of 21 of 100 occurrences.

IA-SC = Iowa special concern species.

NE-SC = Nebraska species of special concern.

KS-SC = Kansas species in need of conservation.

MO-SC = Missouri species of conservation concern.

South Dakota

A total of seven special status wildlife species (eastern spotted skunk, bald eagle, whooping crane, piping plover, interior least tern, false map turtle, and Dakota skipper) and 14 wildlife species of special concern (red-necked grebe, American white pelican, Cooper's hawk, broad-winged hawk, black tern, common tern, northern cricket frog, Blanding's turtle, spiny softshell, small softshell, ringneck snake, fox snake, Ottoe skipper, and Poweshiek skipperling) potentially could occur within suitable habitat along the proposed route in South Dakota.

Based on correspondence and consultation with the SDGFD and the USFWS, respectively, species surveys would only be required for breeding and roosting bald eagles, interior least tern, piping plover, and Dakota skipper. Keystone submitted documentation of agency coordination to the Department of State on September 15, 2006.

Surveys for nesting and roosting bald eagles will occur at all river crossings, if construction were to occur during the breeding and roosting periods. Two active bald eagle nest sites were identified within 0.25 mile from the Missouri River crossing.

Surveys for the interior least tern and piping plover will occur at the Missouri River, if construction were to occur during the breeding period.

A total of 3.7 miles of potential Dakota skipper habitat was identified at six locations in South Dakota (MP 265.2 to MP 266.2, MP 296.9 to 297.9, MP 390.9 to MP 391.7, MP 419.6 to MP 420.0, MP 420.6 to MP 420.8, and MP 421.8 to MP 422.1). Occurrence surveys for this species will occur in 2007.

Nebraska

A total of seven special status wildlife species (river otter, bald eagle, king rail, whooping crane, piping plover, interior least tern, and massasauga) could potentially occur within suitable habitat along the proposed route in Nebraska. No wildlife species of special concern have been identified for the Nebraska portion of the proposed route.

Based on correspondence and consultation with the NGPC and the USFWS, respectively, species surveys would be required for the river otter, breeding and roosting bald eagles, interior least tern, and piping plover. Keystone submitted documentation of agency coordination to the Department of State on September 15, 2006.

Surveys for river otter den sites will occur at the Elkhorn and Platte river crossings, if construction were to occur during the breeding period.

Surveys for nesting and roosting bald eagles will occur at all river crossings, if construction were to occur during the breeding and roosting periods.

Surveys for the interior least tern and piping plover will occur at the Missouri, Platte, and Elkhorn rivers, if construction were to occur during the breeding period.

Kansas

A total of five special status wildlife species (eastern spotted skunk, bald eagle, whooping crane, snowy plover, and Henslow's sparrow), and nine wildlife species of special concern (southern flying squirrel, southern bog lemming, short-eared owl, whip-poor-will, Cerulean warbler, bobolink, eastern hognose snake, timber rattlesnake, and Wallace's deepwater mayfly) could potentially could occur within suitable habitat along the proposed route in Kansas.

Based on correspondence and consultation with the KDWP and the USFWS, respectively, species surveys would be required for breeding and roosting bald eagles. Keystone submitted documentation of agency coordination to the Department of State on September 15, 2006.

Surveys for nesting and roosting bald eagles will occur at all river crossings, if construction were to occur during the breeding and roosting periods. The pipeline route would cross state-designated critical habitat for the bald eagle at the Big Blue and Missouri river crossings in Kansas.

Missouri

A total of 12 special status wildlife species (Indiana bat, eastern spotted skunk, least bittern, bald eagle, greater prairie chicken, king rail, barn owl, loggerhead shrike, Henslow's sparrow, northern harrier, western fox snake, and massasauga) and 13 wildlife species of special concern (long-tailed weasel, pied-billed grebe, great egret, Cooper's hawk, red-shouldered hawk, sora, short-eared owl, yellow-headed blackbird, great plains toad, northern crawfish frog, Blanding's turtle, regal fritillary, and prairie mound ant) potentially could occur within suitable habitat along the proposed route in Missouri.

Based on correspondence and consultation with the MDC and the USFWS, respectively, species surveys would be required for Indiana bat, breeding and roosting bald eagles, barn owl, king rail, massasauga, western fox snake. Keystone submitted documentation of agency coordination to the Department of State on September 15, 2006.

A total of 34.8 miles of potential forested woodlands that meet the Missouri USFWS criteria for Indiana bat habitat was identified for Missouri (Buchanan County – 5.0 miles, Clinton County – 1.8 miles, Caldwell County – 2.7 miles, Carroll County – 2.3 miles, Chariton County – 1.5 miles, Randolph County – 2.1 miles, Audrain County – 1.1 miles, Montgomery County – 5.5 miles, and Lincoln County – 12.8 miles). Potential habitat along the proposed pipeline route represent estimates based on GIS interpretation. Habitat field verifications surveys are planned to occur in fall 2006.

Surveys for breeding and roosting bald eagles will occur at all river crossings, if construction were to occur during the breeding and roosting periods. One active bald eagle nest was observed within the project vicinity at the Mississippi River crossing.

Surveys for breeding barn owls and king rails will occur, if construction were to occur during the nesting period.

A total of 12.2 miles of potential massasauga rattlesnake and western fox snake habitat was identified at 88 sites in Missouri (Buchanan County – 2.5 miles, Carroll County – 1.7 miles, Chariton – 3.4 miles, and St. Charles County – 4.6 miles). Potential habitat along the proposed pipeline route represent estimates based on GIS interpretation. Habitat field verification surveys are planned to occur in fall 2006.

Illinois

A total of 12 special status wildlife species (Indiana bat, river otter, least bittern, bald eagle, barn owl, loggerhead shrike, Henslow's sparrow, yellow-crowned night heron, pied-billed grebe, Illinois chorus frog, massasauga, and Kirtland's snake) potentially could occur within suitable habitat along the proposed route in Illinois. No wildlife species of special concern have been identified for the Illinois portion of the proposed route.

Based on correspondence and consultation with the IL DNR and the USFWS, respectively, species surveys would be required for the river otter, Indiana bat, breeding and roosting bald eagle, barn owl, Henslow sparrow, least bittern, loggerhead shrike, pied-billed grebe, massasauga, Kirtland's snake, and Illinois chorus frog. Keystone submitted documentation of agency coordination to the Department of State on September 15, 2006.

A total of 12.8 miles of potential Indiana bat habitat was identified for Illinois (Madison County – 7.7 miles, Bond County – 2.8 miles, Fayette County – 1.9 miles, and Marion County – 0.4 mile). Potential habitat along the proposed pipeline route represent estimates based on GIS interpretation. Habitat field verifications surveys are planned to occur in fall 2006.

Surveys for the river otter, barn owl, Henslow sparrow, least bittern, loggerhead shrike, and pied-billed grebe will occur, if construction were to occur during the nesting period.

Surveys for breeding and roosting bald eagles will occur at all river crossings, if construction were to occur during the breeding and roosting periods.

Pre-construction surveys for Illinois chorus frog surveys will occur in suitable habitat in Madison County.

A total of 6.4 miles of potential massasauga rattlesnake habitat was identified at 22 locations in Illinois (Madison County – 1.5 miles, Bond County – 1.7 miles, Fayette County – 3.2 miles). Potential habitat along the proposed pipeline route represent estimates based on GIS interpretation. Habitat field verifications surveys are planned to occur in fall 2006.

Oklahoma

A total of four special status wildlife species (bald eagle, whooping crane, piping plover, and interior least tern) potentially could occur within suitable habitat along the proposed route in Oklahoma. No wildlife species of special concern have been identified for the Oklahoma portion of the proposed route.

Based on correspondence and consultation with the ODWC and the USFWS, respectively, species surveys would be required for breeding and roosting bald eagle and interior least tern. Keystone submitted documentation of agency coordination to the Department of State on September 15, 2006.

Surveys for breeding and roosting bald eagles will occur at all river crossings, if construction were to occur during the breeding and roosting periods.

Surveys for the interior least tern will occur at the Cimarron River, if construction were to occur during the breeding period.

3.7.3.2 Aquatic Species

<u>KEYSTONE MAINLINE</u>

Sensitive aquatic species identified as potentially occurring in waterbodies crossed by the proposed route include fish and freshwater mussel species. As identified in **Table 3.7-5**, potential occurrences of federal and state-listed special status species include 13 fish and four mussels. A list of fish and mussel species of concern is provided in **Table 3.7-6**. The lists were based on NHP data for each state, as well as information obtained from state and federal agencies. Habitat information as well as occurrence by state is provided in Appendix G, Tables G-1 and G-2. A summary of sensitive species occurrence by waterbody is provided below for each state.

North Dakota

No federal or state-listed fish or mussel species are known to occur in waterbodies crossed by the North Dakota portion of the proposed route. The only species of concern is blacknose shiner, which could occur in the Sheyenne River.

South Dakota

Seven waterbodies crossed by the proposed route in South Dakota contain known or potential habitat for federally and state-listed species: Foster Creek (Topeka shiner), South Fork Pearl Creek (Topeka shiner), Redstone Creek (Topeka shiner), Rock Creek (Topeka shiner), Wolf Creek (Topeka shiner), James River (pallid sturgeon and winged mapleleaf mussel), and the Missouri River (pallid sturgeon and scaleshell and Higgins' eye mussels). These same streams also contain potential habitat for special concern fish and mussel species.

As part of determining suitable habitat for the federally endangered Topeka shiner, habitat characterization surveys were conducted at 21 stream crossings in South Dakota during September 14 through 17, 2006 (Stark 2006a). Suitable habitat consisting of permanent pools, stable temperatures, and aquatic macrophytes were identified for the following crossings: Foster Creek (MP 298), South Fork Pearl Creek (MP 326.2), Redstone Creek (MP 343), Rock Creek (MP 362.1), and Wolf Creek (MP 384). A mussel survey was conducted at the proposed James River pipeline crossing on September 9, 2006, to determine if two federally listed mussel species, winged mapleleaf (*Quadrula fragosa*) and scaleshell (*Leptodea leptodon*), were present (Perkins 2006). No specimens of either species were collected at the proposed crossing. In total, 288 mussels were collected, which included 49 live specimens representing eight species. The most abundant live mussel species included mapleleaf (*Quadrula quadrula*), fragile heelsplitter (*Potamilus ohiensis*), white heelsplitter (*Lasmigona complanata*), and giant floater (*Pyganodon grandis*). The live mussels were released to similar habitat located upstream of the proposed crossing to avoid construction-related impacts.

Nebraska

Four waterbodies crossed by the Nebraska portion of the proposed route contain known or potential habitat for federally and state-listed species: Platte River (sicklefin chub and sturgeon chub) and the Missouri River (pallid sturgeon, lake sturgeon, sturgeon chub, blacknose shiner, Topeka shiner, northern redbelly dace, and finescale dace, and scaleshell mussel), Elkhorn River (Blacknose shiner), and West Fork Big Blue River (Topeka shiner).

Kansas

Six waterbodies crossed by the Kansas portion of the proposed route contain known populations and critical habitat for numerous federal or state-listed species: Missouri River (chestnut lamprey, pallid sturgeon, flathead chub, sicklefin chub, western silvery minnow, Topeka shiner, and blacknose shiner), South Fork Big Nemaha River (flathead chub and western silvery minnow), North Fork Elm Creek (Topeka shiner), Wolf River (western silvery minnow), and Rock Creek (sicklefin chub). Most of these same streams contain Kansas special concern fish and mussel species. The North Fork Elm Creek contains state critical habitat for Topeka shiner. Based on a habitat characterization survey conducted during September 26 through 28, 2006, marginal habitat was identified in one tributary to North Fork Elm Creek (Stark 2006b). Seining also was conducted in the tributary to North Fork Elm Creek on October 2, 2006. No Topeka shiners were collected.

Missouri

Nine waterbodies crossed by the Missouri portion of the proposed route contain federal or state-listed species. Species known to occur in the Missouri River include the pallid sturgeon, sturgeon chub, sicklefin chub and western silvery minnow. Pallid sturgeon is known to occur in the Mississippi River. Known or potential habitat for Topeka shiner occurs in Brush, Castile, Crabapple, Log, and Shoal creeks and the Little Platte and East Fork Crooked rivers. These streams are considered spawning waters for Topeka shiner, with a timeframe of May 15 through July 3. Special concern species also potentially occur in the Missouri River and streams in Lincoln, Audrain, Montgomery, Clinton, and St. Charles counties.

To provide specific information on Topeka shiner habitat at proposed crossings in Missouri, habitat was characterized at 13 crossings during September 26 through 28, 2006 (Stark 2006b). Topeka shiner habitat was concluded to be suitable in the Little Platte and Shoal Creek and marginal in Castile Creek. Habitat at other proposed crossings on Little Shoal Creek, Log Creek and tributaries, Brush Creek and tributary, Crabapple Creek and tributary, and East Fork Chariton River and tributary was considered low quality. As a follow-up to the aquatic habitat surveys, seining was conducted at nine proposed crossings on October 2 through 4, 2006 to determine if Topeka shiner were present (Stark 2006b). The surveys focused on all streams with water and allowable access. No Topeka shiners were collected at any of the streams in Missouri. The fish surveys indicated that Topeka shiner is unlikely to occur at the proposed crossings.

Illinois

Two waterbodies crossed by the proposed route in Illinois contain federal or state-listed species: the Mississippi River (pallid sturgeon and lake sturgeon) and Kaskaskia River (western sand darter).

CUSHING EXTENSION

Nebraska, Kansas, and Oklahoma

The Cushing Extension crosses streams that may contain habitat for the federally listed Topeka shiner. No sensitive fish or mussel species occur in the intermittent streams crossed by this route in Nebraska.

3.8 Land Use

3.8.1 Land Ownership and Use

Table 3.8-1 provides the linear mileage crossed by the proposed route, categorized by surface ownership. Lands along the proposed route (shown in **Figure 3.8-1**) are primarily privately owned. No Tribal lands are crossed by the proposed route (see Section 2.4.1.4 under Native American Lands Reroute). Land ownership in the vicinity of the proposed project is shown in **Figure 3.8-1**. In addition to the federal land listed in **Table 3.8-1**, the USFWS holds several wetlands easements intersected by the North and South Dakota portion of the proposed route (see Section 3.8.4, **Table 3.8-5**). State and federal lands of special interest are listed in Section 3.8.4, **Table 3.8-4**.

Table 3.8-1 Surface Ownership Crossed by the Proposed Project

	Miles Crossed	% of Total Length
	KEYSTONE MAINLINE	
North Dakota		
Federal	0.0	0.0
State	0.8	0.4
Private	216.1	99.6
ND Subtotal	216.9	100.0
South Dakota		
Federal	0.0	0.0
State	0.5	0.2
Private	218.4	99.8
SD Subtotal	218.9	100.0
Nebraska		
Federal	0.0	0.0
State	0.0	0.0
Private	213.7	100.0
NE Subtotal	213.7	100.0
Kansas		
Federal	0.0	0.0
State	0.0	0.0
Private	98.8	100.0
KS Subtotal	98.8	100.0
Missouri		
Federal	0.1	<0.1
State	1.9	0.7
Private	271.1	99.3
MO Subtotal	273.1	100.0
Illinois		
Federal	3.0	5.3
State	0.0	0.0
Private	53.5	94.7
IL Subtotal	56.5	100.0
Keystone Mainline Subtotal	**1,077.9**	**78.7**

Table 3.8-1 Surface Ownership Crossed by the Proposed Project

	Miles Crossed	% of Total Length
CUSHING EXTENSION		
Nebraska		
Federal	0.0	0.0
State	0.0	0.0
Private	2.4	100.0
NE Subtotal	2.4	100.0
Kansas		
Federal	3.6	1.7
State	0.0	0.7
Private	206.1	98.3
KS Subtotal	209.7	100.0
Oklahoma		
Federal	0.0	0.0
State	5.2	6.5
Private	74.5	93.5
OK Subtotal	79.7	100.0
Cushing Extension Subtotal	**291.8**	**21.3**
PROJECT TOTAL	**1,369.7**	**100.0**

Table 3.8-2 provides the miles crossed, categorized by land use, by the proposed route. The majority of the land in the project area is agricultural. Land uses crossed by the proposed route are shown in **Figure 3.8-2.** Land cover types not specifically described here are discussed in the vegetation and water resources section.

Table 3.8-2 Land Uses Crossed by the Proposed Project

	Keystone Mainline (miles)						Cushing Extension (miles)		
	ND	SD	NE	KS	MO	IL	NE	KS	OK
Developed	1.3	2.8	2.0	0.1	6.8	2.3	0.0	2.3	3.8
Agriculture/Cropland	167.6	158.6	181.0	70.5	148.3	44.4	0.8	136.6	27.7
Grassland/Rangeland	26.3	37.7	24.8	18.5	72.5	1.7	1.2	58.9	41.6
Forest Land	3.0	0.2	2.1	7.5	35.9	4.7	0.4	5.9	2.3
Water	0.6	0.7	1.3	1.3	4.1	1.1	0.0	0.6	0.2
Wetlands	18.1	18.9	2.5	0.9	5.5	2.3	0.0	5.4	4.2
Total	**216.9**	**218.9**	**213.7**	**98.8**	**273.1**	**56.5**	**2.4**	**209.7**	**79.7**

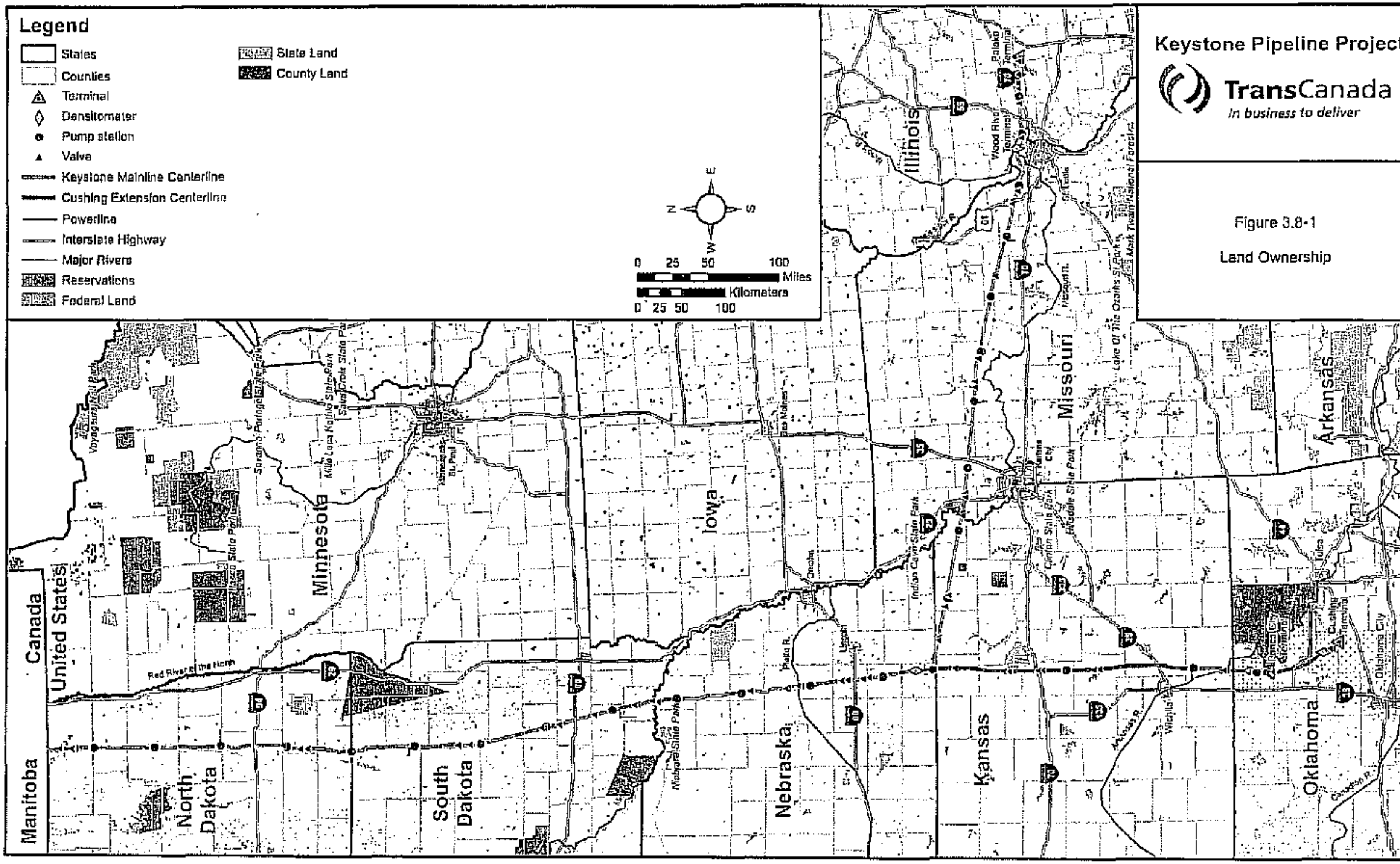
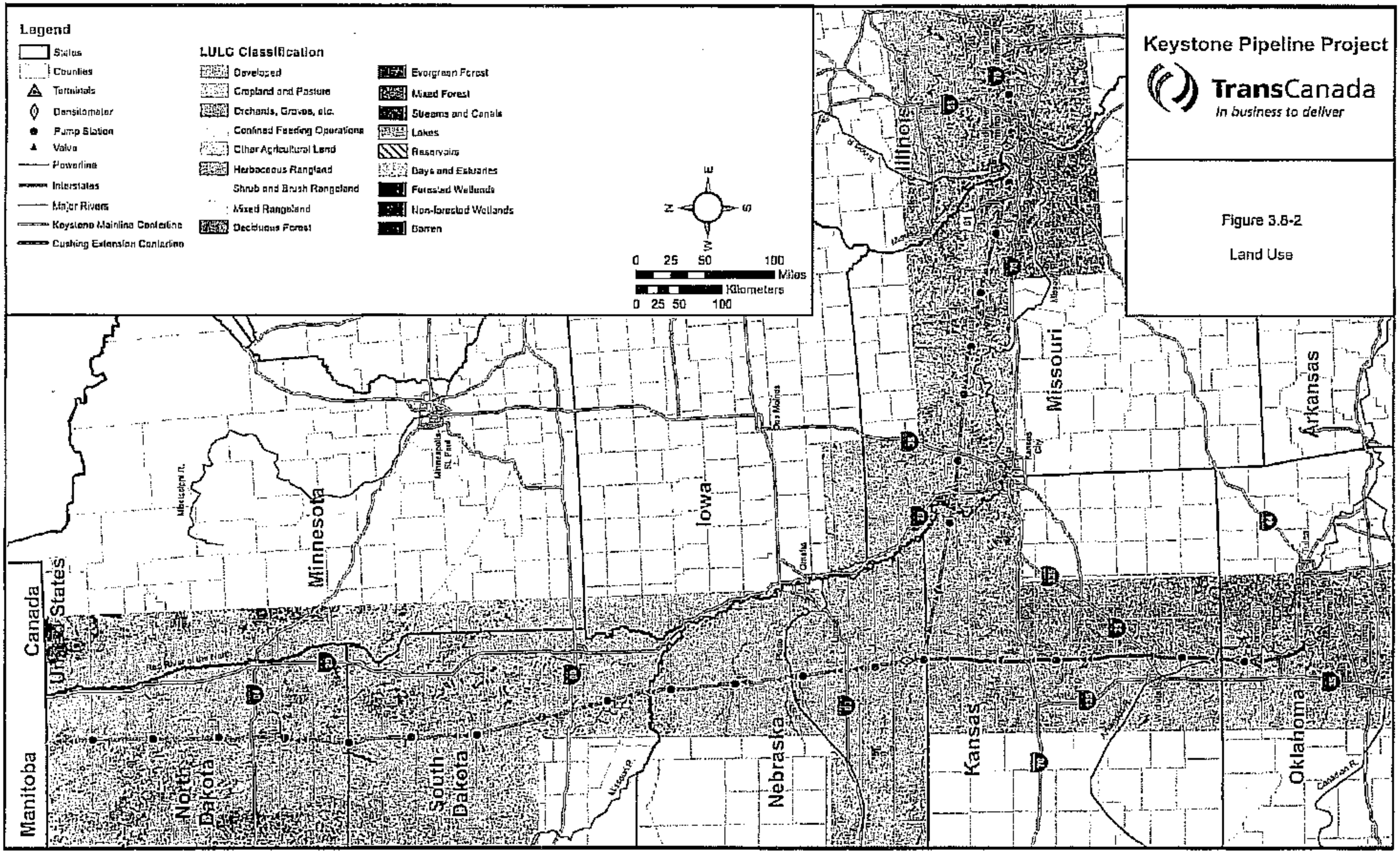


Figure 3.8-1

Land Ownership



Legend
States
Counties
Terminals
Densitometer
Pump Station
Valve
Powerline
Interstates
Major Rivers
Keystone Mainline Centerline
Cushing Extension Centerline
LULC Classification
Developed
Cropland and Pasture
Orchards, Groves, etc.
Confined Feeding Operations
Other Agricultural Land
Herbaceous Rangeland
Shrub and Brush Rangeland
Mixed Rangeland
Deciduous Forest
Evergreen Forest
Mixed Forest
Streams and Canals
Lakes
Reservoirs
Bays and Estuaries
Forested Wetlands
Non-forested Wetlands
Barren
0 25 50 100 Miles
0 25 50 100 Kilometers
Keystone Pipeline Project
TransCanada
In business to deliver
Figure 3.8-2
Land Use
Canada
United States
Manitoba
North Dakota
South Dakota
Minnesota
Iowa
Nebraska
Kansas
Missouri
Illinois
Oklahoma
Arkansas
Minneapolis-St. Paul
Des Moines
Omaha
Kansas City
Mississippi R.
Missouri R.
Canadian R.

3.8.2 Rangeland/Agriculture

Approximately 68 percent of the proposed route crosses croplands. Approximately 21 percent of the proposed route crosses grassland/rangeland. With the exception of proposed facilities within existing industrial sites, pump stations will be located on either cropland or grassland/rangeland. Some of this land, the extent of which is currently unknown, may be terraced and/or have subsurface drainage systems installed.

3.8.3 Residential/Commercial Areas

Residential areas, commercial areas, and utility crossings represent about 0.2 percent of the total proposed route. Residential areas located adjacent to the proposed route are single family units located in rural subdivisions on small lots. **Table 3.8-3** provides a summary of the residences/residential areas and the public assembly places (hospitals, churches, assembly halls, government buildings, etc.) within 500 feet of the proposed centerline. The actual number of residences within 500 feet of the proposed pipeline will be somewhat greater, as the number of individual residences at certain locations has not yet been finally determined.

Table 3.8-3 Potential Residences and Public Assembly Places near the Proposed Project

	Potential Residences or Residential Areas (within 500 feet)[1]	Public Assembly Places (within 500 feet)[1]
	KEYSTONE MAINLINE	
North Dakota	61	2
South Dakota	69	1
Nebraska	112	3
Kansas	87	0
Missouri	579	3
Illinois	77	1
Keystone Mainline Subtotal	985	10
	CUSHING EXTENSION	
Nebraska	1	0
Kansas	134	1
Oklahoma	113	0
Cushing Extension Subtotal	248	1
PROJECT TOTAL	1,233	12

[1]To be confirmed with field surveys within 500 feet of the proposed centerline.

3.8.4 Recreation and Special Interest Areas

Table 3.8-4 lists recreation and special interest areas crossed by the proposed route. No other national, state, or local parks or forests are located within 500 feet of the proposed centerline, other than those listed in **Table 3.8-4. Table 3.8-5** lists USFWS Wetland Easements crossed by the proposed route in South Dakota. These are areas having 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). It also confers protection to federally listed endangered and threatened species throughout the area.

Table 3.8-4 Recreation and Special Interest Areas Crossed by the Proposed Project

	Mileposts	Miles Crossed	Name	Ownership
		KEYSTONE MAINLINE		
North Dakota	6.9 – 7.7	0.8	Tetrault Woods State Forest	North Dakota Forest Service
	8.0	NA	Pembina River	NA
	10.0 – 10.5	0.5	Conservation Reserve	Privately Owned North Dakota Game and Fish Easement
	25.0 – 28.5	3.5	Forest	State Forest Service
	77.0 – 78.0	1.0	Conservation Reserve	Privately Owned North Dakota Game and Fish Easement
	79.5 – 80.0	0.5	Conservation Reserve	Privately Owned North Dakota Game and Fish Easement
	80.2 – 82.3	2.1	Conservation Reserve	Privately Owned North Dakota Game and Fish Easement
	83.3 – 84.3	1.0	Conservation Reserve	Privately Owned North Dakota Game and Fish Easement
	110.1 – 111.1	1.0	Conservation Reserve	Privately Owned North Dakota Game and Fish Easement
	187.2 – 187.7	0.5	Wildlife Preserve	Privately Owned North Dakota Game and Fish Easement
South Dakota	228.4 – 228.9	0.5	Game Production Area	South Dakota Game, Fish, and Parks Department (SDGFD)
	433.5 – 435.8	2.3	Missouri National Recreational River	Privately Owned Designated Wild and Scenic NPS
Nebraska	435.8 – 436.2	0.4	Missouri National Recreational River	NPS
Kansas	NA	0.0	None Identified	NA
Missouri	748.5 – 748.6	0.1	Pigeon Hill Conservation Area	USACE
	748.35 – 752.8	4.45	Western Missouri River Alluvial Plain Conservation Opportunity Area (COA)	Private & MCD
	758.4 – 759.1	0.6	Pigeon Hill Conservation Area	Missouri Conservation Department (MCD)
	767.4 – 769.0	1.4	Platte River Loess Prairie/ Woodland Hills COA	Private

Table 3.8-4 Recreation and Special Interest Areas Crossed by the Proposed Project

	Mileposts	Miles Crossed	Name	Ownership
	771.0 – 772.25	1.25	Little Platte River Woodland COA	Private
	779.3 – 781.5	2.2	Cameron Upland Prairie Plain COA	Private
	823 – 823.8	0.8	Shoal Creek Prairie	Private
	825.9 – 826.5	0.6	Shoal Creek Prairie/ Woodland Scarped Plain COA	Private
	838.8 – 841.6	2.8	Lower Grand River Lowland Plains/ Missouri – Grand River Lowland Plains COA	Private
	867.7 – 869	1.3	Lower Chariton Woodland/ Forest Hills COA	Private
	871.4 – 872.2	0.8	Lower Chariton Woodland/ Forest Hills COA	Private
	923.4	NA	West Fork Cuivre River	NA
	961.1 – 963	1.9	Cuivre River Woodland/ Forest Hills COA	Private
	970.5 – 972.8	2.3	Cuivre River Woodland/ Forest Hills COA	Private
	983 – 983.2	0.2	Cuivre River Woodland/ Forest Hills COA	Private
	983.7 – 984.3	0.6	Cuivre River Woodland/ Forest Hills COA	Private
	984.9-1019.9	35	St Charles County Prairie/ Woodland Low Hills, St Charles/ Lincoln Alluvial Plain, Mairas Temp Clair Alluvial Plain, West Allan Alluvial Plain, St Louis County Prairie/Savannah Dissected Karst Plain COA	Private
	1019.9 – 1021.1	1.2	Edward "Ted" & Pat Jones-Confluence Point State Park	Missouri Department of Natural Resources
Illinois	1069.6 – 1072.7	3.1	Carlyle Lake	USACE
CUSHING EXTENSION				
Nebraska			None identified	
Kansas	50.0 – 51.8	1.8	Milford Wildlife Area	USACE
	52.2 – 52.7	0.5	Milford Wildlife Area	USACE
	52.8 – 53.3	0.5	Milford Wildlife Area	USACE
	53.7 – 54.3	0.6	Milford Wildlife Area	USACE
Oklahoma			None Identified	

Table 3.8-5 USFWS Easements Crossed by the Proposed Project

	Mileposts	Miles Crossed	Survey Target Description
KEYSTONE MAINLINE			
North Dakota	76.0 - 77.0	1.0	USFWS Wetland Easement
	79.1 - 79.6	0.5	USFWS Wetland Easement
	80.1 - 82.3	2.2	USFWS Wetland Easement
	85.8 - 86.5	0.7	USFWS Wetland Easement
	87.0 - 88.1	1.1	USFWS Wetland Easement
	89.6 - 89.9	0.3	USFWS Wetland Easement
	91.7 - 92.7	1.0	USFWS Wetland Easement
	97.7 - 98.3	0.6	USFWS Wetland Easement
	100.9 - 101.2	0.3	USFWS Wetland Easement
	109.6 - 110.1	0.5	USFWS Wetland Easement
	110.6 - 111.1	0.5	USFWS Wetland Easement
	117.3 - 117.7	0.4	USFWS Wetland Easement
	118.9 - 119.2	0.3	USFWS Wetland Easement
	121.8 - 122.3	0.5	USFWS Wetland Easement
	127.6 – 127.9	0.3	USFWS Wetland Easement
	128.3 – 128.6	0.3	USFWS Wetland Easement
	137.3 – 138.2	0.9	USFWS Wetland Easement
	138.9 - 140.0	1.1	USFWS Wetland Easement
	169.3 -170.3	1.0	USFWS Wetland Easement
	172.5 - 173.0	0.5	USFWS Wetland Easement
	170.5 – 170.8	0.3	USFWS Wetland Easement
	174.0 – 174.5	0.5	USFWS Wetland Easement
	175.5 – 176.0	0.5	USFWS Wetland Easement
	176.5 - 177.0	0.5	USFWS Wetland Easement
	177.6 – 179.1	1.5	USFWS Wetland Easement
	180.6 - 183.2	2.5	USFWS Wetland Easement
	183.2 - 183.4	0.3	USFWS Conservation or FHA Easement
	186.7 - 187.2	0.5	USFWS Wetland Easement
	187.7 – 189.2	1.5	USFWS Wetland Easement
	198.8 – 199.1	0.3	USFWS Wetland Easement
	214.9 - 216.9	2.0	USFWS Wetland Easement
South Dakota	216.9 - 218.8	1.9	USFWS Wetland Easement
	219.3 - 219.8	0.5	USFWS Grassland Easement
	222.3 - 222.8	0.5	USFWS Grassland Easement
	261.3 – 261.6	0.3	USFWS Wetland Easement
	210.5 – 311.0	0.5	USFWS Conservation or FHA Easement
	316.4 - 316.9	0.5	USFWS Wetland Easement
	318.8 - 319.3	0.5	USFWS Wetland Easement
	321.9 - 322.4	0.5	USFWS Wetland Easement
	324.4 – 324.6	0.2	USFWS Wetland Easement
	325.5 – 326.5	1.0	USFWS Wetland Easement
	329.2 - 329.6	0.4	USFWS Wetland Easement
	332.2 – 332.7	0.5	USFWS Wetland Easement
	333.7 – 334.7	1.0	USFWS Wetland Easement
	334.9 – 335.2	0.3	USFWS Wetland Easement
	338.9 – 340.0	1.1	USFWS Wetland Easement

Table 3.8-5 USFWS Easements Crossed by the Proposed Project

	Mileposts	Miles Crossed	Survey Target Description
	349.2 – 349.8	0.6	USFWS Wetland Easement
	355.5 – 356.0	0.5	USFWS Wetland Easement
	360.5 – 361.7	1.2	USFWS Wetland Easement
	363.4 - 364.7	1.3	USFWS Wetland Easement

The Missouri River has been designated a National Recreational River at the proposed crossing and the Niobrara/Missouri National River Area is crossed at this location. The Pembina River from Red River to the Canadian border has been classified by the National Rivers Inventory (NRI) as having outstanding resource values (ORVs) for scenery, geology, and being a wild river. The West Fork of the Cuivre River has been classified by the NRI as having ORVs for scenery, geology, and fish.

No designated wilderness or Wilderness Study Areas are crossed by the proposed project.

3.8.5 Noise

The existing noise environment is characterized by determining ambient noise levels, identifying existing noise sources, identifying noise sensitive receptors in the vicinity of project noise sources, and evaluating local terrain features that may affect noise transmission.

The Keystone Pipeline Project will occur primarily in rural agricultural areas. Because of the primarily agricultural and rural land uses, existing ambient noise levels along the pipeline route are quite low. It is estimated that day-night average levels (L_{dn})[1] on the A weighted scale (dBA)[2] 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] L_{dn} is the A-weighted equivalent sound level for a 24-hour period with 10 decibels added to nighttime sounds to adjust for increased sensitivity to noise at night.

[2] The A-weighted scale adjusts for the sensitivity of the human ear to different sound frequencies.

3.9 Cultural Resources

Cultural resources are protected by a series of federal laws enacted to protect these resources from damage or loss due to federally funded or permitted activities. These include the Antiquities Act of 1906, Historic Sites Act of 1935, 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 necessary guidance on protection and enhancement of cultural resources.

In compliance with the mandates listed above, cultural resources investigations for the proposed Keystone Pipeline Project were started in November 2005 and currently are ongoing in each state crossed by the proposed route. The description and results of the investigations as of this date are summarized below by state.

KEYSTONE MAINLINE

North Dakota

In January 2006, Metcalf Archaeological Consultants, Inc. (Metcalf) prepared a research design for the cultural resources field inventory conducted along the proposed route in North Dakota (Stine 2006a). The ideas and concept underlying the research design were the result of informal discussions with the Chief Archaeologist of the North Dakota State Historic Preservation Office (SHPO). The research design included a sampling strategy comprised of five levels of investigation. Two of these levels applied to the entire proposed route through North Dakota, while the remaining three applied only to selected areas. The first level, a literature and files search of an area one mile wide centered on the proposed route, was completed in January 2006 and the results are presented in the following paragraphs. The second level of investigation was a reconnaissance of the proposed route by a geomorphologist in order to identify areas that required closer investigation and conversely areas that were not archaeologically sensitive. The third level was an intensive pedestrian field survey of selected segments of the proposed route in areas with high potential to contain archaeological resources. The fourth level was a reconnaissance survey of approximately 41 miles of the proposed route. The fifth level was no survey, which applied only to areas determined to have essentially no potential for the presence of cultural resources. These areas were determined by the results of the previous four types of investigations. In a letter dated February 23, 2006, the North Dakota SHPO concurred with the proposed cultural resources survey protocol as presented in the research design (Paaverud 2006). The research design and SHPO concurrence letter are included in the September 15, 2006 submittal to the Department of State.

The literature and files search conducted at the State Historical Society of North Dakota identified 117 previously documented cultural resources within the one-mile-wide study corridor. The identified cultural resources included 16 prehistoric sites, seven historic sites, five multi-component sites containing both prehistoric and historic components, 25 architectural sites, 31 historic/archaeological site leads, 24 prehistoric site leads, and nine isolated finds. A "lead" refers to an unmapped site that was reported to the SHPO by an individual (e.g., amateur archaeologist) and the site was subsequently documented in the SHPO database with that designation.

The geomorphological investigation consisted of a study of existing geologic and soil maps and a review of the literature and file search data followed by a windshield survey of the entire proposed route in order to determine areas that had the potential for archaeological sites, in particular, buried sites. At the time of the windshield survey, specific areas were identified where more detailed investigations (e.g., intensive pedestrian survey, soil coring) were recommended.

Approximately 49 miles of the proposed 217-mile route in North Dakota were selected for intensive field inventory. These areas were identified based on the results of the literature and files search and review of the various land forms crossed by or adjacent to the proposed route. The inventory included areas recognized to be archaeologically sensitive, including river crossings and areas with previously documented sites.

Approximately 41 miles of the proposed route were subjected to a reconnaissance drive-by inventory. In forested areas or where the proposed route was generally over 0.25 mile from the road, the proposed route was inspected with a single transect (i.e., archaeologist). Specific areas that appeared to be sensitive (e.g., locally prominent rises, areas near good sources of potable water) were subjected to an intensive field inventory.

Results of Field Investigations

Cultural resources field surveys within selected survey areas consisted of close inspection of a 300-foot-wide corridor centered on the proposed pipeline centerline. The initial field survey of selected survey areas was completed in August 2006. Approximately 26 miles of reroutes and USFWS easements remain to be surveyed. These are scheduled for completion by November 2006, weather permitting.

To date, 16 cultural resources, one prehistoric lead, one historic lead, and eight isolated finds were located during the field surveys. These included prehistoric lithic and cultural material scatters, historic railroads, and a historic foundation. Shovel probes were conducted at nine locations. The purpose of the shovel probes was to augment the pedestrian survey in areas where surface visibility was inadequate and/or where cultural material was suspected to be within three feet of the ground surface. Major stream crossings with minimal ground surface visibility were the focus of the shovel probes. As a result of the shovel probes, material was recovered from four of the nine locations. The material included ceramics, small animal bone fragments, and charcoal.

As a result of the field surveys and shovel probes, four sites were recommended as potentially eligible for the NRHP. Two of the sites were avoided by a reroute. The remaining two sites are located in an area known to contain archaeological sites; therefore, testing was the preferred alternative because of the high likelihood that rerouting around the recorded sites would result in the discovery of additional sites that also would require testing. The purpose of evaluative testing was to 1) determine the extent of the site, both horizontally and vertically, through shovel probing and test excavation units; 2) collect sufficient information to evaluate the site's eligibility for the NRHP; and 3) collect sufficient information to formulate a data recovery plan, if needed. As a result of the testing, both sites were determined not eligible for listing on the NRHP.

During the windshield survey, 52 localities were selected for geomorphological core sampling. The rationale for using sampling tube cores is two-fold. In small valleys, coring is used to determine the presence or absence of buried soils; thus, either confirming a significant distribution of buried soils with the potential for containing cultural deposits or eliminating the location from consideration for backhoe trenching. Second, in the larger valleys, cores are used to narrow the areas that are expected to contain paleosols and buried resources. Paleosols are "fossil" soils found buried within either sedimentary or volcanic deposits. The core sampling currently is underway and expected to be completed in November, weather permitting.

A preliminary survey report, which will include the results of the field surveys, evaluative testing, and geomorphological investigations, will be submitted to the North Dakota SHPO and Department of State in December 2006.

South Dakota

In January 2006, Metcalf prepared a research design for the cultural resources field inventory conducted along the proposed route in South Dakota (Stine 2006b). The ideas and concept underlying the research design were the result of informal discussions with the Review and Compliance Officer at the South Dakota SHPO. The research design included a sampling strategy comprised of five levels of investigation. The five levels of investigation are similar to those described for North Dakota with the exception of the number of miles recommended for the intensive pedestrian field survey and reconnaissance drive-by survey. Approximately 38 miles of the proposed 219-mile route in South Dakota were selected for an intensive pedestrian field survey and approximately 52 miles of the proposed route were subjected to a reconnaissance drive-by survey. These areas were identified based on the results of the literature and files search. In a letter dated March 28, 2006, the South Dakota SHPO concurred with the proposed cultural resources survey protocol as defined in the research design (Hoskinson 2006). The research design and SHPO concurrence letter are included in the September 15, 2006 submittal.

In January 2006, Metcalf conducted a literature and files search of an area one mile wide, centered on the proposed pipeline centerline at the South Dakota Archaeological Research Center in Rapid City and the Department of Tourism and State Department in Pierre. The search identified 30 previously documented cultural resources within the one-mile-wide study corridor. The identified cultural resources included 10 prehistoric sites, 17 historic sites, and three site leads.

Additionally, there were 243 architectural sites on record at the Department of Tourism and State Department that were located within the one-mile-wide study corridor. The sites included several architectural properties in the communities of Iroquois and Yankton, plus farms and homesteads scattered throughout various counties.

Results of Field Investigations

Cultural resources field surveys within selected survey areas consisted of close inspection of a 300-foot-wide corridor centered on the proposed pipeline centerline. The initial field survey of selected survey areas in South Dakota was completed in August 2006. Approximately 15 miles of reroutes and USFWS easements remain to be surveyed. These are scheduled for completion by November 2006, weather permitting.

To date, nine cultural resources and two isolated finds were located during the field surveys. Site records for five previously recorded historic railroads located within the project area were updated. The nine cultural resources included prehistoric lithic scatters, two rock cairns, historic foundations, a house, shed, and farmstead. Of these, only the two rock cairns were recommended as potentially eligible for the NRHP. Both of the rock cairns will be avoided by rerouting the proposed pipeline centerline.

Shovel probes were conducted at five locations. One prehistoric artifact scatter was recorded as a result of the shovel probes. Evaluative testing was recommended for the site in order to determine the site's NRHP eligibility, however, the proposed pipeline centerline has been rerouted to avoid the site.

During the windshield survey, 56 localities were selected for geomorphological core sampling. The core sampling currently is underway and expected to be completed in November 2006, weather permitting.

A preliminary survey report, which will include the results of the field surveys, evaluative testing, and geomorphological investigations, will be submitted to the South Dakota SHPO and Department of State in December 2006.

Nebraska

In Nebraska, approximately 12 miles of the proposed Keystone pipeline corridor will parallel the recently surveyed Rockies Express Pipeline Project (REX) corridor; therefore, the cultural resources information presented below for the proposed Keystone pipeline route in Nebraska includes data found in the draft REX Phase I survey report prepared for the REX project (Schwegman et al. 2006). REX submitted the draft survey report to the Nebraska SHPO in May 2006. In a letter dated July 14, 2006, the Nebraska SHPO concurred with the findings in the draft survey report (Steinacher 2006a). The REX Phase I survey report and concurrence letter are being submitted to the Department of State.

In February 2006, SWCA Environmental Consultants (SWCA) prepared a research design for the cultural resources field inventory conducted along the proposed route in Nebraska (SWCA 2006a). The ideas and concept underlying the research design were the result of informal discussions with the Historic Preservation Officer at the Nebraska SHPO. The review of the files and records maintained by the SHPO indicated that one percent of the Nebraska segment of the proposed pipeline corridor had been previously surveyed;

therefore, the SHPO recommended an intensive pedestrian field survey of the entire proposed route in Nebraska. In a letter dated March 8, 2006, the Nebraska SHPO concurred with the proposed cultural resources survey protocol as defined in the research design (Steinacher 2006b). The research design and SHPO concurrence letter are included in the September 15, 2006 submittal.

In January 2006, SWCA conducted a literature and files search of an area two miles wide centered on the proposed pipeline centerline through the Nebraska SHPO. The search identified 40 previously documented cultural resources within the two-mile-wide study corridor. Of the 40 previously recorded sites, 10 are prehistoric, one is multi-component, one contains either Late Prehistoric or Early Historic components, 27 are historic, and one is of unknown cultural affiliation. One of the sites was recorded as a prehistoric isolate consisting of a single documented flake and the remaining site was recorded as one or more burials of unknown age. Four of the 40 previously recorded sites are within 150 feet of the proposed pipeline centerline. The four sites include a prehistoric campsite or village, burial(s), historic cabin, and possible historic trail ruts.

In February 2006, the General Land Office (GLO) files also were reviewed as part of the literature and files search. Only 14 GLO references were found for the entire length of the Nebraska portion of the proposed route. Ten of the GLO references are associated with maps dating from 1857 to 1873 and most are affiliated with historic roads and/or forts such as the Fort Leavenworth and Laramie Road, the Northwest-Southeast Fort Kearney and Nebraska City Road, the East-West Fort Kearney and Omaha Road, and the Omaha and Fort Sterling Road. The remaining four GLO references were obtained from 1985 maps that show an existing railroad grade associated with the Union Pacific and the Burlington Railroad systems.

Based on review of USGS topographic maps of the proposed route 37 stream valley locations were evaluated as having the potential for containing buried cultural features. Therefore, they were selected for geomorphological investigations. Five of the selected drainages were rivers: Missouri River, Elkhorn River, Platte River, Big Blue River, West Fork Big Blue River. The geomorphological investigations entailed visiting the identified locations and testing the soil with a sampling tube. For those areas that produced evidence of buried cultural deposits, the location was recommended for further evaluation using backhoe trenching.

Results of Field Investigations

As stated above, the proposed Keystone pipeline corridor in Nebraska will parallel the recently surveyed REX pipeline corridor for approximately 12 miles. The REX cultural resources field surveys along the 12-mile segment consisted of close inspection of a 200-foot-wide corridor. The proposed REX pipeline corridor parallels an existing pipeline, therefore, the edge of the 200-foot-wide survey corridor was located 40 feet from the proposed centerline on the side with the existing pipeline and 160 feet from the centerline on the other side. The proposed Keystone pipeline centerline will be located approximately 40 feet from the REX pipeline centerline and within the 160-foot surveyed area. Any ground-disturbing activities associated with construction of the proposed Keystone project will be within the 160-foot-wide surveyed corridor. For any pipeline facilities that fall outside of the survey corridor (e.g., extra workspace areas), additional cultural resource field surveys will be conducted at those locations in early 2007.

The remaining approximately 200 miles of the proposed Keystone pipeline corridor in Nebraska will not parallel an existing pipeline. For this segment of the proposed pipeline route, the field surveys consisted of close inspection of a 300-foot-wide survey corridor centered on the proposed Keystone pipeline centerline. At this time, approximately 85 miles of the proposed pipeline corridor in Nebraska remain to be surveyed.

To date, 20 cultural resource sites have been identified in the survey corridor. These include prehistoric field camps and limited activity sites, historic farmsteads, and a school. Five prehistoric sites were recommended as potentially eligible for the NRHP. All five sites will be avoided by reroutes, therefore, no further work is recommended for these sites.

Geomorphological investigations were conducted at the 37 stream-valley locations identified in the research design. Core samples were taken at all but seven crossings. The seven crossings were not sampled because they were highly disturbed, lacked Holocene surfaces, had a channelized stream, or there was no access. As a result of the core samples, follow-up backhoe trenching is recommended at 15 of the stream crossings. Backhoe trenching also is recommended at one of the drainages that could not be sampled due to lack of survey access.

Backhoe trenching at selected stream crossings will involve the excavation of a trench, which will extend to an average depth of approximately 6 feet below the modern ground surface. One or two of the walls of each of the deep-testing trenches will be scraped and examined for cultural deposits. Any buried soil horizons with the potential for cultural deposits will be investigated further by troweling the walls of the trench. Where buried cultural material is recovered during the troweling of the trench wall, the soil profile will be mapped and recorded. The schedule for backhoe trenching has not been determined at this time.

A preliminary survey report, which will include the results of the field surveys, testing, and geomorphological investigations conducted along the 200 miles of the proposed Keystone pipeline project in Nebraska, will be submitted to the Nebraska SHPO and Department of State in December 2006.

Kansas

The entire proposed Keystone pipeline corridor in Kansas will parallel the recently surveyed REX project corridor, therefore, the cultural resources information presented below is taken from the draft REX Phase I survey report prepared for the REX project (Myers et al. 2006a). REX submitted the draft survey report to the Kansas SHPO in May 2006. In a letter dated June 12, 2006, the Kansas SHPO concurred with the findings in the draft survey report (Weston 2006a). The REX Phase I survey report and concurrence letter are being submitted to the Department of State.

In November 2005, American Resources Group, Ltd. (ARG) prepared a research design for the cultural resources field inventory to be conducted along the proposed REX pipeline route in Kansas (ARG 2005). ARG developed the research design in consultation with the Kansas SHPO. The sampling strategy proposed in the research design included a probabilistic survey of a random transect of the proposed route through Kansas. Those areas to be surveyed were identified through a literature and files search, an examination of the site distribution patterns documented by previous archaeological research conducted in the region, past geomorphological investigations in the project area, and topographic map review. Approximately 36 miles of the approximately 99-mile route in Kansas were selected for intensive field survey. In a letter dated December 14, 2005, the Kansas SHPO concurred with the proposed cultural resources survey protocol as defined in the research design (Weston 2005). The research design and SHPO concurrence letter are being submitted to the Department of State.

During the week of November 14, 2005, ARG conducted a literature and files search of an area two miles wide, centered on the proposed pipeline centerline through the Kansas State Historical Society's website. Historic maps, atlases, and GLO plats also were consulted in order to identify potential historic sites within the pipeline corridor. The literature and files search identified 29 previously documented cultural resources within the two-mile-wide study corridor; however, none of the sites were located within 500 feet of the proposed pipeline centerline. The identified cultural resources included 24 prehistoric sites, two historic sites, and three multi-component sites. Review of the historic maps, GLO plats, and atlases indicated the presence of 87 potential historic sites within the proposed pipeline corridor. The sites included a variety of potential site types, including farmsteads, rural households, roads, railroads, and towns.

Based on review of USGS topographic maps of the proposed route, 25 stream valley locations on 23 different drainages were evaluated as having the potential for containing buried cultural features; therefore, they were selected for geomorphological investigations. Five of the selected drainages are rivers: Big Blue River, South Fork Big Nemaha River, Middle Fork Wolf River, Missouri River, and Delaware River. Nineteen of the remaining drainages are perennial streams and one is an intermittent creek. The geomorphological investigations entailed visiting the identified locations and testing the soil with a sampling tube. For those areas that produced evidence of buried cultural deposits, the location will be further evaluated using backhoe trenching.

Results of Field Investigations

As stated above, the proposed Keystone pipeline corridor in Kansas will parallel the recently surveyed REX pipeline corridor. The REX cultural resources field surveys consisted of close inspection of a 200-foot-wide corridor within selected survey areas. The proposed REX pipeline corridor parallels an existing pipeline, therefore, the edge of the 200-foot-wide survey corridor was located 40 feet from the proposed centerline on the side with the existing pipeline and 160 feet from the centerline on the other side. The proposed Keystone pipeline centerline will be located approximately 40 feet from the REX pipeline centerline and within the 160-foot surveyed area. Any ground-disturbing activities associated with construction of the proposed Keystone project will be within the 160-foot-wide surveyed corridor. For any pipeline facilities that fall outside of the survey corridor (e.g., extra workspace areas), additional cultural resource field surveys will be conducted at those locations in early 2007. Approximately one mile of selected survey areas in Kansas was not surveyed due to lack of survey access.

As a result of the field surveys, 23 cultural resource sites were identified in the survey corridor. These included prehistoric field camps and limited activity sites, historic farmsteads, and debris scatters. Three prehistoric sites were recommended as potentially eligible for the NRHP. Avoidance or evaluative testing in order to make a definitive determination of NRHP eligibility is recommended for these sites. At this time, it is unknown whether or not the sites will be avoided or tested.

In February 2006, geomorphological investigations were conducted at the 25 stream-valley locations identified in the research design. Two of the 25 identified streams were crossed twice by the proposed pipeline corridor; therefore, 27 stream crossings were analyzed. Core samples were taken at all but five crossings. The five crossings were not sampled because they were highly disturbed, lacked Holocene surfaces and/or had a channelized stream. As a result of the core samples, follow-up backhoe trenching is recommended at 12 of the stream crossings. At this time, the schedule for backhoe trenching has not been determined.

Missouri

In Missouri, approximately 172 miles of the proposed 273-mile Keystone pipeline corridor will parallel the recently surveyed REX project corridor, therefore, the cultural resources information presented below for the proposed Keystone pipeline project in Missouri includes data found in the draft REX Phase I survey report prepared for the REX project (Myers et al. 2006b). REX submitted the draft survey report to the Missouri SHPO in May 2006. In a letter dated May 31, 2006, the Missouri SHPO concurred with the findings in the draft survey report (Miles 2006a). The REX Phase I survey report and concurrence letter will be included in the November 15, 2006 submittal.

In January 2006, ARG prepared a research design for the cultural resources field inventory conducted along the proposed route in Missouri (ARG 2006a). ARG developed the research design in consultation with the Missouri SHPO. The sampling strategy proposed in the research design is the same as described above for the proposed route in Kansas with the exception of the number of miles selected for the intensive pedestrian field survey. Approximately 154 miles of the 273-mile proposed route in Missouri were selected for intensive field survey. In a letter dated March 15, 2006, the Missouri SHPO concurred with the proposed cultural resources survey protocol as defined in the research design (Miles 2006b). The research design and SHPO concurrence letter are included in the September 15, 2006 submittal.

During January and February 2006, ARG conducted a literature and files search of an area two miles wide centered on the proposed pipeline centerline through the Archaeological Survey of Missouri. Historic maps, atlases, and GLO plats also were consulted in order to identify potential historic sites within the proposed pipeline corridor. The literature and files search identified 72 previously documented cultural resources within the two-mile-wide study corridor. Forty-nine of the 72 cultural resources were identified within 0.25 mile of the proposed pipeline centerline.

The 49 cultural resources previously documented within 0.25 mile of the proposed pipeline corridor include prehistoric lithic scatters, camps, habitation areas, mounds, and historic debris scatters and farmsteads. Review of the historic maps, GLO plats, and atlases indicated the presence of 169 potential historic sites within the proposed pipeline corridor. The sites included 155 structures (i.e., homesteads and farmsteads), six schools, one church, three cemeteries, one barn, two railroad sidings/stations, and one post office. In addition to the 169 individual potential historic sites, a six-mile-long section of the proposed pipeline corridor lies within the 1830s Allred and Log Creek Mormon settlements and an approximate two-mile-long area was inhabited in part by Bohemian settlers in the 19th Century.

Based on review of USGS topographic maps of the proposed route, 52 stream valley locations on 49 different drainages were evaluated as having the potential for containing buried cultural features, therefore, they were selected for geomorphological investigations. Eleven of the selected drainages are rivers: Missouri River, Platte River, Little Platte River, Grand River, Mussel Fork River, Chariton River, Middle Fork Little Chariton River, East Fork Little Chariton River, South Fork Salt River, West Fork Cuivre River, and Mississippi River. All of the remaining drainages are perennial streams. The geomorphological investigations entailed visiting the identified locations and testing the soil with a sampling tube. For those areas that produced evidence of buried cultural deposits, the location will be further evaluated using backhoe trenching.

Results of Field Investigations

As stated above, the proposed Keystone pipeline corridor in Missouri will parallel the recently surveyed REX pipeline corridor for approximately 172 miles. The REX cultural resources field survey consisted of close inspection of a 200-foot-wide corridor within selected survey areas. The proposed REX pipeline corridor parallels an existing pipeline, therefore, the edge of the 200-foot-wide survey corridor was located 40 feet from the proposed centerline on the side with the existing pipeline and 160 feet from the centerline on the other side. The proposed Keystone pipeline centerline will be located approximately 40 feet from the REX pipeline centerline and within the 160-foot surveyed area. Any ground-disturbing activities associated with construction of the proposed Keystone project will be within the 160-foot-wide surveyed corridor. For any pipeline facilities that fall outside of the survey corridor (e.g., extra workspace areas), additional cultural resource field surveys will be conducted at those locations in early 2007.

The remaining approximately 100 miles of the proposed Keystone pipeline corridor in Missouri parallels an existing pipeline. Survey within selected survey areas included close inspection of a 200-foot-wide corridor. The edge of the 200-foot-wide survey corridor was located 40 feet from the proposed centerline on the side with the existing pipeline and 160 feet from the centerline on the other side. At this time, approximately 42 miles of selected survey areas in Missouri remain to be surveyed.

To date, 55 cultural resource sites have been located within the 200-foot-wide survey corridor. These include prehistoric field camps and limited activity sites, and historic farmsteads. Seventeen are prehistoric sites that are potentially eligible for the NRHP. Avoidance or evaluative testing was recommended for these 17 potentially eligible sites. Five of the sites are located along the segment of the proposed pipeline route that parallels the REX pipeline. At this time, it is unknown whether or not these five sites will be avoided by reroutes or tested. For 11 of the sites, avoidance was not feasible, therefore, in September 2006, evaluative testing was started at eight of the 11 sites. As a result of the testing, five of the eight sites were determined not eligible for listing on the NRHP; testing is ongoing at the remaining three sites. Testing at three of the 11 sites will begin once access is obtained from the landowners. The remaining potentially eligible site recently was located during field surveys. It is not known at this time whether the site can be avoided by a reroute. If avoidance is not feasible, the site will be tested.

Geomorphological investigations were conducted at the 52 stream-valley locations identified in the research design. Core samples were taken at 38 crossings; core sampling at the remaining locations is ongoing. To date, follow-up backhoe trenching is recommended at 18 of the stream crossings as a result of the core sampling. At this time, the schedule for the backhoe trenching has not been determined.

A preliminary report on the field surveys and evaluative testing conducted to date as part of the proposed Keystone pipeline project was submitted to the Missouri SHPO on October 17, 2006, and is being provided to the Department of State.

Illinois

In January 2006, ARG prepared a research design for the cultural resources field inventory conducted along the proposed route in Illinois (ARG 2006b). ARG developed the research design in consultation with the Illinois SHPO. The survey strategy proposed in the research design included an intensive field survey and geomorphological investigations of the entire 56 miles of proposed route in Illinois. In a letter dated May 18, 2006, the Illinois SHPO concurred with the proposed cultural resources survey protocol as defined in the research design (Haaker 2006). The research design and SHPO concurrence letter were included in the September 15, 2006 submittal.

During the week of January 5, 2006, ARG conducted a literature and files search of an area two miles wide centered on the proposed pipeline centerline, through the Illinois Historic Preservation Agency (IHPA). Historic maps and atlases also were examined in order to identify potential historic sites within the proposed pipeline corridor. Due to the large number of sites located within the two-mile-wide study corridor, only those sites within 0.25 mile of the proposed pipeline centerline are discussed here. The literature and files search identified 49 previously documented cultural resources within 0.25 mile of the proposed pipeline centerline; 20 of these extend into the proposed pipeline corridor. The majority of the previously documented sites were recorded more than 30 years ago, therefore, there is little available information for many of the sites.

Of the 20 cultural resources located within 0.25 mile of the proposed pipeline centerline, 17 are prehistoric sites, one is a historic site, and two are of unknown age or cultural affiliation. Review of historic maps indicated the presence of 45 potential historic sites within the proposed pipeline corridor. These included 42 structures, two schools, and one church and cemetery. In addition to reviewing the historic maps, early 19th Century GLO plats were examined in order to determine if any cultural features are present in the proposed pipeline corridor; however, none were identified.

Based on review of USGS topographic maps of the proposed route, 18 stream valley locations were evaluated as having the potential for containing buried cultural features, therefore, they were selected for geomorphological investigations. Two of the selected stream valleys are rivers: Mississippi River and Kaskaskia River. Thirteen of the remaining drainages are perennial streams and three are intermittent tributaries. The geomorphological investigations entailed visiting the identified locations and testing the soil with a sampling tube. For those areas that produced evidence of buried cultural deposits, the location will be further evaluated using backhoe trenching.

Results of Field Investigations

The entire length of the proposed Keystone pipeline corridor in Illinois parallels an existing pipeline. Field survey included close inspection of a 200-foot-wide corridor along the proposed pipeline route. The edge of the 200-foot-wide survey corridor was located 40 feet from the proposed centerline on the side with the existing pipeline and 160 feet from the centerline on the other side. Approximately eight miles in Illinois remain to be surveyed.

To date, 33 cultural resource sites and one isolated find have been located within the 200-foot-wide survey corridor. These included prehistoric field camps and limited activity sites, historic farmsteads, and debris scatter. Of these, 10 are prehistoric sites that are potentially eligible for the NRHP. Avoidance or evaluative testing was recommended for the 10 potentially eligible sites. Two of the 10 sites may be avoided by rerouting the proposed pipeline centerline, therefore, testing is on hold until the reroutes are confirmed.

Avoidance was not feasible for the remaining eight sites, therefore, in September 2006, evaluative testing was started at the eight sites. As a result of the testing, one of the sites was determined eligible for listing on the NRHP, three of the sites were determined not eligible for the NRHP, and eligibility of the remaining four sites is pending completion of the testing.

Core sampling at the 18 stream-valley locations identified in the research design is currently ongoing. Results of the coring are being submitted to the Department of State.

A preliminary survey report, which will include the results of the field surveys, testing, and geomorphological investigations, will be submitted to the Illinois SHPO and Department of State in December 2006.

CUSHING EXTENSION

Nebraska

In February 2006, SWCA prepared a research design for the cultural resources field inventory to be conducted along the Nebraska segment of the proposed Cushing Extension (SWCA 2006b). The cultural resources investigations to be conducted along the proposed extension will be the same as described above for the proposed mainline route in Nebraska. In a letter dated March 8, 2006, the Nebraska SHPO concurred with the proposed cultural resources inventory protocol as defined in the research design developed for the Nebraska segment of the proposed Keystone pipeline project (Steinacher 2006b). The research design and SHPO concurrence letter are included in the September 15, 2006 submittal.

In March 2006, SWCA conducted a literature and files search of an area two miles wide centered on the proposed pipeline centerline through the Nebraska SHPO. As a result of the literature and files search, one previously documented archaeological site was identified within the two-mile-wide study corridor. The site was identified as a historic water-powered mill built around 1881.

Results of Field Investigations

Approximately two miles of the proposed Cushing Extension will cross Nebraska. At this time, cultural resources field surveys and geomorphological investigations have not been conducted along this segment of the proposed extension. It is anticipated that field surveys and geomorphological investigations will start in February 2007, weather permitting, and be completed by summer 2007. Results of the field surveys and geomorphological investigations will be documented in a survey report and submitted to the Nebraska SHPO and Department of State.

Kansas

In March 2006, ARG prepared a research design for the cultural resources inventory and geomorphological investigations to be conducted along the Kansas segment of the proposed Cushing Extension (ARG 2006c). The inventory and geomorphological investigations proposed in the research design are the same as those described above for the proposed mainline route through Kansas with the exception of the number of miles recommended for intensive pedestrian field survey and number of stream valley locations identified for geomorphological investigations. Approximately 85 miles of the approximately 210-mile pipeline extension in Kansas have been selected for an intensive pedestrian field survey and 39 stream valley locations have been selected for geomorphological investigations. In a letter dated March 17, 2006, the Kansas SHPO concurred with the proposed cultural resources inventory protocol as defined in the research design (Weston 2006b). The research design and SHPO concurrence letter are included in the September 15, 2006 submittal.

ARG conducted a literature and files search of an area two miles wide centered on the proposed pipeline centerline through the Kansas State Historic Society's website during the week of February 20, 2006. The 1887 atlas of the state of Kansas and mid-19th Century GLO plats also were consulted in order to identify potential historic sites within the proposed pipeline corridor. The literature and files search identified

66 previously documented cultural resources within the two-mile-wide study corridor; eight of the resources are within 500 feet of the proposed pipeline centerline. The eight cultural resources include a historic village, camp, and artifact scatter, and five prehistoric camps/sites. Review of the GLO plats and state atlas indicated the presence of 29 potential historic sites within and adjacent to the proposed pipeline corridor. The sites include seven schools, one church, two cemeteries, six towns, two mills, and 11 roads.

A number of important historic trails spanned northeastern Kansas, many of which played important roles in facilitating western expansion in the mid-19th Century. Two of these trails will be crossed by the proposed Cushing Extension: Mormon Trail and Santa Fe and Westport Road (Santa Fe Trail). Prior to the Civil War, Westport, which is located near present-day Kansas City, was a popular shipping and travel stop on the route to Santa Fe. The Gold Rush of the late 1840s to 1850 increased the importance of Westport as an outfitting and trade port. In the 1850s, Mormon emigrants traveled to the Kansas Territory and stopped at Westport to purchase wagons, oxen, and supplies for the trip across the plains to Utah.

Results of Field Investigations

Approximately 210 miles of the proposed Cushing Extension will cross Kansas. At this time, cultural resources field surveys and geomorphological investigations have not been conducted along this segment of the proposed extension. It is anticipated that field surveys and geomorphological investigations of selected survey areas will start in February 2007, weather permitting, and be completed by summer 2007. The results of the field surveys and geomorphological investigations will be documented in a survey report and submitted to the Kansas SHPO and Department of State.

Oklahoma

In February 2006, GeoMarine, Inc. prepared a research design for the cultural resources inventory and geomorphological investigations to be conducted along the Oklahoma segment of the proposed Cushing Extension (Jones and Kuehn 2006). The research design was developed in consultation with the Oklahoma SHPO. Preparation of the research design involved the identification of previously recorded sites and previously conducted inventories in the vicinity of the proposed pipeline corridor, a geomorphological reconnaissance along the proposed route, construction of a GIS layer including topographic features, and probability modeling. In a letter dated March 28, 2006, the Oklahoma SHPO concurred with the proposed cultural resources survey protocol as defined in the research design (Brooks 2006). The research design and SHPO concurrence letter are included in the September 15, 2006 submittal.

GeoMarine conducted a literature and files search of an area one mile wide centered on the proposed pipeline centerline through the Oklahoma SHPO, Oklahoma Archaeological Survey (OAS), and the NRHP database for Kay, Noble, Osage, Payne, and Pawnee counties. GLO maps currently on microfiche also were examined. The literature and files search identified 61 cultural resources in the one-mile-wide study corridor; 16 of the resources are located with 250 feet of the proposed pipeline centerline. Of the 16 cultural resources, two are prehistoric lithic scatters, four are prehistoric open habitation sites, one is a prehistoric open camp, six are historic farmsteads, one is a historic homestead and associated scatter, one consists of historic stone mounds/rock piles, and one is an original aircraft maintenance site. No GLO structures were identified in or near the proposed pipeline corridor.

On February 22 through 24, 2006, GeoMarine conducted a geomorphological windshield reconnaissance along the proposed route for the purposes of assessing the potential for buried cultural resources, to identify areas of heavy cultural disturbance, and identify areas that may require backhoe trenching. Access to the proposed route was not obtained at the time of the reconnaissance, therefore, the reconnaissance consisted of driving state, county, and local farm roads with the goal of intersecting the proposed route as frequently as possible. As a result of the geomorphological reconnaissance, 15 areas were identified as having "good" potential for buried archaeological sites, 14 were identified as having "good to fair" potential, 25 were identified as having "fair" potential, and 20 areas along the proposed route were identified as having "poor" potential for buried archaeological sites.

Thirteen of the 15 areas identified during the geomorphological reconnaissance as having "good" potential for buried archaeological sites are recommended for backhoe trenching. These areas correspond with the floodplains of Bois d' Arc Creek, the Salt Fork River, Red Rock Creek, Black Bear Creek, Long Branch Creek, and Cimarron River. The total number of miles recommended for backhoe trenching is approximately 9.4 miles or 11.8 percent of the total distance of the proposed Cushing Extension in Oklahoma.

Based on the results of the literature and files search and geomorphological reconnaissance, an intensive cultural resources field inventory is recommended for the entire approximately 80 miles of the proposed Cushing Extension in Oklahoma. The intensive field inventory will consist of close inspection of a 300-foot-wide corridor centered on the proposed pipeline centerline. Shovel testing is recommended along moderate probability segments (approximately 16.5 miles) of the proposed pipeline corridor. Moderate probability segments are defined as those areas that are within 650 feet of a previously identified site and/or 1,312 feet of a secondary tributary crossing. During the field inventory, the field archaeologist may recommend additional shovel testing in other areas.

Results of Field Investigations

Approximately 80 miles of the proposed Cushing Extension will cross Oklahoma. At this time, cultural resources field surveys have not been conducted along this segment of the proposed extension. It is anticipated that field surveys will start in February 2007, weather permitting, and be completed by summer 2007. Results of the field surveys will be documented in a survey report and submitted to the Oklahoma SHPO and Department of State.

3.10 Native American Consultation

Various federal statutes require consultation 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 regarding Native American consultation and include Section 106 NHPA of 1966, as amended; EO 13007; The AIRFA of 1978; and the NAGPRA of 1990.

Section 106 of NHPA requires all federal agencies to take into account the effects of their actions on historic properties and provide the Advisory Council on Historic Preservation (ACHP) with an opportunity to comment on those actions and the manner in which federal agencies are taking historic properties into account in their decisions.

EO 13007 requires federal agencies to accommodate access to and ceremonial use of Native American sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. It also requires agencies to develop procedures for reasonable notification of proposed actions or land management policies that may restrict access to or ceremonial use of, or adversely affect, sacred sites.

AIRFA established federal policy of protecting and preserving the inherent right of individual Native Americans to believe, express, and exercise their traditional religions. The legislation established that laws passed for other purposes were not meant to restrict the rights of Native Americans.

NAGPRA established a means for Native Americans, including Indian Tribes, to request the return of human remains and other sensitive cultural items held by federal agencies or federally assisted museums or institutions. NAGPRA also contains provisions regarding the intentional excavation and removal of, inadvertent discovery of, and illegal trafficking in Native American human remains and sensitive cultural items.

Consultation includes the identification of places (i.e., physical locations) of traditional cultural importance to Native American tribes. Places that may be of traditional cultural importance to Native American people include, but are not limited to, locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world; locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken. Additionally, some of these locations may be considered sacred to particular Native American individuals or tribes. The Department of State must take into account the effects of the proposed Keystone Project on these types of locations.

If a resource has been identified as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property (TCP). The term "traditional cultural property" first came into use within the federal legal framework for historic preservation and cultural resource management in an attempt to categorize historic properties containing traditional cultural significance. National Register Bulletin 38: *Guidelines for Evaluating and Documenting Traditional Cultural Properties* (Parker and King 1989) defines a TCP as "one that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identify of the community." To qualify for nomination to the NRHP, a TCP must be more than 50 years old, must be a place with definable boundaries, must retain integrity, and meet certain criteria as outlined in National Register Bulletin 15 (NPS 1995).

<u>KEYSTONE MAINLINE</u>

In compliance with the above-mentioned federal laws, Metcalf and ARG initiated Native American consultation by sending letters to the Native American tribes listed below. These tribes were identified as potentially falling within the consultation requirements of the above discussed statutes. The letters were sent to inform the various tribes of the proposed undertaking and solicit their concerns regarding the possible presence of properties of cultural, religious, and/or traditional importance to the tribes in the proposed project area. **Table 3.10-1** lists the Native American tribes that have been contacted and the status of consultation.

Table 3.10-1 Keystone Tribal Contact List

State	Tribe	Date of Contact	Status
Illinois	Peoria Tribe of Indians of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Iowa Tribe of Kansas and Nebraska	June 13, 2006	No reply at this time.
Missouri	Iowa Tribe of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Sac and Fox of the Missouri In Kansas and Nebraska	June 13, 2006	No reply at this time.
Missouri	Sac and Fox Nation of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Sac and Fox Tribe of the Mississippi in Iowa	June 13, 2006	No reply at this time.
Missouri	Choctaw Nation of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Jena Band of Choctaw Indians	June 13, 2006	No reply at this time.
Missouri	Eastern Shawnee Tribe of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Miami Tribe of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Muscogee (Creek) Nation of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Kaw Indian Tribe of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Delaware Nation	June 13, 2006	No reply at this time.
Missouri	Cherokee Nation of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Quapaw Tribe of Oklahoma	June 13, 2006	No reply at this time.
Missouri	Absentee-Shawnee Tribe of Indians of Oklahoma	June 13, 2006	No reply at this time.
Nebraska	Omaha Tribe of Nebraska and Iowa	June 14, 2006	No reply at this time.
Nebraska	Pawnee Nation of Oklahoma	June 14, 2006	No reply at this time.
Nebraska	Santee Sioux Nation	June 14, 2006	No reply at this time.
Nebraska	Delaware Nation	June 14, 2006	No reply at this time.
Nebraska	Iowa Tribe of Kansas and Nebraska	June 14, 2006	No reply at this time.
Nebraska	Iowa Tribe of Oklahoma	June 14, 2006	No reply at this time.
Nebraska	Kaw Indian Tribe of Oklahoma	June 14, 2006	No reply at this time.
Nebraska	Ponca Tribe of Nebraska	June 14, 2006	No reply at this time.
Nebraska	Sac and Fox of the Missouri in Kansas and Nebraska	June 14, 2006	No reply at this time.
Nebraska	Sac and Fox Nation of Oklahoma	June 14, 2006	No reply at this time.
Nebraska	Sac and Fox Tribe of the Mississippi in Iowa	June 14, 2006	No reply at this time.
Nebraska	Winnebago Tribe	June 14, 2006	No reply at this time.
Nebraska	Otoe-Missouria Tribe of Indians, Oklahoma	June 14, 2006	No reply at this time.
North Dakota	Three Affiliated Tribes	June 13, 2006	On July 6, 2006, Elgin Crows Breast and Calvin Grinnel of the Three Affiliated Tribes contacted Metcalf Archaeological Consultants. See below for expanded discussion.
North Dakota	Spirit Lake	June 13, 2006	No reply at this time.
North Dakota	Standing Rock Sioux	June 13, 2006	No reply at this time.
North Dakota	Turtle Mountain Chippewa	June 13, 2006	No reply at this time.

Table 3.10-1 Keystone Tribal Contact List

State	Tribe	Date of Contact	Status
South Dakota	Cheyenne River	June 13, 2006	No reply at this time.
South Dakota	Flandreau Santee Sioux Tribe	June 13, 2006	No reply at this time.
South Dakota	Oglala Sioux	June 13, 2006	No reply at this time.
South Dakota	Rosebud Sioux	June 13, 2006	No reply at this time.
South Dakota	Yankton Sioux	June 13, 2006	No reply at this time.
South Dakota	Sisseton-Wahpeton Oyate	June 13, 2006	On August 14, 2006, James Whitted of the Sisseton Tribal Historic Preservation Office contacted Metcalf Archaeological Consultants. See below for expanded discussion.
South Dakota	Crow Creek Sioux	June 13, 2006	No reply at this time.
South Dakota	Lower Brule Sioux	June 13, 2006	No reply at this time.
Montana tribes with traditional ties to the project area	Crow	June 13, 2006	No reply at this time.
Montana	Fort Peck	June 13, 2006	No reply at this time.
Montana	Northern Cheyenne	June 13, 2006	No reply at this time.

Currently, two of the tribes (Three Affiliated Tribes and Sisseton-Wahpeton Oyate) have responded to the consultation letters. On July 6, 2006, Elgin Crows Breast and Calvin Grinnel of the Three Affiliated Tribes (Fort Berthold Indian Reservation) telephoned Metcalf Archaeological Consultants regarding the proposed project and left a message. The tribe wanted to know if they would be reimbursed for per diem and travel expenses. There was no mention of a site visit or request for additional information. Subsequently, the Department of State has indicated that it will conduct further tribal consultations; Keystone forwarded all information regarding its tribal consultation activities to the Department of State on September 15, 2006. On August 14, 2006, James Whitted of the Sisseton Tribal Historic Preservation Office contacted Metcalf Archaeological Consultants to discuss the proposed project. Mr. Whitted was informed of two possible cairns located in South Dakota and that avoidance of these sites was recommended. He appreciated the information regarding avoidance of these sites and requested a visit to the sites prior to construction and to possibly monitor the sites during construction. Additionally, Mr. Whitted would like to get copies of the survey report and site forms when available, and updates on pipeline progress from time to time. He was told that his concerns would be forwarded to the appropriate people.

CUSHING EXTENSION

The following is a list of the Native American tribes that Keystone will contact regarding cultural resource field surveys prior to their start along the proposed extension:

- Cheyenne-Arapaho Tribes of Oklahoma
- Delaware
- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma
- Kansa
- Kickapoo Tribe of Indians
- Omaha Tribe of Oklahoma
- Osage Nation

- Otoe-Missouria Tribe of Indians
- Pawnee Indian Tribe of Oklahoma
- Sac & Fox Nation of Oklahoma
- Sac & Fox Tribe of Missouri in Kansas and Nebraska
- Sac & Fox Tribe of the Mississippi Iowa
- Stockbridge-Munsee Tribe
- United Keetoowah Band of Cherokee
- Wichita and Affiliated Tribes
- Caddo Nation
- Cherokee Nation
- Kaw Nation
- Osage Nation
- Otoe-Missouria Tribe of Indians, Oklahoma
- Iowa Tribe of Oklahoma
- Pawnee Nation of Oklahoma
- Ponca Tribe of Indians of Oklahoma
- Tonkawa Tribe of Indians of Oklahoma
- Wichita and Affiliated Tribes

3.11 Social and Economic Conditions

The proposed Keystone Mainline route crosses 48 counties in six states: North Dakota, South Dakota, Nebraska, Kansas, Missouri, and Illinois. The Cushing Extension would add 10 counties in the states of Kansas and Oklahoma. Counties crossed are listed by state in **Table 3.11-1**.

Table 3.11-1 States and Counties Crossed by the Keystone Pipeline Project

State	Number of Counties	Counties
KEYSTONE MAINLINE		
North Dakota	9	Cavalier, Pembina, Walsh, Nelson, Steele, Barnes, Ransom, Sargent, and Dickey
South Dakota	11	Brown, Marshall, Day, Clark, Beadle, Kingsbury, Miner, Hanson, McCook, Hutchinson, and Yankton
Nebraska	10	Cedar, Wayne, Stanton, Platte, Colfax, Butler, Seward, Saline, Jefferson, and Gage
Kansas	4	Marshall, Nemaha, Brown, and Doniphan
Missouri	10	Buchanan, Clinton, Caldwell, Carroll, Chariton, Randolph, Audrain, Montgomery, Lincoln, and St. Charles
Illinois	4	Madison, Bond, Fayette, and Marion
CUSHING EXTENSION		
Nebraska[1]	1	Jefferson
Kansas	6	Washington, Clay, Dickinson, Marion, Butler, and Cowley
Oklahoma	4	Kay, Noble, and Payne

[1]*Addressed in Keystone Mainline.*

A list of communities that may be affected by the proposed project and their respective year 2000 population statistics are shown in **Table 3.11-2**. This list identifies all communities within one-half and two miles of the project.

3.11.1 Population, Employment, and Income

Table 3.11-3 summarizes the population, unemployment rate, and income trends in the counties crossed by the proposed route. 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. Exceptions to this include Buchanan County, Missouri, which includes the St. Joseph metropolitan area; two Missouri and one Illinois counties in the greater St. Louis metropolitan area; Marion County, Illinois, and Payne County, Oklahoma, on the Cushing Extension, which includes the Stillwater metropolitan area.

In general, populations in affected counties in North Dakota, South Dakota, and Kansas have declined from 1990 to 2000, with North Dakota experiencing the greatest overall loss. The only county in South Dakota with substantial increase in population was Yankton County, which also is the most densely populated county. In contrast, populations in affected counties in Nebraska, Missouri, and Illinois generally have increased from 1990 to 2000, with the greatest overall increase experienced in Missouri, particularly in the two counties in the greater St. Louis metropolitan area.

Table 3.11-2 Affected Communities Along the Keystone Pipeline Project

State / Community[2]	County	Relative Proximity to Project (miles)	Population (2000)
KEYSTONE MAINLINE			
NORTH DAKOTA			
Lankin	Walsh	0.5	131
Walhalla	Pembina	2	1,057
Sharon	Steele	2	109
Fort Ransom	Ransom	2	70
Niagara	Grand Forks	2	57
Sibley	Barnes	2	46
Luverne	Steele	2	44
SOUTH DAKOTA			
Yankton	Yankton	0.5	13,528
Iroquios	Kingsbury	0.5	278
Raymond	Clark	0.5	86
Roswell	Miner	0.5	21
Emery	Hansen	2	439
Carthage	Miner	2	187
Spencer	McCook	2	157
NEBRASKA			
Leigh	Colfax	0.5	442
Richland	Colfax	0.5	89
Garrison	Butler	0.5	67
Sholes	Wayne	0.5	24
Seward	Seward	2	6,319
Stanton	Stanton	2	1,627
Randolph	Cedar	2	955
Dorchester	Saline	2	615
Plymouth	Jefferson	2	477
Bellwood	Butler	2	446
Hoskins	Wayne	2	283
Staplehurst	Seward	2	270
Fordyce	Cedar	2	182
Swanton	Saline	2	106
Steele City	Jefferson	2	84
Harbine	Jefferson	2	56
KANSAS			
Seneca	Nemaha	2	2,122
Fairview	Brown	2	271
Denton	Doniphan	2	186
Severance	Doniphan	2	108
Oketo	Marshall	2	87
Oneida	Nemaha	2	70
MISSOURI			
Troy	Lincoln	0.5	6,737
Moscow Mills	Lincoln	0.5	1,742

Table 3.11-2 Affected Communities Along the Keystone Pipeline Project

State / Community[2]	County	Relative Proximity to Project (miles)	Population (2000)
Salisbury	Chariton	0.5	1,726
Agency	Buchanan	0.5	599
West Alton	St. Charles	0.5	573
Keytesville	Chariton	0.5	533
Cowgill	Caldwell	0.5	247
Renick	Randolph	0.5	221
Chain of Rocks	Lincoln	0.5	91
St. Joseph	Buchanan	2	73,990
St. Charles	St. Charles	2	60,321
St. Peters	St. Charles	2	51,381
Moberly	Randolph	2	11,945
Mexico	Audrain	2	11,320
St. Paul	St. Charles	2	1,634
Gower	Buchanan	2	1,399
Polo	Caldwell	2	582
Bosworth	Carroll	2	382
Portage Des Sioux	St. Charles	2	351
Old Monroe	Lincoln	2	250
Tina	Carroll	2	193
Turney	Clinton	2	155
Fountain N' Lakes	Lincoln	2	129
Truxton	Lincoln	2	96
Triplett	Chariton	2	64
Cave	Lincoln	2	7
ILLINOIS			
Edwardsville	Madison	0.5	21,491
Highland	Madison	0.5	8,438
South Roxana	Madison	0.5	1,888
Roxana	Madison	0.5	1,547
Hartford	Madison	0.5	1,545
Pocahontas	Bond	0.5	727
Grantfork	Madison	0.5	254
Vernon	Marion	0.5	178
Granite City	Madison	2	31,301
Alton	Madison	2	30,496
Godfrey	Madison	2	16,286
Wood River	Madison	2	11,296
East Alton	Madison	2	6,830
Patoka	Marion	2	633
CUSHING EXTENSION			
NEBRASKA			
Steele City[3]	Jefferson	2	84
KANSAS			
Towanda	Butler	0.5	1,338

Table 3.11-2 Affected Communities Along the Keystone Pipeline Project

State / Community[2]	County	Relative Proximity to Project (miles)	Population (2000)
Chapman	Dickinson	0.5	1,241
Potwin	Butler	0.5	457
Greenleaf	Washington	0.5	357
Hollenberg	Washington	0.5	31
Winfield	Cowley	2	12,206
Arkansas City	Cowley	2	11,963
Augusta	Butler	2	8,423
Marion	Marion	2	2,110
Douglass	Butler	2	1,813
Washington	Washington	2	1,223
Wakefield	Clay	2	838
Hope	Dickinson	2	372
Green	Clay	2	147
Ramona	Marion	2	94
OKLAHOMA			
Ponca City	Kay	0.5	25,919
Cushing	Payne	0.5	8,371
Newkirk	Kay	2	2,243
Morrison	Noble	2	636
Marland	Noble	2	280

[1]Affected communities include those communities where new pipeline facilities or surface disturbing activities associated with pipeline refurbishment are proposed.

[2]Communities are listed in order by state as the proposed project crosses from north to south, proximity to proposed project centerline, and descending size based on year 2000 population.

[3]Addressed in Keystone Mainline.

Sources: Census 2000; ESRI 2005.

Table 3.11-3 Socioeconomic Conditions in Affected Counties[1] Along the Keystone Pipeline Project

State / County[2]	Population 1990	Population 2000	% Change in Population 1990-2000	Population Density (per square mile) 2000	Per Capita Personal Income ($) 1999	Median Household Income ($) 1999	Unemployment Rate (%) November 2005
KEYSTONE MAINLINE							
NORTH DAKOTA	**639,005**	**642,200**	**0.5**	**9.3**	**$17,169**	**$34,604**	**4.6**
Cavalier	6,061	4,831	-20.3	3.2	15,817	31,868	2.9
Pembina	9,241	8,585	-7.1	7.7	18,692	36,430	5.9
Walsh	13,842	12,389	-10.5	9.7	16,496	33,845	4.3
Nelson	4,412	3,715	-15.8	3.8	16,320	28,892	3.0
Steele	2,420	2,258	-6.7	3.2	17,601	35,757	2.0
Barnes	12,540	11,775	-6.1	7.9	16,566	31,166	2.5
Ransom	5,920	5,890	-0.5	6.8	18,219	37,672	2.4
Sargent	4,548	4,366	-4.0	5.1	18,689	37,213	2.0
Dickey	6,105	5,757	-5.7	5.1	15,846	29,231	2.3
SOUTH DAKOTA	**695,709**	**754,844**	**8.5**	**9.9**	**$17,562**	**$35,282**	**4.4**
Brown	35,567	35,460	-0.3	20.7	18,464	35,017	2.8
Marshall	4,842	4,576	-5.5	5.5	15,462	30,567	5.0
Day	6,979	6,267	-10.2	6.1	15,856	30,227	5.5
Clark	4,403	4,143	-5.9	4.3	15,597	30,208	4.9
Beadle	18,245	17,023	-6.7	13.5	17,832	30,510	4.6
Kingsbury	5,928	5,815	-1.9	6.9	16,522	31,262	3.9
Miner	3,274	2,884	-11.9	5.1	15,155	29,519	4.9
Hanson	2,995	3,139	4.8	7.2	14,778	33,049	3.1
McCook	5,690	5,832	2.5	10.2	16,374	35,396	3.5
Hutchinson	8,265	8,075	-2.3	9.9	15,922	30,026	3.9
Yankton	19,246	21,652	12.5	41.5	17,312	35,374	3.5
NEBRASKA	**1,578,656**	**1,711,263**	**8.4**	**22.3**	**$19,613**	**$39,250**	**3.5**
Cedar	10,132	9,615	-5.1	13.0	15,515	33,435	2.4
Wayne	9,364	9,851	5.2	22.2	14,644	32,366	2.5
Stanton	6,243	6,455	3.4	15.0	15,511	36,676	3.2
Platte	29,814	31,662	6.2	46.7	18,064	39,359	3.3
Colfax	9,143	10,441	14.2	25.3	15,148	35,849	2.5
Butler	8,604	8,767	1.9	15.0	16,394	36,331	3.2

Table 3.11-3 Socioeconomic Conditions in Affected Counties[1] Along the Keystone Pipeline Project

State / County[2]	Population 1990	Population 2000	% Change in Population 1990-2000	Population Density (per square mile) 2000	Per Capita Personal Income ($) 1999	Median Household Income ($) 1999	Unemployment Rate (%) November 2005
Seward	15,446	16,496	6.8	28.7	18,379	42,700	2.7
Saline	12,712	13,843	8.9	24.1	16,287	35,914	2.9
Jefferson	8,762	8,333	-4.9	14.5	18,380	32,629	3.4
Gage	22,788	22,993	0.9	26.9	17,190	34,908	4.2
KANSAS	**2,477,805**	**2,688,418**	**8.5**	**32.9**	**$20,506**	**$40,624**	**4.2**
Marshall	11,702	10,965	-6.3	12.1	17,090	32,089	4.3
Nemaha	10,445	10,717	2.6	14.9	17,121	34,296	3.9
Brown	11,124	10,724	-3.6	18.8	15,163	31,971	4.6
Doniphan	8,135	8,249	1.4	21.0	14,849	32,537	7.1
MISSOURI	**5,119,132**	**5,595,211**	**9.3**	**81.2**	**$19,936**	**$37,934**	**5.3**
Buchanan	83,090	85,998	3.5	209.9	17,882	34,704	5.6
Clinton	16,590	18,979	14.4	45.3	19,056	41,329	5.0
Caldwell	8,382	8,969	7.0	20.9	15,343	31,240	5.6
Carroll	10,747	10,285	-4.3	14.8	15,522	30,643	5.2
Chariton	9,202	8,438	-8.3	11.2	15,515	32,285	5.8
Randolph	24,371	24,663	1.2	51.1	15,010	31,464	4.9
Audrain	23,589	25,853	9.6	37.3	16,441	32,057	5.4
Montgomery	11,353	12,136	6.9	22.6	15,092	32,772	5.4
Lincoln	28,890	38,944	34.8	61.8	17,149	42,592	4.6
St. Charles	212,806	283,883	33.4	506.6	23,592	57,258	3.9
ILLINOIS	**11,435,813**	**12,419,293**	**8.6**	**223.4**	**$23,104**	**$46,590**	**6.0**
Madison	249,221	258,941	3.9	357.2	20,509	41,541	5.0
Bond	14,994	17,633	17.6	46.4	17,947	37,680	5.1
Fayette	20,883	21,802	4.4	30.4	15,357	31,873	5.7
Marion	41,566	41,691	0.3	72.9	17,235	35,227	5.8
CUSHING EXTENSION							
NEBRASKA[3]							
KANSAS	**2,477,805**	**2,688,418**	**8.5**	**32.9**	**$20,506**	**$40,624**	**4.2**
Washington	7,070	6,483	-8.3	7.2	15,515	29,363	4.0
Clay	9,161	8,822	-3.7	13.7	17,939	33,965	4.2

Table 3.11-3 Socioeconomic Conditions in Affected Counties[1] Along the Keystone Pipeline Project

State / County[2]	Population 1990	Population 2000	% Change in Population 1990-2000	Population Density (per square mile) 2000	Per Capita Personal Income ($) 1999	Median Household Income ($) 1999	Unemployment Rate (%) November 2005
Dickinson	19,739	19,344	-2.0	22.8	17,180	35,975	4.4
Marion	12,884	13,361	3.7	14.2	16,100	34,500	4.4
Butler	50,580	59,482	17.6	41.7	20,150	45,474	5.8
Cowley	36,919	36,291	-1.7	32.2	17,509	34,406	5.9
OKLAHOMA	**3,145,537**	**3,450,654**	**9.7**	**50.3**	**$17,646**	**$33,400**	**5.3**
Kay	48,080	48,080	0.0	52.3	16,643	30,762	4.7
Noble	11,046	11,411	3.3	15.6	17,022	33,968	3.7
Payne	61,488	68,190	10.9	99.4	15,983	28,733	3.3

[1]Affected counties include those counties where new pipeline facilities or surface disturbing activities associated with pipeline refurbishment are proposed.

[2]States and counties are listed geographically from north to south as proposed project crosses the area.

[3]Addressed in Keystone Mainline.

Sources: Census 2000.

Populations in affected counties along the Cushing Extension have increased on average by approximately 5.7 percent, although four of the six affected counties in Kansas experienced decreases in population from 1990 to 2000. The overall increase in growth occurred because Butler County, Kansas, which includes the Wichita metropolitan area, experienced a significant increase in growth. Populations in all affected counties in Oklahoma remained unchanged or increased.

Average income levels vary throughout the regions, with the lowest 2000 per capita income levels occurring in Wayne County, Nebraska, Hanson County, South Dakota, and Doniphan County, Kansas. The lowest 2000 median household income levels are found in Nelson and Dickey counties in North Dakota, and Miner County, South Dakota. St. Charles County, Missouri, near St. Louis experienced the highest income levels in terms of both per capita income and median household income.

Income levels in affected counties along the Cushing Extension also vary. The lowest year 2000 per capita income level occurred in Washington County, Kansas, and the lowest median household income occurred in Payne County, Oklahoma. Butler County, Kansas, experienced the highest per capita and median household incomes for affected counties along the Cushing Extension.

The most recent civilian unemployment rates (November 2005) were relatively constant throughout the Keystone Mainline project area, ranging from approximately two to seven percent. Steele and Sargent counties in North Dakota experienced the lowest unemployment rate, while Doniphan County, Kansas, had the highest.

Unemployment rates along the Cushing Extension varied from approximately three to six percent with the lowest rate occurring in Payne County, Oklahoma and the highest rate occurring in Cowley County, Kansas.

3.11.2 Infrastructure

3.11.2.1 Housing

Housing availability across the proposed route is a function of the housing stock, recent economic and population growth, the inventory of short-term lodging accommodations, such as recreational vehicle (RV) parks and hotel and motel rooms, and demand for housing from other sources. **Table 3.11-4** summarizes the base housing stock in counties crossed by the project for 2000 and planned development for 2002. Counties in North and South Dakota tended to have the lowest total housing supply and lowest level of new development, while counties in Illinois and Missouri tended to have the highest. The lowest housing supply and growth occurred in Steele County, North Dakota, and Hanson, Miner, and Clark counties in South Dakota. Brown County, South Dakota, had the highest number of total housing units as well as the highest new development in 2002 for these two states.

Table 3.11-4 Housing Assessment for Counties along the Keystone Pipeline Project

State / County[1]	Total Housing Units (2000)	Total Rental Units (2000)	Rental Vacancy Rate (%) (2000)	Building Permits (2002)
KEYSTONE MAINLINE				
NORTH DAKOTA				
Cavalier	2,725	454	17.8	3
Pembina	4,115	902	15.3	3
Walsh	5,757	1,331	12.5	9
Nelson	2,014	373	13.7	4

Table 3.11-4 Housing Assessment for Counties along the Keystone Pipeline Project

State / County[1]	Total Housing Units (2000)	Total Rental Units (2000)	Rental Vacancy Rate (%) (2000)	Building Permits (2002)
Steele	1,231	228	7.9	0
Barnes	5,599	1,574	10.5	15
Ransom	2,604	641	9.5	37
Sargent	2,016	415	13.0	14
Dickey	2,656	779	16.4	1
ND Total in Counties Crossed	**28,717**	**6,697**	**13.0 (avg)**	**86**
SOUTH DAKOTA				
Brown	15,861	5,423	9.0	114
Marshall	2,562	482	15.1	14
Day	3,618	725	14.5	23
Clark	1,880	356	11.5	6
Beadle	8,206	2,731	15.1	48
Kingsbury	2,724	651	10.0	27
Miner	1,408	308	8.1	4
Hanson	1,218	243	4.1	NA
McCook	2,383	512	9.4	33
Hutchinson	3,517	724	6.5	9
Yankton	8,840	2,798	9.7	36
SD Total in Counties Crossed	**52,217**	**14,953**	**10.3 (avg)**	**314**
NEBRASKA				
Cedar	4,200	811	13.4	13
Wayne	3,662	1,278	5.5	10
Stanton	2,452	483	5.0	10
Platte	12,916	3,538	8.8	68
Colfax	4,088	999	8.6	5
Butler	3,901	917	9.7	10
Seward	6,428	1,793	6.2	96
Saline,	5,611	1,598	4.8	43
Jefferson	3,942	932	9.4	4
Gage	10,030	2,941	8.7	48
NE Total in Counties Crossed	**57,230**	**15,290**	**8.0 (avg)**	**307**

Table 3.11-4 Housing Assessment for Counties along the Keystone Pipeline Project

State / County[1]	Total Housing Units (2000)	Total Rental Units (2000)	Rental Vacancy Rate (%) (2000)	Building Permits (2002)
KANSAS				
Marshall	4,999	1,047	12.7	6
Nemaha	4,340	821	7.6	11
Brown	4,815	1,342	8.0	2
Doniphan	3,489	866	8.8	9
KS Total in Counties Crossed	**17,643**	**4,097**	**9.3 (avg)**	**28**
MISSOURI				
Buchanan	36,574	11,745	7.4	224
Clinton	7,877	1,627	7.4	165
Caldwell	4,493	853	6.3	0
Carroll	4,897	1,215	10.8	2
Chariton	4,250	817	17.7	4
Randolph	10,740	3,141	18.3	22
Audrain	10,881	2,849	10.5	19
Montgomery	5,726	1,147	10.5	49
Lincoln	15,511	3,010	11.2	186
St. Charles	105,514	19,489	6.1	4,990
MO Total in Counties Crossed	**206,463**	**45,893**	**10.6 (avg)**	**5,681**
ILLINOIS				
Madison	108,942	29,223	8.6	1,575
Bond	6,690	1,342	7.1	59
Fayette	9,053	1,805	8.7	9
Marion	18,022	4,195	7.4	63
IL Total in Counties Crossed	**142,707**	**36,566**	**8.0 (avg)**	**1,706**
Keystone Mainline Subtotal	**504,977**	**123,497**	**10.1 (avg)**	**8,122**
CUSHING EXTENSION				
NEBRASKA[2]				
KANSAS				
Washington	3,142	631	13.0	0
Clay	4,084	973	13.6	20
Dickinson	8,686	2,214	9.9	51

Table 3.11-4 Housing Assessment for Counties along the Keystone Pipeline Project

State / County[1]	Total Housing Units (2000)	Total Rental Units (2000)	Rental Vacancy Rate (%) (2000)	Building Permits (2002)
Marion	5,882	1,153	10.9	44
Butler	23,176	5,327	9.8	408
Cowley	15,673	4,689	12.6	24
KS Total in Counties Crossed	**60,643**	**14,987**	**11.6 (avg)**	**547**
OKLAHOMA				
Kay	21,804	6,117	11.4	32
Noble	5,082	1,268	12.2	6
Payne	29,326	12,680	7.3	167
OK Total in Counties Crossed	**56,212**	**18,287**	**10.3 (avg)**	**205**
Cushing Extension Subtotal	**116,855**	**31,602**	**11.2 (avg)**	**752**
PROJECT TOTAL	**621,832**	**158,549**	**10.3 (avg)**	**8,874**

[1]States and counties are listed geographically from north to south as proposed project crosses area.

[2]Addressed in Keystone Mainline.

NA = Data not available.

Sources: Census 2000a,b.

The greatest housing supply and growth along the route were in Missouri and Illinois, with the majority occurring in counties around the St. Louis, Missouri, and St. Joseph, Missouri, metropolitan areas. Counties throughout central Missouri had the lowest housing supply and development for these two states. Housing supply and new development along the Cushing Extension was lowest in Washington and Clay counties in Kansas and highest in Payne County, Oklahoma, and Butler County, Kansas.

A key indicator of housing availability to meet short-term needs is the number of available rental units. Among the rural counties in the northern portion of the proposed route the number of such units recorded in the 2000 Census was lowest in Steele and Nelson counties in North Dakota and in Hanson, Miner, and Clark counties in South Dakota, all with less than 400 total rental units available. A larger number of rental units was available in the more urban communities, particularly in the more southern portion of the proposed route through Missouri and Illinois near St. Joseph and St. Louis, Missouri. This trend also is true along the proposed Cushing Extension, with the lowest available rental housing occurring in Washington and Clay counties in the more rural northern parts of Kansas and the highest availability occurring near larger metropolitan areas such as Payne County, Oklahoma, near Stillwater.

The most pertinent component of local housing markets for purposes of the Keystone Pipeline Project is the inventory of short-term accommodations. Such accommodations include RV spaces, motel and hotel rooms, and mobile home spaces. In some instances, recreational cabins and seasonal housing for migratory workers also may be available. This data has not yet been collected at this time but will be gathered and assessed as the project progresses in order to determine the best means of accommodating housing needs for pipeline construction crews.

3.11.2.2 Public Services and Facilities

Table 3.11-5 outlines selected public services and facilities serving the proposed project area. In general, the public services available are functions of the size and population of the county and the number of larger communities in the county. There are multiple law enforcement providers including the respective state patrols, county sheriffs, local police departments, and special law enforcement services, such as university police. In many instances, mutual aid/cooperative agreements among agencies allow members of one agency to provide support or backup to other agencies in emergency situations.

A network of fire departments and districts provide fire protection and suppression services across the region. Many of the fire districts across the region are staffed by volunteers and are housed in stations located in the larger communities.

Table 3.11-5 lists the critical access facilities for each county that are within approximately 50 miles of the proposed route. Non-federal, short-term, acute care facilities nearest the route also are identified on the table. For each county along the proposed route there is at least one acute care facility either within the county crossed or near the proposed route in a neighboring county, providing emergency medical care and in several cases also serving as the base for local emergency medical response and transport services.

3.11.3 Fiscal Relationships

Employing a cost approach, states generally assess the value of pipelines to facilitate consistent valuation over all the counties crossed within the state. The resultant value is assigned to affected counties and taxing jurisdictions and property taxes are assessed accordingly. The effective property tax rates are then calculated using state property tax levies for pipelines, county property tax levies on pipelines, or a combination of the two. **Table 3.11-6** lists the various property tax mill levy values as well as the effective tax rates for each county along the Keystone Mainline and Cushing Extension.

Property taxes on pipelines in North Dakota are calculated using a five percent state property tax combined with county property taxes ranging from approximately 30 to 40 percent, for effective property tax rates in affected counties of approximately two percent. In South Dakota, a straight 2.15 percent property tax is applied in all counties in the state, while Nebraska uses varying county-based property taxes only, ranging from approximately 1.6 to 2.0 percent. Property taxes on pipelines in Kansas employ a combination of a 33 percent flat state property tax rate and county mill levies of approximately 10 to 14 percent to yield effective property rates ranging from approximately three to five percent in counties crossed by either the Keystone Mainline or the Cushing Extension. Missouri on the Mainline and Oklahoma on the Cushing Extension both employ a combination of a flat property tax rate for the state (32 percent in Missouri and 22.85 percent in Oklahoma) and another flat rate for each county (seven percent in Missouri and 10.5 percent in Oklahoma) for consistent effective tax rates of 2.2 and 2.4 percent, respectively. The State of Illinois does not levy property taxes on pipelines.

Other taxes levied by various state, county, or local taxing jurisdictions may include taxes on gross receipts from the sales of goods and services and corporate income taxes. Federal agencies also assess fees for use of public lands for activities such as pipeline and transmission line ROWs. These taxes and fees vary by region and have not been identified for the Keystone Pipeline Project.

3.11.4 Environmental Justice

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 FR 7629) requires that impacts on minority or low-income populations be taken into account when preparing environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by federal agencies. The Environmental Justice Guidance under NEPA prepared by the Council on Environmental Quality (CEQ Guidance) (1997) is commonly used in implementing EO 12898 in preparing NEPA documents.

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
		KEYSTONE MAINLINE	
NORTH DAKOTA			
Cavalier	2	4	Cavalier County Memorial Hospital (Langdon)
Pembina	5	8	Pembina County Memorial Hospital (Cavalier)
Walsh	3	10	First Care Health Center (Park River); Unity Med.l Center & Grafton Family Clinic (Grafton); Mercy Hospital (Devils Lake)
Nelson	2	5	Nelson County Health Systems (McVille); Northwood Deaconess Health Center (Northwood); *Altru Hospital (Grand Forks)
Steele	1	2	Copperstown Medical Center (Cooperstown); Union Hospital (Mayville); Hillsboro Medical Center (Hillsboro)
Barnes	3	8	Mercy Hospital (Valley City); Jamestown Hospital (Jamestown); *Dakota Clinic at Innovis Health (Fargo); *MeritCare Hospital (Fargo); *MeritCare South University (Fargo)
Ransom	2	3	Lisbon Area Health Services (Lisbon)
Sargent	4	4	Lisbon Area Health Services (Lisbon); Oaks Community Hospital (Oakes)
Dickey	2	5	Oaks Community Hospital (Oakes)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
SOUTH DAKOTA			
Brown	3	10	*Avera Saint Lukes (Aberdeen); *Marshall County Healthcare Center / Avera Health (Britton); Coteau Des Prairies Hospital (Sisseton)
Marshall	1	5	*Marshall County Healthcare Center / Avera Health (Britton); *Avera Saint Lukes (Aberdeen); Coteau Des Prairies Hospital (Sisseton)
Day	4	5	Lake Area Hospital (Webster)
Clark	2	3	*Prairie Lakes Healthcare Systems – Hospital (Watertown); Community Memorial Hospital (Redfield)
Beadle	3	4	*Huron Regional Medical Center (Huron)
Kingsbury	4	5	De Smet Memorial Hospital (De Smet); *Brookings Hospital (Brookings)
Miner	2	2	Madison Community Hospital (Madison); Avera Weskota Memorial Medical Center (Wessington Springs)
Hanson	1	2	*Avera Queen of Peace Hospital (Mitchell)
McCook	2	3	*Sioux Valley USD Medical Center (Sioux Falls); *Avera McKennan Hospital & University Health Center (Sioux Falls); Dell Area Health Center (Dell Rapids)
Hutchinson	6	4	Freeman Community Hospital & Nursing Home (Freeman); Avera Saint Benedict Health Center (Parkston); Douglas County Memorial Hospital (Armour); Pioneer Memorial Hospital (Viborg); Canton-Inwood Memorial Hospital (Canton)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Yankton	2	5	Landmann-Jungmann Memorial Hospital (Scotland); Saint Michael's Hospital & Nursing Home (Tyndall); *Avera Sacred Heart Hospital (Yankton); South Dakota Human Services Center (Yankton); *Sioux Valley Vermilion Medical Center (Vermillion); Wagner Community Memorial Hospital (Wagner)
NEBRASKA			
Cedar	4	8	*Avera Sacred Heart Hospital (Yankton, SD); *Sioux Valley Vermilion Medical Center (Vermillion, SD); *Lundberg Memorial Hospital (Creighton); * Mercy Medical Center (Sioux City, IA); *Saint Luke's Regional Medical Center (Sioux City, IA)
Wayne	2	3	Providence Medical Center (Wayne); Plainview Public Hospital (Plainview); Osmond General Hospital (Osmond); Pender Community Hospital (Pender)
Stanton	2	2	*Faith Regional Health Services (Norfolk); Norfolk Regional Center (Norfolk); Saint Francis Memorial Hospital (West Point)
Platte	3	5	*Columbus Community Hospital (Columbus)
Colfax	5	3	Memorial Hospital (Schuyler); Saint Francis Memorial Hospital (West Point)
Butler	2	7	Annie Jeffery Memorial County Health Center (Osceola); Butler County Health Care Center (David City)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Seward	3	5	*Bryan LGH Medical Center East / West (Lincoln); *Saint Elizabeth Regional Medical Center (Lincoln); Memorial Hospital (Seward); York General Hospital (York)
Saline	4	5	Warren Memorial Hospital (Friend); Crete Area Medical Center (Crete); Fillmore County Hospital (Geneva)
Jefferson	3	5	Jefferson Community Health Center (Fairbury); Thayer County Health Services (Hebron)
Gage	3	6	*Beatrice Community Hospital (Beatrice)
KANSAS			
Marshall	6	6	Washington County Hospital (Washington); Community Memorial Healthcare, Inc. (Marysville)
Nemaha	3	5	Sabetha Community Hospital (Sabetha); Nemaha Valley Community Hospital (Seneca); *Community Hospital Onaga, Inc. (Onaga); Humboldt Health Care Inc. (Humboldt, NE); Pawnee County Medical Center (Pawnee City, NE)
Brown	4	5	Hiawatha Community Hospital (Hiawatha); Holton Community Hospital (Holton); Community Medical Center Inc. (Falls City, NE)
Doniphan	4	4	*Atchison Hospital (Atchison); Jefferson County Memorial Hospital (Winchester)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
MISSOURI			
Buchanan	5	4	*Heartland Regional Medical Center (St. Joseph); *Saint Francis Hospital & Health Services (Maryville); *Saint Luke's Hospital (Kansas City) *Truman Medical Center (Kansas City); *North Kansas City Hospital (North Kansas City); *Baptist-Luthern Medical Center (Kansas City); *Saint Joseph Medical Center (Kansas City); *Saint Luke Hospital (Kansas City); Kindred Hospital (Kansas City)
Clinton	6	2	*Cameron Regional Medical Center (Cameron); *Saint Luke's Northland Hospital (Smithville); *Excelsior Springs Medical Center (Excelsior Springs); *Liberty Hospital (Liberty); *Independence Regional Health Center (Independence); *Medical Center of Independence (Independence)
Caldwell	6	4	*Hedrick Medical Center (Chillicothe); *Ray County Memorial Hospital (Richmond); Wright Memorial Hospital (Trenton)
Carroll	4	4	*Carroll County Memorial Hospital (Carrollton); *Fitzgibbon Hospital (Marshall); *Lafayette Regional Health Center (Lexington)
Chariton	4	6	Pershing Memorial Hospital (Brookfield)
Randolph	5	5	*Moberly Regional Medical Center (Moberly); *Cooper County Memorial Hospital (Boonville); Samaritan Hospital (Macon)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Audrain	4	5	*Audrain Medical Center (Mexico); *Boone Hospital Center (Columbia); *Columbia Regional Hospital (Columbia); *University of Missouri Hospital (Columbia)
Montgomery	6	8	Hermann Area District Hospital (Hermann)
Lincoln	9	6	Lincoln County Medical Center (Troy); *Pike County Memorial Hospital (Louisiana)
St. Charles	8	11	*Saint Luke Hospital (Chesterfield); *Northwest Healthcare (Florissant); CenterPointe Hospital (St. Charles); *Barnes-Jewish Hospital (St. Louis); *Christian Hospital (St. Louis); *Des Peres Hospital (St. Louis); *Forest Park Hospital (St. Louis); *Missouri Baptist Medical Center (St. Louis); *Saint Alexius Hospital (St. Louis); *Saint Anthony Medical Center (St. Louis); *Saint John Mercy Hospital (St. Louis); *Saint Louis University Hospital (St. Louis); *SSM DePaul Health Center (St. Louis); *SSM Saint Joseph Health Center (St. Charles/Wentzville); *SSM Saint Joseph Hospital (St. Louis/Lake St. Louis); *SSM Saint Mary Hospital (St. Charles); Kindred Hospital (St. Louis)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
ILLINOIS			
Madison	24	38	*Saint Anthony's Health Center (Alton); *Alton Memorial Hospital (Alton); *Memorial Hospital (Belleville); *Touchette Regional Hospital (Centreville); *Gateway Regional Medical Center (Granite City); *Jersey Community Hospital (Jerseyville); *Saint Elizabeth Hospital (Belleville); *Saint Joseph Hospital (Highland); *St Francis Hospital (Litchfield); *Anderson Hospital (Maryville); Community Memorial Hospital (Staunton); Thomas H Boyd Mem Hospital (Carrollton); ALSO SEE ST. CHARLES COUNTY, MISSOURI (ST. LOUIS)
Bond	4	5	*Saint Joseph Hospital (Breese); Edward A Utlaut Memorial Hospital (Greenville)
Fayette	6	6	*Fayette County Hospital (Vandalia); Hillsboro Area Hospital (Hillsboro); Washington County Hospital (Nashville)
Marion	9	8	*Saint Mary's Hospital (Centralia); *Good Samaritan Regional Health Center (Mount Vernon); *Crossroads Community Hospital (Mount Vernon); *Clay County Hospital (Flora); *St Anthony's Memorial Hospital (Effingham); Pana Community Hospital (Pana); Salem Township Hospital (Salem)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
CUSHING EXTENSION			
NEBRASKA[4]			
KANSAS			
Washington	2	10	Washington County Hospital (Washington); Community Memorial Healthcare, Inc. (Marysville); Republic County Hospital (Belleville)
Clay	4	3	Clay County Medical Center (Clay Center); *Mercy Regional Health Center (Manhattan)
Dickinson	6	8	*Morris County Hospital (Council Grove); *Salina Regional Health Center (Salina)
Marion	5	9	*Augusta Regional Medical Center (Augusta); *Mercy Hospital, Inc. (Moundridge); *Newman Regional Health (Emporia)
Butler	8	12	*Newton Medical Center (Newton); *Susan B. Allen Memorial Hospital (El Dorado); *Via Christi Riverside Medical Center (Wichita); *Wesley Medical Center (Wichita)
Cowley	6	7	*South Central Kansas Regional Medical Center (Arkansas City); *William Newton Memorial Hospital (Winfield); *Sumner Regional Medical Center (Wellington)
OKLAHOMA			
Kay	5	11	*Integris Blackwell Regional Hospital (Blackwell); *Via Christi Oklahoma Regional Medical Center (Ponca City)
Noble	3	5	*Integris Bass Baptist Health Center (Enid); *Perry Memorial Hospital (Perry); *Saint Mary's Regional Medical Center (Enid)

Table 3.11-5 Existing Public Services and Facilities Along the Pipeline Route

State / County[1]	Police/Sheriff Departments[2]	Fire Departments[2]	Nearest Medical Facilities[3]
Payne	7	5	*Cushing Regional Hospital (Cushing); *Bristow Medical Center (Bristow); *Hillcrest Medical Center (Tulsa); *Saint Francis Hospital (Tulsa); *Saint John Medical Center (Tulsa); *Stillwater Medical Center (Stillwater); *Tulsa Regional Medical Center (Tulsa); Saint John Sapulpa (Sapulpa); Prague Municipal Hospital (Prague); Logan Hospital & Medical Center (Guthrie); Cleveland Area Hospital (Cleveland); *Pawnee Municipal Hospital (Pawnee)

[1]States and counties are listed geographically from north to south as proposed project crosses the area.

[2]Includes special law enforcement units for universities. Includes volunteer, district, city, and town fire departments (Capitol Impact 2006).

[3]All facilities listed are critical access facilities within approximately 50 miles of the project; those marked with and asterisk (*) are non-federal, short-term, acute care facilities. AHD 2006.).

[4]Addressed in Keystone Mainline.

Table 3.11-6 Property Mill Levies and Tax Rates for the Keystone Pipeline Project

State/County[1]	Property Tax Mill Levy (mills)	Effective Tax Rate (%)
KEYSTONE MAINLINE		
NORTH DAKOTA		
Cavalier	324.33	1.62
Pembina	354.14	1.77
Walsh	395.51	1.98
Nelson	401.15	2.01
Steele	356.84	1.78
Barnes	370.65	1.85
Ransom	413.04	2.07
Sargent	406.01	2.03
Dickey	369.16	1.85
SOUTH DAKOTA		
Brown	21.5	2.15
Marshall	21.5	2.15
Day	21.5	2.15
Clark	21.5	2.15
Beadle	21.5	2.15
Kingsbury	21.5	2.15
Miner	21.5	2.15
Hanson	21.5	2.15
McCook	21.5	2.15
Hutchinson	21.5	2.15
Yankton	21.5	2.15
NEBRASKA		
Cedar	17.420	1.7420
Wayne	18.655	1.8655
Stanton	18.366	1.8366
Platte	16.504	1.6504
Colfax	17.900	1.7900
Butler	17.428	1.7428

Table 3.11-6 Property Mill Levies and Tax Rates for the Keystone Pipeline Project

State/County[1]	Property Tax Mill Levy (mills)	Effective Tax Rate (%)
Seward	17.730	1.7730
Saline	19.815	1.9815
Jefferson	19.620	1.9620
Gage	19.319	1.9319
KANSAS		
Marshall	123.487	4.08
Nemaha	116.84	3.86
Brown	118.295	3.90
Doniphan	103.635	3.42
MISSOURI		
Buchanan	70	2.24
Clinton	70	2.24
Caldwell	70	2.24
Carroll	70	2.24
Chariton	70	2.24
Randolph	70	2.24
Audrain	70	2.24
Montgomery	70	2.24
Lincoln	70	2.24
St. Charles	70	2.24
ILLINOIS		
Madison	0	0.00
Bond	0	0.00
Fayette	0	0.00
Marion	0	0.00
CUSHING EXTENSION		
NEBRASKA		
Jefferson	19.620	1.9620
KANSAS		
Washington	142.43	4.70
Clay	140.633	4.64

Table 3.11-6 Property Mill Levies and Tax Rates for the Keystone Pipeline Project

State/County[1]	Property Tax Mill Levy (mills)	Effective Tax Rate (%)
Dickinson	116.802	3.85
Marion	125.699	4.15
Butler	135.282	4.46
Cowley	143.694	4.74
OKLAHOMA		
Kay	105	2.40
Noble	105	2.40
Payne	105	2.40

[1]States and counties are listed geographically from north to south as proposed project crosses the area.

Source: Information was based on discussions with the counties in January 2005 to obtain current local tax rates and valuation methodology.

The purpose of the order is to avoid the disproportionate placement of any adverse environmental, economic, social, or health impacts from federal actions and policies on minority populations, low-income populations, and Indian tribes and to allow all portions of the population an opportunity to participate in the development of, compliance with, and enforcement of federal laws, regulations, and policies affecting human health of the environment regardless of race, color, national origin, or income. The provisions of the order apply to programs involving Native Americans and Hispanic communities. These requirements will be addressed by a) ensuring broad distribution of public information on the Keystone Pipeline Project through public scoping meetings and b) conducting government-to-government consultation with Native American groups either residing in or with historical ties to the project area. Details regarding public scoping meeting dates and locations can be found in Section 1.7, Public Participation and Issues, and in Appendix D, Public Consultation Summary. For an expanded discussion of Native American consultation, see Section 3.10, Native American Consultation.

3.11.4.1 Minority Populations

The CEQ Guidance defines the term "minority population" to include people who identify themselves during the Census as Black or African American, Asian or Pacific Islander, Native American or Alaskan Native, or Hispanic. Hispanic origin refers to ethnicity and language, not race, and may include people whose heritage is Puerto Rican, Cuban, Mexican, and Central or South American.

In accordance with the CEQ Guidance, minority populations should be identified where either a) the minority population in an affected area (e.g., a community) exceeds 50 percent; or b) the minority population percentage of the affected area is meaningfully greater (1.5 times) than the minority population percentage in the general population of the surrounding area (e.g., the county or other appropriate unit of geographical analysis). This is determined by multiplying the percentage of minorities in the surrounding area by 1.5. If the resulting figure exceeds the percentage of the minority population in the community, the community is not a minority population.

Tables 3.11-7 and **3.11-8** provide 2000 Bureau of the Census statistics on race, ethnicity, and income status in affected counties and communities. Affected counties are those counties crossed by the Keystone Mainline or Cushing Extension and affected communities are those in the proximity of the proposed route. Communities

Table 3.11-7 Environmental Justice Statistics in Affected Counties[1]

State / County[2]	Total Population 2000	Racial/Ethnic Categories (% of total population, 2000)[3]							Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
		White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races		
KEYSTONE MAINLINE										
NORTH DAKOTA	642,200	92.4	0.6	4.9	0.6	1.2	0.4	1.2	$43,654	8.3
Cavalier	4,831	98.1	0.1	0.5	0.1	0.6	0.1	1.0	$39,601	7.8
Pembina	8,585	95.5	0.2	1.4	0.2	3.1*	1.3	1.4	$45,338	7.4
Walsh	12,389	94.9	0.3	1.0	0.2	5.7*	2.5	1.1	$41,619	7.7
Nelson	3,715	98.6	0.1	0.3	0.3	0.2	0.1	0.6	$37,406	7.2
Steele	2,258	98.3	0.0	0.6	0.0	0.2	0.2	0.8	$43,914	5.0
Barnes	11,775	97.9	0.5	0.8	0.2	0.5	0.1	0.6	$42,149	6.4
Ransom	5,890	97.9	0.2	0.3	0.3	0.8	0.4	0.9	$44,865	6.3
Sargent	4,366	98.2	0.0	0.5	0.0	0.7	0.5	0.7	$44,063	6.0
Dickey	5,757	97.8	0.1	0.3	0.5	1.4	0.6	0.7	$36,682	11.6*
SOUTH DAKOTA	754,844	88.7	0.6	8.3	0.6	1.4	0.5	1.3	$43,237	9.3
Brown	35,460	95.5	0.3	2.7	0.5	0.7	0.2	0.9	$44,788	7.0
Marshall	4,576	92.6	0.1	6.3	0.1	0.8	0.2	0.7	$36,295	10.4*
Day	6,267	91.3	0.1	7.4	0.1	0.4	0.2	0.9	$38,011	11.4*
Clark	4,143	98.6	0.1	0.6	0.1	0.5	0.2	0.4	$35,559	10.9*
Beadle	17,023	96.9	0.7	0.9	0.3	0.9	0.3	0.8	$40,596	7.9
Kingsbury	5,815	98.5	0.1	0.4	0.3	0.7	0.2	0.5	$41,057	7.0
Miner	2,884	98.8	0.5	0.3	0.1	0.6	0.1	0.2	$36,667	8.2
Hanson	3,139	99.5	0.0	0.1	0.1	0.1	0.0	0.2	$39,500	12.5*
McCook	5,832	98.9	0.1	0.4	0.2	0.8	0.2	0.4	$42,609	5.5
Hutchinson	8,075	98.8	0.1	0.6	0.1	0.5	0.1	0.4	$37,715	9.6*
Yankton	21,652	95.1	1.2*	1.6	0.4	1.8	0.7	0.9	$43,600	6.6
NEBRASKA	1,711,263	89.6	4.0	0.9	1.3	5.5	2.8	1.4	$48,032	6.7
Cedar	9,615	99.1	0.1	0.2	0.0	0.4	0.2	0.4	$39,422	6.3
Wayne	9,851	96.8	0.9	0.3	0.3	1.5	0.9	0.7	$43,840	7.4*
Stanton	6,455	96.7	0.4	0.5	0.1	2.3	1.4	0.9	$41,040	5.3

Table 3.11-7 Environmental Justice Statistics in Affected Counties[1]

State / County[2]	Total Population 2000	Racial/Ethnic Categories (% of total population, 2000)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
Platte	31,662	94.3	0.4	0.3	0.4	6.5	3.5	1.2	$47,776	5.4
Colfax	10,441	81.7	0.1	0.2	0.2	26.2*	15.9	1.7	$40,936	7.2*
Butler	8,767	98.4	0.1	0.1	0.1	1.7	0.8	0.4	$44,441	4.8
Seward	16,496	98.0	0.3	0.2	0.3	1.1	0.4	0.7	$51,812	4.1
Saline	13,843	93.0	0.4	0.4	1.7	6.6	3.7	1.1	$44,199	6.4
Jefferson	8,333	98.4	0.1	0.4	0.2	1.3	0.5	0.4	$40,747	8.0*
Gage	22,993	97.7	0.3	0.6	0.3	0.9	0.3	0.8	$43,072	6.6
KANSAS	2,688,418	86.1	5.7	0.9	1.7	7.0	3.4	2.1	$49,624	6.7
Marshall	10,965	98.1	0.2	0.4	0.2	0.8	0.3	0.8	$39,705	6.4
Nemaha	10,717	98.3	0.5	0.2	0.1	0.7	0.2	0.6	$41,638	6.5
Brown	10,724	86.9	1.6	8.8*	0.2	2.3	0.7	1.8	$39,525	10.6*
Doniphan	8,249	94.8	2.0	1.2	0.3	1.2	0.4	1.3	$39,357	9.0*
MISSOURI	5,595,211	84.9	11.2	0.4	1.2	2.1	0.8	1.5	$46,044	8.6
Buchanan	85,998	92.7	4.4	0.4	0.4	2.4	0.6	1.4	$42,408	8.5
Clinton	18,979	96.6	1.5	0.3	0.2	1.1	0.3	1.1	$48,244	7.3
Caldwell	8,969	98.6	0.1	0.3	0.1	0.7	0.2	0.7	$37,067	9.7*
Carroll	10,285	96.9	1.7	0.3	0.1	0.7	0.1	0.8	$36,773	9.7*
Chariton	8,438	96.0	3.2	0.2	0.1	0.6	0.1	0.4	$39,176	8.8*
Randolph	24,663	90.6	7.0	0.5	0.4	1.1	0.2	1.3	$39,268	9.2*
Audrain	25,853	91.1	7.2	0.3	0.3	0.7	0.2	0.9	$40,448	11.1*
Montgomery	12,136	96.0	2.0	0.2	0.3	0.8	0.2	1.3	$38,632	8.4
Lincoln	38,944	96.1	1.7	0.4	0.2	1.1	0.4	1.1	$47,747	6.2
St. Charles	283,883	94.7	2.7	0.2	0.9	1.5	0.5	1.1	$64,415	2.8
ILLINOIS	12,419,293	73.5	15.1	0.2	3.4	12.3	5.8	1.9	$55,545	7.8
Madison	258,941	90.2	7.3	0.3	0.6	1.5	0.5	1.1	$50,862	7.2
Bond	17,633	90.7	7.4	0.5*	0.3	1.4	0.4	0.7	$45,412	6.7
Fayette	21,802	94.0	4.9	0.1	0.2	0.8	0.3	0.5	$39,044	8.42*
Marion	41,691	94.0	3.8	0.2	0.6	0.9	0.2	1.1	$41,427	8.63*

Table 3.11-7 Environmental Justice Statistics in Affected Counties[1]

State / County[2]	Total Population 2000	Racial/Ethnic Categories (% of total population, 2000)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
CUSHING EXTENSION										
NEBRASKA[7]										
KANSAS	2,688,418	86.1	5.7	0.9	1.7	7.0	3.4	2.1	$49,624	6.7
Washington	6,483	98.9	0.1	0.3	0.0	0.6	0.1	0.5	$37,260	7.3*
Clay	8,822	97.7	0.6	0.4	0.1	0.8	0.3	0.9	$41,103	6.8*
Dickinson	19,344	96.4	0.6	0.5	0.3	2.3	0.8	1.4	$43,952	5.3
Marion	13,361	97.1	0.5	0.6	0.2	1.9	0.5	1.1	$41,386	4.8
Butler	59,482	94.9	1.4	0.9	0.4	2.2	0.7	1.7	$53,632	5.4
Cowley	36,291	90.1	2.7	2.0*	1.5	3.6	1.4	2.3	$43,636	9.2*
OKLAHOMA	3,523,553	76.2	7.6	7.9	1.5	5.2	2.4	4.5	$40,709	11.2
Kay	48,080	84.2	1.8	7.5	0.5	4.3	2.0	4.0	$38,144	12.4*
Noble	11,411	86.4	1.6	7.6	0.3	1.8	0.6	3.4	$40,180	9.6
Payne	68,190	84.3	3.6	4.6	3.0*	2.1	0.8	3.6	$40,823	10.8

[1]Affected areas are those counties where existing facilities exist, or counties where new pipeline facilities or surface disturbing activities associated with pipeline refurbishment are proposed.

[2]States and counties are listed geographically from north to south as proposed project crosses the area.

[3]Minority populations defined as black, Native American or Alaskan Native, Asian Pacific Islander, or Hispanic with percentages meaningfully greater than 1.5 times that of the minority population percentage in the general population of the surrounding area (i.e., the corresponding state) are identified with an asterisk (*).

[4]Persons of Hispanic origin may be of any race, and for census-gathering purposes, Hispanic is a self-identified category. In this table individuals may have reported themselves as only Hispanic or in combination with one or more of the other races listed. This may result in the sum of percentages for all ethnic categories to be greater than 100 percent for any one county.

[5]The median family income is defined here for a family of three. The poverty threshold is defined as the average threshold for a family of three and is not adjusted for regional, state, or local variations in the cost of living.

[6]The percent of families with income below the poverty threshold in 2000, as defined by the Census Bureau for Federal statistical purposes, based on a family of three. Counties with a higher percent of the population below the poverty level than that occurring in the respective state are identified with an asterisk (*).

[7]Addressed in Keystone Mainline.

Source: Census 2000a.

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Relative Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
KEYSTONE MAINLINE										
NORTH DAKOTA		92.4	0.6	4.9	0.6	1.2	0.4	1.2	$43,654	8.3
Lankin	0.5	96.9	0.0	2.3	0.0	0.0	0.0	0.8	$40,313	0.0
Walhalla	2	89.8	0.0	6.0	0.0	0.9	0.1	4.2	$39,375	9.7*
Sharon	2	94.5	0.0	1.8	0.0	0.0	0.0	3.7	$43,125	0.0
Fort Ransom	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$31,250	11.8*
Niagara	2	94.7	0.0	1.8	0.0	0.0	0.0	3.5	$31,240	0.0
Sibley	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$17,500	14.3*
Luverne	2	97.7	0.0	2.3	0.0	0.0	0.0	0.0	$37,188	0.0
SOUTH DAKOTA		88.7	0.6	8.3	0.6	1.4	0.5	1.3	$43,237	9.3
Yankton	0.5	94.4	1.6*	1.6	0.5	2.5*	0.9	1.0	$44,009	6.2
Iroquois	0.5	95.7	0.0	0.4	0.4	2.5*	1.4	2.2	$36,250	18.8*
Raymond	0.5	96.5	0.0	0.0	0.0	4.7*	3.5	0.0	$36,250	13.6*
Roswell	0.5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$51,250	0.0
Emery	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$35,313	3.8
Carthage	2	98.9	0.0	0.0	0.0	0.0	0.0	1.1	$32,917	13.2*
Spencer	2	98.7	0.0	0.6	0.6	0.0	0.0	0.0	$34,688	7.0
NEBRASKA		89.6	4.0	0.9	1.3	5.5	2.8	1.4	$48,032	6.7
Leigh	0.5	99.5	0.0	0.0	0.0	1.8	0.0	0.6	$40,481	4.5
Richland	0.5	97.8	1.1	1.1	0.0	1.1	0.0	0.0	$33,125	0.0

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Relative Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population)[3]							Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
		White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races		
Garrison	0.5	95.5	0.0	4.5*	0.0	0.0	0.0	0.0	$51,000	0.0
Sholes	0.5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$36,250	0.0
Seward	2	98.0	0.5	0.1	0.5	1.0	0.4	0.6	$54,808	4.1
Stanton	2	97.2	0.2	0.6	0.3	2.4	1.1	0.7	$42,717	5.8
Randolph	2	99.0	0.1	0.3	0.3	0.2	0.2	0.1	$40,000	4.9
Dorchester	2	97.2	0.0	0.0	0.0	4.1	2.6	0.2	$40,982	4.1
Plymouth	2	99.4	0.0	0.0	0.0	0.8	0.4	0.2	$42,813	1.5
Bellwood	2	100.0	0.0	0.0	0.0	0.4	0.0	0.0	$39,286	1.6
Hoskins	2	99.6	0.0	0.0	0.0	0.4	0.0	0.4	$39,583	5.3
Staplehurst	2	97.4	0.0	0.0	0.4	0.4	0.0	2.2	$42,361	7.4*
Fordyce	2	100.0	0.0	0.0	0.0	4.9	0.0	0.0	$37,031	2.4
Swanton	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$52,500	0.0
Steele City	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$32,500	8.3*
Harbine	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$40,833	0.0
KANSAS		86.1	5.7	0.9	1.7	7.0	3.4	2.1	$49,624	6.7
Seneca	2	98.8	0.4	0.0	0.0	0.7	0.0	0.6	$40,819	4.4
Fairview	2	95.2	3.3	0.0	0.0	1.1	0.0	1.5	$51,607	11.0*
Denton	2	99.5	0.0	0.0	0.0	0.5	0.0	0.5	$40,625	0.0
Severance	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$27,083	21.4*
Oketo	2	95.4	0.0	0.0	0.0	0.0	0.0	4.6	$30,893	8.7*

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Relative Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[5] (%) (1999)
Oneida	2	94.1	2.9	0.0	0.0	0.0	0.0	0.0	$48,750	0.0
MISSOURI		84.9	11.2	0.4	1.2	2.1	0.8	1.5	$46,044	8.6
Troy	0.5	93.9	2.9	0.4	0.1	1.7	0.8	1.9	$46,818	7.6
Moscow Mills	0.5	94.3	3.2	0.3	0.1	0.9	0.3	1.8	$42,083	5.3
Salisbury	0.5	94.8	4.2	0.2	0.2	0.6	0.1	0.5	$41,389	7.1
Agency	0.5	98.5	0.0	0.0	0.5	1.7	0.5	0.5	$52,500	3.7
West Alton	0.5	99.1	0.0	0.2	0.2	0.5	0.5	0.0	$45,556	4.5
Keytesville	0.5	95.3	3.9	0.0	0.0	0.2	0.2	0.6	$35,568	10.9*
Cowgill	0.5	97.6	0.4	0.0	0.0	0.0	1.2	0.8	$24,444	21.2*
Renick	0.5	95.5	0.0	0.9*	0.0	0.0	0.0	3.6	$37,500	10.0*
Chain of Rocks	0.5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$38,125	7.1
St. Joseph	2	91.9	5.0	0.5	0.5	2.6	0.7	1.4	$40,995	9.1*
St. Charles	2	93.3	3.5	0.3	1.0	2.0	0.7	1.2	$60,175	4.6
St. Peters	2	94.3	2.8	0.2	1.2	1.5	0.4	1.1	$65,123	1.5
Moberly	2	90.5	6.7	0.4	0.6	1.7	0.4	0.3	$37,488	11.1*
Mexico	2	88.8	9.2	0.3	0.5	0.9	0.3	0.9	$39,406	10.0*
St. Paul	2	99.0	0.1	0.1	0.0	1.3	0.2	0.7	$68,438	1.1
Gower	2	99.4	0.1	0.1	0.0	0.8	0.0	0.4	$55,694	2.4
Polo	2	99.5	0.0	0.0	0.0	1.4	0.2	0.3	$36,705	5.2
Bosworth	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$26,750	11.7*

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Relative Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
Portage Des Sioux	2	99.1	0.0	0.3	0.0	1.4	0.6	0.0	$42,321	2.8
Old Monroe	2	98.4	0.0	0.0	0.0	2.8	0.8	0.8	$42,188	0.0
Tina	2	99.5	0.0	0.0	0.0	0.0	0.0	0.5	$34,643	5.4
Turney	2	95.5	0.6	1.3*	0.0	0.6	1.3	1.3	$36,429	6.0
Fountain N' Lakes	2	99.2	0.0	0.8*	0.0	0.0	0.0	0.0	$31,563	17.2*
Truxton	2	95.8	0.0	0.0	3.1*	1.0	0.0	1.0	$40,938	4.5
Triplett	2	87.5	7.8	1.6*	1.6	0.0	0.0	1.6	$33,750	30.8*
Cave	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	$41,250	0.0
ILLINOIS		73.5	15.1	0.2	3.4	12.3	5.8	1.9	$55,545	7.8
Edwardsville	0.5	87.7	8.7	0.3	1.7	1.0	0.3	1.4	$65,555	5.0
Highland	0.5	98.6	0.1	0.1	0.5	1.3	0.3	0.5	$52,240	3.6
South Roxana	0.5	97.7	0.3	0.4*	0.3	0.8	0.3	1.0	$37,344	17.4*
Roxana	0.5	98.5	0.1	0.3	0.3	0.6	0.4	0.5	$45,500	2.5
Hartford	0.5	98.4	0.1	0.2	0.4	0.7	0.3	0.5	$40,652	10.3*
Pocahontas	0.5	98.6	0.1	0.3	0.3	0.0	0.0	0.7	$37,000	12.5*
Grantfork	0.5	99.2	0.0	0.4*	0.0	0.4	0.0	0.4	$48,750	3.1
Vernon	0.5	98.3	0.0	0.6*	0.0	1.7	0.0	1.1	$24,583	17.9*
Granite City	2	94.7	2.0	0.5*	0.5	2.9	0.9	1.4	$42,130	8.8*
Alton	2	72.3	24.7*	0.2	0.4	1.5	0.7	1.7	$37,910	14.7*
Godfrey	2	94.1	4.0	0.3	0.7	1.0	0.2	0.7	$57,971	3.2

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Relative Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
Wood River	2	97.6	0.6	0.3	0.5	1.2	0.4	0.7	$41,688	13.2*
East Alton	2	96.7	0.9	0.2	0.4	1.0	0.2	1.5	$35,655	7.8
Patoka	2	98.9	0.0	0.0	0.2	1.3	0.0	0.9	$33,917	11.6*
CUSHING EXTENSION										
NEBRASKA[7]										
KANSAS		86.1	5.7	0.9	1.7	7.0	3.4	2.1	$49,624	6.7
Towanda	0.5	96.8	0.4	0.4	0.2	0.7	0.2	2.0	$47,188	5.1
Chapman	0.5	94.8	0.5	1.0	0.4	3.0	0.7	2.7	$44,063	4.3
Potwin	0.5	95.4	0.0	1.5*	0.2	0.9	0.0	2.8	$42,500	4.7
Greenleaf	0.5	99.4	0.0	0.0	0.0	0.8	0.3	0.3	$38,125	8.3*
Hollenberg	0.5	96.8	0.0	0.0	0.0	3.2	3.2	0.0	$52,083	0.0
Winfield	2	88.1	3.3	1.1	3.7*	4.7	1.7	2.1	$44,539	8.9*
Arkansas City	2	87.2	4.5	2.7*	0.6	4.5	1.9	3.0	$39,692	12.4*
Augusta	2	96.1	0.2	0.8	0.4	2.6	0.7	1.9	$51,886	4.1
Marion	2	97.6	0.0	0.8	0.1	1.4	0.2	1.2	$42,202	5.3
Douglass	2	96.2	0.3	1.6*	0.2	1.7	0.5	1.2	$49,875	4.5
Washington	2	98.9	0.1	0.2	0.0	0.6	0.2	0.5	$37,448	8.6*
Wakefield	2	95.9	0.8	1.1	0.1	1.2	0.6	1.4	$50,526	4.2
Hope	2	98.1	0.8	0.5	0.3	0.3	0.0	0.3	$32,813	4.8
Green	2	96.6	0.7	2.7*	0.0	1.4	0.0	0.0	$29,167	5.3

Table 3.11-8 Environmental Justice Statistics in Affected Communities[1]

State / Community[2]	Relative Proximity to Route (within x miles)	Racial/Ethnic Categories (% of total population)[3] White	Black	Native American or Alaskan Native	Asian or Pacific Islander	Hispanic[4]	Other	Two or More Races	Median Family Income (1999)[5]	Families With Income Below the Poverty Level[6] (%) (1999)
Ramona	2	95.7	0.0	0.0	0.0	6.4	4.3	0.0	$33,125	0.0
OKLAHOMA		76.2	7.6	7.9	1.5	5.2	2.4	4.5	$40,709	11.2
Ponca City	0.5	84.2	3.0	6.3	0.7	4.4	2.1	3.8	$39,846	12.7*
Cushing	0.5	79.7	7.0	8.0	0.1	2.7	0.9	4.3	$32,284	15.1*
Newkirk	2	83.7	1.2	8.7	0.1	2.1	0.8	5.4	$38,125	11.0
Morrison	2	89.2	0.3	2.8	0.5	4.2	2.7	4.6	$35,417	13.5*
Marland	2	48.9	0.0	38.6*	0.0	10.0*	3.2	9.3	$25,625	31.0*

[1]Affected areas are those communities where existing facilities exist, or communities where new pipeline facilities or surface disturbing activities associated with pipeline refurbishment are proposed.

[2]Communities are listed in order by state as the proposed project crosses from north to south, proximity to proposed project centerline, and descending size based on year 2000 population.

[3]Minority populations defined as black, Native American or Alaskan Native, Asian Pacific Islander, or Hispanic with percentages meaningfully greater than 1.5 times that of the minority population percentage in the general population of the surrounding area (i.e., the corresponding state) are identified with an asterisk (*).

[4]Persons of Hispanic origin may be of any race, and for census-gathering purposes, Hispanic is a self-identified category. In this table individuals may have reported themselves as only Hispanic or in combination with one or more of the other races listed. This may result in the sum of percentages for all ethnic categories to be greater than 100 percent for any one community.

[5]The median family income is defined here for a family of three. The poverty threshold is defined as the average threshold for a family of three and is not adjusted for regional, state, or local variations in the cost of living.

[6]The percent of families with income below the poverty threshold in 2000, as defined by the Census Bureau for Federal statistical purposes, based on a family of three. Communities with a higher percent of the population below the poverty level than that occurring in the respective state are identified with an asterisk (*).

[7]Addressed in Keystone Mainline.

Source: Census 2000a.

in the proximity of the proposed routes include those communities crossed by the proposed route (within one-half mile) as well as communities located within two miles of the proposed route. Based upon review of the available Census data for minority populations in all of the counties crossed and communities in the proximity of the proposed route, the various minority populations do not exceed 50 percent, however, there are minority populations occurring in portions of the counties crossed by the proposed route that are "meaningfully greater" than their corresponding minority populations in the general population. Therefore, for the purposes of identifying environmental justice concerns, minority populations, as defined in the CEQ Guidance, exist within the study area. For this ER, general minority populations used for comparison were state populations.

Two affected counties in North Dakota have minority populations greater than 1.5 times the relevant minority population in the state. These include Pembina and Walsh counties. There are no communities with a notable minority population in the proximity of the project.

In South Dakota, one county and three of the affected communities have minority populations greater than 1.5 times the relevant minority population in their associated general populations. These include Yankton County and the communities of Yankton, Iroquois, and Raymond. All three communities are within one-half mile of the project.

One affected county and one affected community in Nebraska have minority populations greater than 1.5 times their respective relevant minority populations. These include Colfax County and the community of Garrison, which is within one-half mile of the project.

In Kansas, Brown County has a minority population greater than 1.5 times the relevant minority population in the state. There are no communities with a notable minority population in the proximity of the project.

Five of the affected communities in Missouri have minority populations greater than 1.5 times the relevant minority population in the state. These include Renick within one-half mile of the project and Turney, Fountain N' Lakes, Truxton, and Triplett between one-half and two miles. There are no affected counties in Missouri with minority populations meaningfully greater than the minority population of the state.

In Illinois, one affected county and five communities have minority populations greater than 1.5 times the relevant minority population in the associated general populations. These include Bond County, South Roxana, Grantfork, and Vernon within one-half mile of the project, and Granite City and Alton between one-half and two miles.

Along the Cushing Extension in Kansas, Cowley County and five communities have minority populations greater then 1.5 times the relevant minority populations in the associated general populations. The five communities include Potwin, Winfield, Arkansas City, Douglass, and Green. Of these five Potwin is the only one within one-half mile of the proposed project.

In Oklahoma, one affected county and one community have minority populations greater than 1.5 times the relevant minority population in the associated general populations. These include Payne County and the community of Marland between one-half and two miles of the proposed project.

3.11.4.2 Low-Income Populations

According to the CEQ Guidance, low-income populations in an affected area should be identified using the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, federal agencies may consider as a community either a group of individuals living in geographic proximity to one another or a set of individuals (such as migrant workers or Native Americans) where either type of group experiences common conditions of environmental exposure or effect. The poverty thresholds are revised annually to allow for changes in the cost of living as reflected in the Consumer Price Index. They are the same for all parts of the country (i.e., they are not adjusted for regional, state, or local variations in the cost of living). The poverty threshold for a family of three used for analysis was $13,290 in 2000. The median family income in the nation was $50,046 for a family of three and the percent of families below the poverty level was 9.2 percent.

Low income populations were identified along the proposed project route by comparing the percent of the population below the poverty level in the affected counties and communities to the percent of the population below the poverty level in each respective state. If the percent in the affected county or community was greater than the percent in the state, the affected county or community was determined to be a low-income population. Low-income counties and communities are identified on **Tables 3.11-7** and **3.11-8**.

The percent of the population below the poverty level in all states except Oklahoma is approximately the same as or lower than the percent of the population below the poverty level in the nation. Dickey County and three communities in North Dakota have been identified as having low-income populations. Five of South Dakota's 11 counties and three communities, three of Nebraska's 10 counties and two communities, and two of Kansas' four counties and three communities are considered low-income populations along the proposed mainline route. In the more heavily populated states, five of 10 counties and nine communities in Missouri have low-income populations as well as two of Illinois' four counties and eight communities. Along the proposed Cushing Extension, Kansas has additional low-income populations in three of six counties and four additional communities, while Oklahoma has low-income populations in one of the three counties crossed and four of the five communities in proximity to the project.

3.12 Public Health and Safety

Keystone submitted a preliminary risk assessment for the accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

ENVIRONMENTAL CONSEQUENCES

CHAPTER 4

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Analysis and Assumptions

Assumptions

For the purpose of analysis, the following assumptions were made:

1. Keystone's construction, operation, and reclamation methods and environmental protection measures contained in the Construction, Mitigation, and Reclamation Plan (Plan) (Appendix E) will be implemented on all land ownership (federal, state, and private) unless specific exceptions are stated. Individual landowners may include specific construction and reclamation requirements in ROW agreements with Keystone. These site-specific requirements are likely to result in similar or less environmental impacts than discussed here.

2. Keystone will acquire all necessary federal, state, and local permits and approvals to construct and operate the Keystone system (not including powerlines, which will be controlled and operated by power companies), regardless of whether these permits and approvals are listed.

Guidelines

1. For the Proposed Action and all alternatives, the term "Construction Phase" is defined fully in Chapter 2.0. Activities in this phase include the surface-disturbing activities needed to construct the pipeline, pump stations, lateral tie-ins, pigging stations, valves, and permanent access roads so that the pipeline system can be placed into service. It also includes reclamation activities for areas where the surface has been disturbed.

2. For the Proposed Action and all alternatives, the term "Operation Phase" is defined fully in Chapter 2.0. Activities in this phase include the transportation of crude oil in the Keystone pipeline system. This definition also includes normal operations, routine pipeline ground and aerial inspections, emergency response activities, future routine internal and external integrity inspections and repairs along short segments of the entire pipeline, and future reclamation activities such as reseeding and repair of erosion control structures.

3. Prior to abandonment, Keystone will coordinate with appropriate federal and state land management agencies to ensure that abandonment procedures follow agency-approved procedures at that time.

4. For all resources, unless specific exceptions are stated, short-term impacts are those that will occur over a five-year period or less, while long-term impacts are those that exceed five years.

5. Keystone's committed environmental protection measures included in the Plan (Appendix E) were used to evaluate environmental impacts.

4.2 Proposed Action

4.2.1 Air Quality

Issues

- Fugitive dust generation from pipeline construction equipment and unpaved road traffic;
- Hydrocarbon combustion emissions from construction equipment; and
- Fugitive emissions from pump stations and valves.

Construction

The quantity of fugitive dust (particulate matter) generated by construction is dependent on the area of surface disturbance and the type of equipment causing surface disturbance. Local dust concentrations increase as the silt fraction in the soil increases and as excavation and clearing equipment increase in size. A general particulate matter (PM_{10}) emissions factor for all types of construction activity is 0.11 ton per acre per month (South Coast Air Quality Management District 1996). 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 states crossed by the project are in attainment for PM_{10}. No dust control or mobile emissions permits from state agencies will be required.

Keystone will limit dust impacts in residential and commercial areas adjacent to pipeline construction by utilizing dust minimization techniques (primarily watering disturbed surfaces) in accordance with the Plan (Appendix E). Wind-generated dust after construction will be controlled utilizing land surface reclamation measures outlined in the Plan.

Operation

All pipeline pumps will be electrical and no storage tanks will be installed at any location along the pipeline. As a consequence, there will be no long-term hydrocarbon emissions from project operations except for very small fugitive emissions from valves and pumping equipment.

4.2.2 Geology, Minerals, and Paleontology

Issues

- Disturbance of unique geological features that are protected under state or federal programs;
- Loss of access to underlying mineral resources from installation of pipeline facilities; and
- Potential loss of vertebrate or invertebrate fossils that are considered by paleontologists to have scientific importance.

Construction

No unique geological features that have received state or federal protection will be disturbed by project facilities.

The proposed pipeline route does not cross any active quarries or mines. A pipeline (or other utility) may preclude or interfere with the future extraction of underlying mineral resources. The proposed route crosses sand, gravel, clay, and stone deposits in North Dakota, South Dakota, and Nebraska where the proposed route is not adjacent to an existing ROW corridor. Glacial sand and gravel deposits occur over a large area within these states and loss of access to underlying deposits will be very small relative to the available mineral materials supply. In Kansas, Missouri, and Illinois, the route will be in or adjacent to an existing pipeline corridor that already precludes development of mineral resources.

The proposed route crosses an area in Madison County, Illinois where coal historically has been mined with underground methods (Illinois Geological Survey 2004). It is possible that surface mining methods will be used to extract shallow coal seams underlying the pipeline. If a new surface mining proposal in this area were approved in the future, the presence of a pipeline could serve as an impediment or complication to such a proposal. However, the Keystone pipeline route follows existing pipelines within Illinois and, as such, does not represent a significant new impediment to any such development

The proposed route does not cross the wellpads of any active oil and gas wells. Future wells can be located to avoid the pipeline ROW so that extraction of these resources will not be precluded.

There is the potential for discovery of Pleistocene-era mammal fossils during pipeline grading and trenching where the proposed route crosses continental glacial drift in North Dakota, South Dakota, Nebraska, and Missouri. Any mammalian fossils incidentally excavated during pipeline construction will not be recovered or studied for the scientific record.

Where karst terrain is present near the surface or suspected to be near the surface, Keystone will conduct studies necessary to characterize the karst features and evaluate effects on construction techniques. Generally this will only be an issue where deep horizontal directional drilling is proposed at major water crossings.

Operation

No additional disturbance or loss of unique geological features, mineral resources, or scientifically important fossils will occur because there will be no additional surface disturbance required.

4.2.3 Soils

Issues

- Accelerated wind or water erosion on disturbed areas during construction and operation (including maintenance activities);
- Reduced soil quality and corresponding reductions in the productivity of desirable vegetation or crops as a result of accelerated erosion, soil mixing, compaction, spills, or disturbance of irrigation or drainage features; and
- Hydrocarbon contaminated soils encountered within the pipeline trench caused by leaks and spills from adjacent pipelines.

Construction

Grading and excavating for the proposed pipeline and ancillary facilities will disturb a variety of agricultural, rangeland, wetland, and forestland soils. Certain inherent soil characteristics influence the agricultural productivity and revegetation potential after disturbance. The major soil characteristics of concern are indicated in **Table 4.2-1**, as well as with their extent along the proposed route in each state. The quantification of acreage for each of the characteristics is based on data in the STATSGO general soils mapping database.

Table 4.2-1 Acreage Summary, Soil Characteristics of Concern

State/ County	Total Acres[1]	Highly Erodible Water[2]	Prime Farmland[3]	Hydric[4]	Compaction Prone[5]	Stony – Rocky[6]	Shallow Bedrock[7]	Droughty[8]
KEYSTONE MAINLINE								
North Dakota	3,343	270	1,607	392	198	39	45	0.0
South Dakota	3,099	167	6	383	398	21	4	0.0
Nebraska	3,027	625	1,906	126	154	7	30	0.0
Kansas	1,402	351	642	16	105	3	22	0.0
Missouri	3,936	728	2,069	803	2,054	260	271	0.0
Illinois	736	57	537	218	454	1	5	0.0
Keystone Mainline Subtotal[9]	15,243	2,198	8,237	1,938	3,363	533	373	0.0
CUSHING EXTENSION								
Nebraska	35	15	30	0	0	0.0	0.0	0.0
Kansas	2,968	182	2,221	20	155	138	536	0.0
Oklahoma	1,155	63	770	<1	5	113	150	0.0
Cushing Extension Subtotal[9]	4,158	260	3,012	20	160	251	686	0.0
Project Total	19,401	2,458	11,248	1,959	3,522	582	1,059	0.0

[1]Based on a total of 110-foot-wide ROW for 30- and 36-inch pipe and a 95-foot-wide ROW for 24-inch pipeline during construction, except in certain wetlands and as agreed with landowners, in shelterbelts and other forested areas, and commercial/industrial areas where an 85-foot-wide construction ROW will be used, or in areas requiring extra width for workspace necessitated by site conditions. Acreage does not account for 1,820 acres associated with pipe storage/contractor yards or disturbance associated with transmission lines or access roads. Individual soils may occur in more than one characteristic class.

[2]Includes soils listed as identified by a STATSGO database search.

[3]Includes land listed by the NRCS (1995) as potential prime farmland if adequate protection from flooding and adequate drainage are provided.

[4]As designated by the NRCS (1995).

[5]Includes soils that have clay loam or finer textures in somewhat poor, poor, and very poor drainage classes.

[6]Includes soils that have either: 1) a cobbly, stony, bouldery, gravelly, or shaly modifier to the textural class, or 2) have >five percent (weight basis) of stones larger than three inches in the surface layer.

[7]Includes soils that have bedrock within 60 inches of the soil surface.

[8]Includes coarse-textured soils (sandy loams and coarser) that are moderately well to excessively drained.

[9]Discrepancies in acreage totals are due to rounding.

Approximately 14 percent of the overall project surface disturbance will affect soils that are highly erodible by water. The hilly portions of Kansas and Missouri will be particularly susceptible to accelerated sheet erosion, rilling, or gullying.

Overall, approximately half of the proposed route crosses soils designated by the NRCS as prime farmland. Prime farmland is particularly extensive in Illinois. These soils typically possess the most favorable qualities for agricultural production (e.g., fertility, structure, depth and waterholding capacity, microbial populations, infiltration and percolation rates, slope, and drainage). Short-term impacts such as soil compaction from equipment traffic, excavation and handling, and spills of fuels and lubricants may alter the capability of these soils temporarily following construction.

Hydric soils generally are defined as those that have evidence of saturation within 12 inches of the land surface for an extended period of time during the growing season. Approximately 13 percent of the overall proposed route is occupied by soils that fit this description, with the most notable occurrences in the Dakotas, Missouri, and Illinois. The presence of a hydric soil is often associated with native wetland hydrology and vegetation or with agricultural (farmed) wetlands. Both compaction-prone and hydric soils are especially prone to structural and aeration damage when trafficked or excavated. Soil compaction to a degree that will adversely affect backfilling and restoration efforts will be most likely to occur during wet conditions. In some of these areas, drain tile systems may exist which could be disturbed by project construction. Acceptable clay texture soil replacement may be more difficult due to the presence of large clods or blocks of soil materials.

Stony or rocky soils associated with glacial till will be crossed in North Dakota and near-surface bedrock will be crossed in Missouri. Revegetation recovery rates may be slow in these areas. Similarly, in areas of shallow bedrock (relative to the trench excavation depth), excavation may result in rock fragments remaining on the surface or within the trench backfill at levels that will limit the success of restoration efforts. This will be a particular issue in Missouri where this soil limitation occurs along about nine percent of the proposed route.

Although droughty soils were not identified as present along the proposed route on the basis of inquiries of the STATSGO database, it is likely that small, scattered areas of droughty soils will be crossed. Similarly, scattered areas of saline and/or sodic soils are known to occur in the project region generally from Kansas northward. Droughty soils will be prone to wind erosion during construction and will be more difficult to successfully stabilize and revegetate following construction. Saline and/or sodic soils often have drainage limitations and may undergo compaction impacts similar to the hydric or compaction–prone soils. In addition, the success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical and chemical characteristics of the soils.

Potential impacts to soils will be minimized or mitigated by the soil protection measures identified in the Plan. The measures include procedures for segregating and replacing topsoil, trench backfilling, relieving areas compacted by heavy equipment, removing surface rock fragments, and implementing water and wind erosion control practices. In addition, Keystone will work closely with landowners and soil conservation agencies to identify and implement recommended soil conservation practices in specific areas where they are needed. Damaged irrigation and tile drainage systems will be repaired in accordance with the Plan.

To accommodate potential discoveries of contaminated soils, Keystone will develop unanticipated contaminated soil discovery procedures in consultation with relevant agencies. These procedures will be added to the Plan. If hydrocarbon contaminated soils are encountered during trench excavation, the state agency responsible for emergency response and site remediation will be contacted immediately. A remediation plan of action will be developed in consultation with that agency. Depending on the level of contamination found, affected soil may be replaced in the trench or removed to an approved landfill for disposal.

<u>Operation</u>

Very small scale, isolated surface disturbance impacts resulting in accelerated erosion, soil compaction, spills, and related reductions in the productivity of desirable vegetation or crops could result from pipeline maintenance traffic and incidental repairs. Impacts related to excavation and topsoil handling are not likely to occur. If they do occur, they will be limited to small areas where certain pipeline maintenance activities take place.

4.2.4 Water Resources

4.2.4.1 Surface Water

Issues

- Water quality degradation from temporary increases in suspended solids concentrations during in-stream construction activities or erosion from disturbed lands;
- Increased sedimentation in streams resulting from in-stream construction or nearby activities;
- Channel and bank modifications that affect channel morphology and stability;
- Reduced flows in streams where water is withdrawn for hydrostatic testing; and
- Water quality degradation in streams, lakes, impoundments, or surface water-based public water supplies from pipeline spills or leaks, or from spills or leaks of fuel, lubricants, or hazardous materials during construction or operations.

Construction

Waterbody Crossings

Depending upon the construction technique used, the installation of the pipeline across water bodies can cause the following impacts:

- Temporary degradation of water quality in the form of increased suspended solids concentrations
- Sedimentation (deposition of solids introduced into suspension by construction activities)
- Channel and bank modifications.

As described in Section 2.1.8, Keystone is proposing the following water crossing techniques:

- Horizontal Directional Drilling (HDD)
- Open Cut Wet Crossings
- Open Cut Dry Flumed Crossing
- Open Cut Dry Dam and Pump Crossing

Keystone is proposing to utilize HDD at nine major river crossings (two Missouri River, one Platte River, one Chariton River, two Cuivre River, one Mississippi River, one Hurricane Creek, and one Kaskaskia River crossings). Since HDD does not involve any intended direct contact with the water body, channel bed, or banks, no impact is expected at these crossings. At present, Keystone is proposing open cut wet crossings at the remainder of the crossings. Open cut wet crossings involve the direct excavation of the channel and banks in contact with any flow present. Additional HDD or dry crossing procedures may be considered at some of these proposed open cut crossings pending determination of crossing-specific resources (aquatic life), which may warrant extraordinary mitigation. At open cut wet crossings the extent of increased suspended solids concentrations and downstream sedimentation impacts will depend on the flow conditions at the time of construction and the channel substrate. Measures related to managing spoil, timing, access, and equipment are included in the Plan. These measures will limit impacts of increased suspended solids concentrations and downstream sedimentation. Most open cut crossings will be completed in 48 hours or less. Larger open cut crossings may take upwards of seven to 10 days.

Runoff and the resulting erosion of lands adjacent to water bodies can lead to the introduction of solids into suspension and the deposition of sediment in-stream. The Plan includes extensive procedures to limit the extent of disturbed land adjacent to water bodies, to control erosion, and methods to prevent sediments from entering water bodies or wetlands. These measures include Best Management Practices (BMPs), such as clearing limits, buffer strips, drainage diversion structures, and sediment barrier installations. In accordance with the Clean Water Act (CWA), Keystone will comply with the National Pollutant Discharge Elimination System (NPDES) permit process with respect to pipeline construction and operation. Keystone will develop and file a Storm Water Pollution Prevention Plan (SWPPP) as part of the NPDES permitting effort. This plan will include BMPs to minimize soil erosion and sedimentation.

Open cut crossings will involve disturbance of stream banks and channel bottoms. The Plan includes procedures for limiting the extent of this disturbance and the restoration of disturbed areas. Restoration includes grading, stabilization, and revetment BMPs. These BMP's embrace bioengineering concepts, which encourage the restoration of natural streambanks.

The pipeline will be constructed under flood management structures (levees and drainage ditches) as well as river channels with potential for lateral scour. The pipeline will be buried at an adequate depth under channels, adjacent floodplains, and flood protection levees to avoid pipe exposure caused by channel degradation and lateral scour. Determination of the pipeline burial depth will be based on site-specific channel and hydrologic investigations where deemed necessary. Rivers that exhibit highly modified channels and extensive levee systems include the Chariton and Cuivre rivers in Missouri.

Geotechnical explorations have been initiated to define the subsurface conditions in areas to be crossed by HDD. Preliminary site-specific crossing plans, including initial results from geotechnical information, are provided in Appendix D.

Hydrostatic Test Water Withdrawal and Discharge

Depending on locations, state requirements, and availability, water will be obtained and withdrawn from nearby streams or privately owned reservoirs. Recycling water between test sections will reduce withdrawal volumes. In its preliminary hydrostatic test water management plan, Keystone has identified 29 surface water sources which could provide hydrostatic test water, depending on the flows at the time of testing and the sensitivity of the individual water bodies for other uses.

Water used for hydrostatic testing of the pipeline will be obtained from surface water resources. The volume for a 50-mile test section of 30-inch pipeline is approximately 90 million gallons. Withdrawal rates and volumes will be designed to avoid impacts to aquatic life and downstream water users. Hydrostatic test water will be discharged to the land surface at an approved location. Discharged water may evaporate or infiltrate into the soil or drainage where the water is released.

If water is withdrawn from a sensitive surface water source during a low-flow period or at a time when particular flow ranges are needed for other uses, habitat reductions for water-dependent resources (e.g., fisheries, aquatic invertebrates) could occur. A similar effect on surface water resources could occur if large withdrawals are made from aquifer zones that provide late-season baseflows to streams.

In accordance with the Plan, hydrostatic test water withdrawals from surface waterbodies will be made at controlled rates and with equipment that will minimize impacts on stream beds and aquatic life. Keystone will coordinate with federal and state agencies to further identify such water sources and seasonal concerns. Similarly, discharges of hydrostatic testing waters will be made such that water quality requirements are met. Discharge controls will include restrictions on pipeline dewatering rates, velocity control devices (such as splash pups or diffusers) and/or temporary synthetic channel linings.

Water quality will not be reduced by pipe cleaning or hydrostatic test waters because discharged water will be required to meet water quality standards imposed by the discharge permits issued by the individual states for the permitted discharge locations. Water discharge rates will not exceed the daily discharge criteria referenced in the permits.

Spill Prevention

Refueling and lubricating of most construction equipment will be restricted to upland areas at least 100 feet away from the edge of any streams, wetlands, ditches, and other waterbodies and at least 150 feet away from groundwater wells. Wheeled and tracked construction equipment will be moved to an upland area more than 100 feet away from streams, wetlands, ditches, and other waterbodies for refueling when necessary. Fuels and lubricants will be stored in designated areas and in appropriate service vehicles. Whenever possible, storage sites for fuels, other petroleum products, chemicals, and hazardous materials, including wastes will be located in uplands or at least 100 feet from waterbodies and wetlands. SPCC procedures are described in the Plan and will be implemented in the various states in compliance with 40 CFR 112 (for oil spills) and corresponding state regulations (including NPDES requirements for spills of other substances that may occur during construction activities).

In a few cases, such as for pumps or directional drill equipment located within or near a waterbody or wetland, refueling will be completed within or near a waterbody or wetland. In these situations, the specific measures identified in the SPCC portion of the Plan will be followed.

Operation

Normal operations will not adversely affect water resources. Minor surface disturbance activities from pipeline inspection and maintenance may occur infrequently and at widely spaced locations.

The USDOT prescribes pipeline design and operational requirements that limit the risk of accidental crude oil releases (leaks or spills) from pipelines. Over the operational life of the Keystone pipeline there will be a very low likelihood of a crude oil release (leak or spill) from the pipeline that could enter surface water resources and drinking water supplies. On July 1, 2006, Keystone submitted two key documents to the Department of State: a preliminary ERP and a preliminary pipeline risk assessment. The ERP outlines the measures that Keystone will implement in the event of an accident. The preliminary risk assessment evaluates accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

To reduce the amount of product that could enter surface waters, federal regulation (49 CFR 195.260(3)) stipulates that new pipelines must have valves installed on both sides of any waterbody, which has at least a 100-foot width between ordinary high water marks. According to the OPS, intermittent and ephemeral streams are not considered waterbodies. In general, wetlands also are not considered by the OPS to be waterbodies. Consequently, valves are required by OPS for the larger perennial streams. Keystone will comply with these OPS requirements. Valve locations in addition to those required for major waterbody crossings are described in Chapter 2.0. These additional valves will further aid in minimizing the amount of material, which could be released into other waterbodies in the unlikely event of a spill. The location of valves, spill containment measures, and Keystone's ERP will minimize adverse effects to perennial, intermittent, and ephemeral waterbodies, as well as to groundwater.

4.2.4.2 Groundwater

Issues

- Groundwater quality degradation during or after construction from disposal of materials, pipeline spills, or leaks that seep into shallow aquifers used for domestic, agricultural, or public water supplies.

Construction

Reductions in groundwater quality from spills, leaks, or disposal practices are not anticipated during construction. Most of the aquifers along the route will be at least temporarily isolated from any spills on the land surface and attending personnel will be able to respond to an incident before contaminants migrate into groundwater. In areas with near-surface groundwater or in areas adjacent to surface waterbodies, additional procedures and measures will be implemented as presented in Chapter 2.0 and in the Plan.

Operation

While routine operation of the Keystone Pipeline and ancillary facilities will not affect groundwater resources, there is the possibility that a crude oil release could migrate through near-surface materials and enter a water-bearing zone or system. Public water supply wells were identified within 300 feet of the proposed pipeline centerline in Seward and Jefferson counties, Nebraska, and Chariton County, Missouri.

The USDOT prescribes pipeline design and operational requirements that limit the risk of accidental crude oil releases (leaks or spills) from pipelines. Over the operational life of the Keystone pipeline, there will be a very low likelihood of a crude oil release from the pipeline that could enter water supply aquifers. On July 1, 2006, Keystone submitted two key documents to the Department of State: a preliminary ERP and a preliminary pipeline risk assessment. The ERP outlines the measures that Keystone will implement in the event of an accident. The preliminary risk assessment evaluates accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

4.2.4.3 Wetlands

Issues

- Potential modifications in wetland productivity because of modifications to surface and subsurface flow patterns from pipeline construction;
- Temporary and permanent modifications in wetland vegetation community composition and structure from clearing and operational maintenance;
- Loss of wetlands due to backfilling or draining;
- Wetland soil disturbance;
- A temporary increase in turbidity and fluctuations in wetland hydrology; and
- Construction through prairie pothole areas could affect the water retaining substrate in these wetlands and result in permanent alterations to their water holding capacity.

Construction

Based on 2006 field survey results and photointerpretation, less than three percent (67 miles) of the proposed pipeline route will cross wetlands. Of this total there are approximately 46.2 miles of palustrine emergent wetlands (marshlands and meadows), 9.1 miles of palustrine forested wetlands (riparian woodlands), 2.3 miles of palustrine scrub-shrub, and 9.9 miles of stream channels and open water. None of the proposed pump stations will be located in wetlands, based on NWI mapping.

Effects on wetland vegetation will be greatest during and immediately following construction. To mitigate the potential for these impacts, Keystone will implement procedures as outlined in the Plan.

The construction ROW width will be reduced to 85 feet through certain wetlands to minimize potential effects. Keystone will restore or mitigate impacts to wetlands affected by construction activities, to the extent practicable. Pipeline construction through wetlands must comply, at a minimum, with USACE Section 404 permit conditions. Section 404(b)(1) guidelines restrict the discharge of dredged or fill material into wetland areas where a less environmentally damaging practicable alternative exists.

The larger river crossings, such as the Missouri and Mississippi rivers, will be horizontally directionally drilled. Streamside wetlands or floodplain forests associated with these areas will not be affected. Smaller streams and ephemeral or intermittent drainages will likely be open cut and wetlands located in these areas will be crossed by trenching. No permanent loss of wetlands will occur as a result of this project; however, approximately 55 acres of forested wetland will be permanently converted to herbaceous wetland. Herbaceous vegetation in palustrine emergent wetlands is expected to reestablish to pre-construction levels within three to five years following the completion of reclamation, resulting in a short-term loss of vegetation and available habitat for some wildlife species. Trees in forested wetlands will recover in 20 to 50 years.

As described in the Plan, specific construction techniques will be used to retain the hydrological and vegetation characteristics of wetlands that will be disturbed by construction. These techniques will include segregation and replacement of wetland soils (except in areas of standing water, saturated wetlands, or where no topsoil is evident) so that soil profiles and native vegetation seed and rootstock will be reestablished to help ensure successful restoration and reestablishment of local drainage patterns to restore existing surface and subsurface water flow patterns.

Operation

Woody vegetation in forested wetlands will be removed periodically above the pipeline (approximately 15 feet on each side of the centerline) to maintain visibility of the area above the pipeline for aerial pipeline observation and to permit access to all areas along the pipeline in the event of an emergency

4.2.4.4 Vegetation

Issues

- Removal of vegetation from the ROW and ancillary facility areas during construction (with a consequent reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion);
- Alteration of existing vegetative communities as a result of ROW maintenance (e.g., removal of trees from wooded areas);
- Loss of sensitive plant individuals and habitat as a result of construction clearing and grading; and
- A potential expansion of invasive and noxious weed populations along the pipeline ROW as a result of construction.

Construction

Vegetation Communities

During construction of the Keystone Pipeline Project, vegetation will be cleared from the construction ROW and re-established following construction. Sites for ancillary facilities (e.g., pump stations) that will remain cleared for the life of the project. Approximately 62 percent of the disturbance associated with project construction will occur on agricultural lands, which typically are disturbed annually during planting operations (see Section 4.2.6, **Tables 4.2-4** and **4.2-5**). Other affected vegetation communities include rangeland (consisting of native prairie and seeded pastureland-19 percent), forested woodlands (four percent), and wetlands (five percent). Potential impacts to wetlands are discussed under Section 4.2.4, Water Resources.

Pipeline construction will involve both the temporary and permanent alteration of vegetation through ROW preparation and excavation, high traffic activity, and the clearing of shrubs and trees. There will be minimal change to agricultural lands since these areas will be revegetated and maintained in vegetative cover similar to that found before construction.

Vegetation recovery rates are estimated to be one to five years for herbaceous components, five to 15 years for low shrubs, and 20 or more years for woodlands (depending on their age and species). The reestablishment of pastures, rotated croplands, and open grassland range following construction is expected to take approximately one to five years.

Reclamation, native species revegetation, and revegetation success monitoring, as outlined in the Plan, will be completed for disturbed areas within the construction ROW after pipeline construction activities are completed. Under normal to above-normal precipitation conditions, vegetative cover in the reclaimed areas will consist primarily of herbaceous planted and weedy species after one to three years. Approximately three to five years after reclamation, vegetative cover in reclaimed areas will consist primarily of desirable species (i.e., species in the reclamation seed mixture), with a minor component of weedy species. Reclamation success is dependent upon several variables including soil preparation, season of seed application, and precipitation levels after seed application.

Long-term impacts to vegetation include the loss of woody species (i.e., evergreen and deciduous trees and shrub species) during clearing activities. The permanent ROW will be maintained free of trees for the life of the project. Within that permanent ROW, a 30-foot-wide corridor, centered on the pipeline, will be maintained solely in a herbaceous condition. Trees and shrubs will be removed during clearing activities and converted to early successional herbaceous and grassland communities. Trees and shrubs eventually will reinvade the temporary easement area after construction. However, shrubs will not become reestablished in the temporary easement area naturally for approximately five years or more and trees will require a minimum of 20 years or more, depending on species and age of woodlands cleared.

Based on the Plan, Keystone will monitor revegetation success along the pipeline ROW until revegetation is successful. Revegetation will be considered successful if, upon visual survey, the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation will be considered successful if crop yields are similar to adjacent undisturbed portions of the same field. Reseeding will be based upon reclamation success and natural rainfall amounts received in the years following revegetation efforts.

Keystone will use seed mixtures approved by the NRCS in each affected county. On federal lands, Keystone will use seed mixtures approved by the appropriate agencies. Consequently, the various vegetation types altered by the proposed pipeline, other than forested communities, are expected to return rapidly to near pre-project conditions. Impacts that may occur if desirable plant species are not established in the ROW within a short period of time include higher soil erosion rates, increases in weedy species, and reduced forage production.

Sensitive Plant Species

A total of 63 plant species (nine special status species and 54 species of special concern) have been identified as potentially occurring within the project area, based on preliminary response from state and federal agencies. Of these, five are federally listed threatened and endangered plant species (Decurrent false aster, eastern prairie fringed orchid, western prairie fringed orchid, prairie bush-clover, running buffalo clover). The federally listed species are generally associated with native prairie or wetland/riparian habitats.

Decurrent false aster is known to grow in the Mississippi River floodplain in the eastern half of St. Charles County, Missouri. Clearance surveys will be conducted during the August-to-October flowering period to ensure its lack of presence prior to construction. If a population were located within the construction ROW, suitable mitigation measures will be developed in consultation with the USFWS.

A number of occurrences of state-listed threatened or endangered species or species of special concern have been identified by state NHPs as occurring near or within the proposed route. For plants, most of these species are state-listed as threatened or endangered or species of concern that may be rare within a given state but have relatively secure populations elsewhere. However, some species also may be globally rare, such that disturbance of a local population through construction could result in extirpation of a remnant population and contribute to a trend toward listing as federal threatened and endangered. The required level of field survey for state-listed species and recommendations for their protection have not yet been determined.

Noxious and Invasive Plant Species

Construction surface disturbance could contribute to the introduction of noxious and invasive weed species and other undesirable plant species. These species are fast-growing and could displace native species and inhibit the establishment of native grass, forb, and shrub species. Increases in noxious and invasive weed species are particularly serious within wetland areas and other sensitive plant communities. Typical locations for noxious weed infestations are riparian zones, livestock concentration areas, roads and highways, and disturbed soils.

Despite efforts to prevent the spread of noxious weeds, it is possible that pipeline construction, operation, and maintenance activities will increase the prevalence of noxious weeds along the pipeline ROW or that weeds will be transported into areas that are relatively weed-free. Over the long-term, it is expected that noxious weeds will continue to spread within previously disturbed areas due to grazing, seed dispersion by livestock, and the overall competitive advantages of weeds over native species.

The Plan provides weed control measures that the project will implement throughout the project areas to minimize the spread and establishment of noxious and invasive species.

Operation

Pipeline operation and maintenance will have minimal impact to revegetated areas. Maintenance impacts will be limited to infrequent traffic along the pipeline ROW. Routine vegetation clearing generally will not occur more frequently than every three years.

The USDOT prescribes pipeline design and operational requirements that limit the risk of accidental crude oil releases (leaks or spills) from pipelines. Over the operational life of the Keystone pipeline, there will be a very low likelihood of a crude oil release from the pipeline which could injure terrestrial vegetation. On July 1, 2006, Keystone submitted two key documents to the Department of State: a preliminary ERP and a preliminary pipeline risk assessment. The ERP outlines the measures that Keystone will implement in the event of an accident. The preliminary risk assessment evaluates accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

4.2.5 Wildlife, Aquatic Resources, and Sensitive Species

4.2.5.1 Terrestrial Wildlife

Issues

- Habitat loss or alteration and incremental habitat fragmentation;
- Loss of breeding success from exposure to construction and operational noise and from higher levels of human activity;
- Limited direct mortalities from project construction and operation; and
- The potential loss of individuals from exposures to accidental crude oil releases.

Construction

Wildlife Habitat

About 62 percent of the approximately 21,000 acres necessary for construction of the pipeline and ancillary facilities will consist of agricultural land that is tilled annually (see Section 4.2.6, **Tables 4.2-3**). Rangeland, forestland, and wetlands together constitute about 28 percent of the total disturbance. Due to the linear nature of the project over a large geographic area (approximately 1,350 linear miles), these acreages will represent far less than one percent of available wildlife habitat on a regional basis. In addition, the effects of long-term habitat loss on native wildlife populations will be relatively small since the majority of habitat disturbance will be located in agricultural habitats.

Agricultural lands will continue to be used for pre-construction uses while native habitats will be reclaimed to primarily herbaceous communities using appropriate seed mixes prescribed by local, state and federal agencies. Loss of shrub communities will be long-term (five to 20 years or more) within reclaimed areas of the construction ROW since these communities will become reestablished through the natural reinvasion of woody species. Loss of woodland vegetation will be permanent since trees will not be allowed to reestablish above the pipeline centerline. Habitat losses also will be long term at permanent aboveground pipeline facility locations such as pump stations and access roads.

Pipeline construction will result in the short-term disturbance and long-term habitat modification of 11 acres in the Pigeon Hill State Wildlife Area in Buchanan County, Missouri, and 33 acres in the Carlyle Wildlife Management Area in Fayette County, Illinois. Long-term conversion of wooded habitats to herbaceous communities will result in an incremental increase in habitat fragmentation in these state wildlife management areas but habitat conversion also could increase habitat diversity, depending on the extent of habitats affected and the extent and distribution of undisturbed habitats remaining in the state wildlife areas. Construction during the fall hunting seasons will create conflicts with hunter use of these areas.

Big Game Species

Project construction will affect only a single big game species, white-tailed deer, since the ranges of other potential big game species are very peripheral to the project area and impacts to these wide-ranging species will be negligible or non-existent. Impacts to white-tailed deer will include the incremental loss of potential forage (native vegetation and croplands) and will result in an incremental increase in habitat fragmentation within the proposed surface disturbance areas. However, these incremental losses of vegetation will represent a small percentage (far less than one percent) of the overall available habitat within the project region. No sensitive habitats for white-tailed deer have been identified along the proposed route.

Indirect impacts will result from increased noise levels and human presence during surface disturbance activities. Because white-tailed deer have adapted to human activities and land uses, displacement from construction areas are likely to be short-term.

Small Game Species

Potential direct impacts to small game species could include nest or burrow abandonment or loss of eggs or young where construction occurs during the breeding season. Of greatest concern is the potential for loss of waterfowl nests if pipeline construction occurs in or near wetlands or surface water during the nesting and brood rearing season (approximately March 1 through August 31). Loss of an active nest, incubating adults, eggs, or young of a waterfowl species will constitute a loss under the MBTA.

Potential impacts to small game from the Keystone Pipeline Project will result in the incremental loss of habitat and increased habitat fragmentation until vegetation is reestablished. Indirect impacts could include the temporary displacement of small game from the disturbance areas as a result of increased noise and human presence. Although habitats adjacent to the proposed route and other disturbance areas may support some displaced animals, species that are at or near carrying capacity could suffer some increased mortalities due to displacement. Displacement or loss of small game animals from disturbance areas will be short-term because of their generally high reproductive potentials and the fact that animals will return to the disturbance areas following completion of construction and reclamation activities. Overall, losses of small game species and their habitats will be relatively small since most habitat loss will occur within agricultural habitats. However, if disturbance were to involve important habitat, such as greater prairie chicken leks, loss of this habitat could have a significant effect on local related populations.

Non-game Species

Direct impacts to non-game species from surface disturbance activities will result from the incremental long-term loss of habitat and increased fragmentation until vegetation is reestablished. Potential impacts also will result in mortalities of less mobile or burrowing non-game species (e.g., small mammals, birds, reptiles, amphibians, invertebrates) due to exposure to vehicles and construction equipment traffic. Potential direct impacts could also include nest or burrow abandonment or loss of eggs or young where construction occurs during the breeding season. Other impacts will include the short-term displacement of some of the more mobile species (e.g., medium-sized mammals, adult birds) as a result of surface disturbance. Although the habitats adjacent to the proposed disturbance area may support some displaced animals, species that are at or near carrying capacity could suffer some increased mortalities. Displacement or loss of non-game species from disturbance areas will be short-term because of their generally high reproductive potentials and the fact that animals will return to the disturbance areas following completion of construction and reclamation activities. Overall, losses of non-game species and their habitats will be relatively small since most habitat loss will occur within agricultural habitats.

If surface disturbance activities occur during the breeding season for passerines, raptors, and other summer avian residents (approximately March 1 through August 31), nest or territory abandonment or the loss of eggs or young (loss of productivity) for the breeding season could result. Loss of an active nest, incubating adults, eggs, or young of a migratory bird species will constitute a loss under the MBTA. Impacts to nesting birds will depend on the nest location relative to the proposed disturbance area, the phase of the breeding period, and the level and duration of the disturbance.

Of the 116 active nest sites that were documented during the 2006 raptor surveys, 108 (93 percent) were occupied by red-tailed hawks, Swainson's hawks, and great-horned owls. These species are known to be relatively tolerant of human activity and development (Call 1978; Johnsgard 1988, 1990; Kingery 1998). As a result, direct impacts to nesting raptors would be limited primarily to the incremental loss of potential nest structures within the construction ROW. Since the projects include very minimal tree clearing, this potential is minor. Impacts resulting from increased noise and human presence are expected to be minor.

Operation

Normal pipeline operations will have negligible effects on terrestrial wildlife resources. Direct impacts to wildlife species populations and habitats from extensive maintenance activities such as physical pipe inspections or ROW repair will be the same as those discussed above for construction. In order to reduce potential impacts to important wildlife resources as a result of maintenance activities, Keystone will consult with the appropriate state wildlife agencies prior to the initiation of maintenance activities beyond standard inspection measures.

The USDOT prescribes pipeline design and operational requirements that limit the risk of accidental crude oil releases (leaks or spills) from pipelines. Over the operational life of the Keystone Pipeline there will be a very low likelihood of a crude oil release from the pipeline, which could injure wildlife individuals and habitat. On July 1, 2006, Keystone submitted two key documents to the Department of State: a preliminary ERP and a preliminary pipeline risk assessment. The ERP outlines the measures that Keystone will implement in the event of an accident. The preliminary risk assessment evaluates accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

4.2.5.2 Aquatic Resources

Issues

- Short-term physical disturbance to stream channels;
- Short-term increases in suspended solids concentrations from in-stream activities and erosion from adjacent disturbed lands;
- One-time increases in downstream sedimentation from in-stream activities and erosion from adjacent disturbed lands;
- Potential fuel spills from equipment and toxicity to aquatic biota if fuel reached a waterbody;
- Local short-term reductions in habitat if surface water is used for hydrostatic testing and loss of individuals during pumping; and
- Loss of individuals as a result of acute and chronic toxicity from exposure to accidental crude oil releases.

Construction

Crossings

Since Keystone has committed to directional drilling at nine crossings (two Missouri River, one Platte River, one Chariton River, two Cuivre River, one Mississippi River, one Hurricane Creek, and one Kaskaskia River), construction-related impacts on aquatic biota and their habitat will be minor at these rivers. Drilling at these rivers will aid in minimizing impacts to important game and commercial fish species and special status species. Directional drilling will not alter or remove habitat because construction within the channel will not be required. It is possible that mud from the directional drilling could inadvertently enter the active stream along the drilling route. However, if mud seepage is detected, the drilling operation will be stopped immediately to reduce pressure within the bore hole. Corrective measures will be implemented to eliminate or minimize seepage. If any seepage enters the stream, increased turbidity or physical impact to the covering substrate will be localized and short-term (less than one day).

Open-cut trenching will be used at the other perennial streams, all of which contain at least one or more game fish species. Open cut crossing can have the following impacts:

- Loss of in-stream habitat through direct disturbance
- Loss of bank cover
- Disruption of fish movement
- Direct disturbance to spawning
- Water Quality effects
- Sedimentation Effects

In-stream Habitat

In the vicinity of the trenchline, trenching and backfilling can result in alteration of in-stream habitat and the mortality of benthic invertebrates inhabiting that reach of the watercourse.

Studies done to monitor the effects on benthic invertebrates have indicated that the impacts are short term. The disturbed area typically is recolonized by benthic invertebrates to near pre-construction levels by the spring or summer following construction (Tsui and McCart 1981; Schubert and Vinikour 1987).

Backfilling the in-stream trench can either improve or lessen the quality of habitat available. This habitat quality change will depend largely on the nature of the soil materials from the lower depths of the trench with respect to those near the surface. If backfilling results in a different material on the stream bed surface than the adjacent areas, a local habitat modification may have occurred. However, the limited extent of the disturbed area and the active bottom substrate sorting by a river suggest any such habitat modification will be small and of short duration in most stream environments.

Bank Cover

Vegetative cover along the stream banks of a waterbody provides cover for fish, shading, bank stability, erosion control and an increased food and nutrient supply due to the deposition of insects and vegetative matter into the watercourse. Loss of bank cover may result in increased water temperatures, reduced food supply, impaired aesthetics, and reduced productivity. The potential for channel migration also can be increased since the removal of vegetation destabilizes the banks at discrete locations. Given the relatively small width of disturbance associated with a pipeline crossing, the above impacts tend to be negligible relative to an entire stream system. The Plan provides bank restoration measures that will insure short-term bank stability (temporary erosion control structures) and rapid vegetation recovery (replanting woody species where appropriate).

Interruption of Fish Movement

Most water crossing methods allow movement of fish across the ROW, however, some techniques such as dry crossing procedures, may block or delay normal movements. Long-term interruption of fish movement in a watercourse or a relatively short-term delay in spawning migration can have adverse impacts. Interruptions during sensitive periods typically are not a concern since in-stream construction generally can be performed outside of sensitive periods. Blockage of non-spawning related fish movement for limited periods (less than seven days) should not affect fish growth and behavior. Delays of less than three days will not adversely affect spawning migrations (Dryden and Stein 1975).

Direct Disturbance of Spawning

In-stream construction activities can displace spawning fish from preferred habitat and result in the utilization of lower quality spawning habitat. Generally, this is of limited concern for water crossing construction since in-stream activities generally are not scheduled during spawning period. Keystone will work with agencies as necessary to further define spawning periods and to refine construction schedules to avoid, where possible, in-stream activities during sensitive periods. As shown in **Table 3.7-4**, spawning periods for most fish species extend from April through June.

Water Quality Effects

It is widely recognized that in-stream excavation activities result in short-term increases in TSS levels and turbidity. These levels decrease with distance from the source as particles settle. The levels also decrease with time following cessation of in-stream activities. Prolonged increase in TSS can adversely affect aquatic systems in the following ways:

- Triggering the drift of benthic organisms
- Reducing the abundance of insect larvae
- Damaging benthos through abrasion
- Clogging fish gills
- Damaging gill membranes
- Altering fish behaviors
- Reducing the ability of fish to feed by sight
- Making the fish susceptible to disease by the added stress of a turbid environment

The damage to aquatic organisms by increase in suspended solids levels is a function of the duration of exposure and the concentration of suspended solids. While relatively high levels of TSS can occur immediately downstream of a crossing, the effects are very short-term with construction across most streams being completed in one day. Additionally, the waterbodies in the project area experience wide ranges in seasonal flow rates, large peak flows due to precipitation events, and drain through areas with relatively fine-grained soils. These factors cause sudden natural peaks in suspended solids concentrations. The aquatic systems supported by these waterbodies are adapted to such increases.

The extent of the increase in TSS levels will be mitigated by Keystone through the use of BMPs described in the Plan. These BMP's include measures to reduce the period of in-stream activity, spoil handling techniques, equipment access installation procedures and dry crossing techniques, where warranted. The BMP's also address upland erosion and sediment control procedures to limit the potential for runoff from disturbed areas to contribute to increased in-stream TSS levels.

Sedimentation Effects

Solids introduced into suspension in a waterbody ultimately will settle on the streambed downstream of the crossing. The distance from the crossing is dependent upon the depth flow, flow velocity, particle diameter and flow characteristics. Coarser materials (sands and gravels) tend to settle relatively close to the crossing location and tend to be distributed uniformly across the stream section. Fine silts and clays can stay in suspension for considerable periods of time and will tend to settle in natural depositional areas downstream of the crossing.

Sedimentation can have the following impacts

- Covers or alters fish habitat
- Covers fish eggs
- Covers benthic organisms

The channel substrates of the streams and rivers that will be crossed by the project consist primarily of fine-grained materials (clay, silt, and sand). Fine-grained excavated material that is deposited downstream is expected to be similar to the existing substrate. Stream flows will suspend and re-deposit excavated materials during higher flow periods.

Young and Mackie (1991) found that benthic invertebrates inhabiting the upper surface of the substrate may be more adaptable to sedimentation than are taxa occupying the interstitial spaces of the substrate. Post-construction studies have shown that benthic invertebrate population generally have recovered to normal within one to two months of construction. Tsui and McCart (1981) reported benthic invertebrate populations downstream of a water crossing had recovered to near pre-construction levels shortly after construction.

Suspended sediment can prevent the successful incubation and hatching of fish eggs or the emergence of fry. This is an issue only when construction occurs during a spawning period.

The BMPs adopted for the Keystone Pipeline Project as described in the Plan will mitigate the short-term effects of downstream sedimentation, as discussed under Water Quality Effects.

Hydrostatic Testing

The Plan lists 26 streams or rivers and three impoundments as water sources for hydrostatic testing on the Keystone Mainline. A further 12 water sources have been identified on the Cushing Extension. The water sources are located throughout the length of the proposed route. The water is likely to be withdrawn from water sources during summer and fall months. Relatively small one-time withdrawals will occur from the streams or rivers designated for hydrostatic test water in accordance with withdrawal permits.

Water used for hydrostatic testing of the pipeline will be obtained from surface water resources. The volume for a 50-mile test section of 30-inch pipeline is approximately nine million gallons. Withdrawal rates and volumes will be designed to avoid impacts to aquatic life and downstream water users. Hydrostatic test water will be discharged to the land surface at an approved location. Discharged water may evaporate or infiltrate into the soil or drainage where the water is released.

Water withdrawal could entrain small fish and drifting macroinvertebrates. The expected numbers of organisms removed during entrainment is considered to be relatively small in relation to the overall numbers in the stream or river. In summary, hydrostatic testing will result in minor impacts to aquatic biota. The discharge of hydrostatic test water will follow state permit requirements, which will reduce potential effects on water quality or aquatic organisms. Energy dissipaters also will be used to prevent erosion at discharge locations.

Operation

Routine maintenance of the pipeline ROW will consist of periodic vegetation clearance. Vegetation removal adjacent to waterbodies will be limited to the removal of trees encroaching on the 50-foot operational ROW. As a result, maintenance activities will not affect aquatic biota or their habitat.

The USDOT prescribes pipeline design and operational requirements that limit the risk of accidental crude oil releases (leaks or spills) from pipelines. Over the operational life of the Keystone pipeline there will be a very low likelihood of a crude oil release from the pipeline that could injure aquatic biota and habitats. On July 1, 2006, Keystone submitted two key documents to the Department of State: a preliminary ERP and a preliminary pipeline risk assessment. The ERP outlines the measures that Keystone will implement in the event of an accident. The preliminary risk assessment evaluates accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

4.2.5.3 Sensitive Wildlife and Aquatic Species

Issues

The issues will be the same identified for general wildlife species in Section 4.2.5.1 and aquatic resources in Section 4.2.5.2.

Construction

Terrestrial Wildlife Species

As discussed in Section 3.7.3, Sensitive Terrestrial and Aquatic Wildlife Species, a total of 61 terrestrial wildlife species (24 special status species and 37 species of special concern) could potentially occur within the project area (see **Tables 3.7-5** and **3.7-6**). Six of these species are federally listed as threatened and endangered (Indiana bat, gray wolf, bald eagle, whooping crane, piping plover, and interior least tern, Eskimo curlew, American burying beetle). Two of the species are federal candidates (massasauga and Dakota skipper).

Potential impacts to sensitive wildlife resources will parallel those discussed in Section 4.2.5.1, Terrestrial Wildlife. Direct impacts to sensitive species from surface disturbance activities include the incremental long-term loss or alteration of potential breeding and/or foraging habitats and increased incremental habitat fragmentation until native vegetation has become reestablished. Potential impacts also could include mortalities of less mobile species as the result of exposure to vehicle and construction equipment traffic, and the potential abandonment of a nest site or territory, including the loss of eggs or young (e.g., piping plover, interior least tern). Other impacts will include short-term displacement of some of the more mobile species from the disturbance areas as a result of increased noise and human presence.

Removal of snags and trees from the ROW during construction could result in the loss of maternity roosts for the Indiana bat. No construction-related disturbance to maternity roosts, bachelor roosts, or hibernacula is anticipated from project activities.

Removal of large trees or snags along rivers, streams, or in wetlands, particularly in the vicinity of the Missouri and Mississippi rivers, could result in the loss of wintering bald eagle roosts or nesting habitat.

A number of occurrences of state-listed threatened or endangered species or species of special concern have been identified by the various state NHP's as occurring near or within the proposed route. For terrestrial wildlife, most of these species are state-listed as threatened or endangered or species of concern that may be rare within a given state but their populations are relatively secure elsewhere. In addition, most are relatively mobile species that could avoid short-term construction disturbance with no resulting long-term adverse effects on local populations. Increased mortality rates could occur in species that are less mobile as the result of exposure to vehicles and construction traffic. This will result in the loss of some individuals but the relatively narrow and linear disturbance area that will be associated with pipeline construction is unlikely to have measurable adverse effects on local populations of sensitive species. For a few species, however, such as the greater prairie chicken, construction through an important habitat feature, such as a lek, may result in the loss of a local breeding population. This could result in extirpation of a remnant population and contribute to a trend toward listing as federal threatened and endangered without the implementation of appropriate mitigation. As mentioned earlier, greater prairie chickens are listed as endangered in Missouri.

The majority of construction disturbance will occur within agricultural lands and these disturbances will be unlikely to affect populations of sensitive species. Surface disturbance activities along the pipeline ROW will, however, result in the incremental long-term disturbance of portions of native tall-grass prairie, wetland, and woodland habitats which may contain potentially suitable habitat for a number of sensitive species. Preconstruction surveys for federally listed and state listed threatened and endangered species, which will be completed prior to surface disturbance activities, are still to be determined through consultation with the USFWS and state wildlife agencies. Once these surveys are complete and if important habitat or populations are identified, appropriate protection measures will be implemented in order to minimize potential impacts to these species.

Aquatic Species

The Keystone Mainline route will cross 17 streams or rivers that contain known or potential habitat for special status (federal and state-listed) fish and mussel species. These include the Sheyenne River (North Dakota); James River (South Dakota); Foster Creek (South Dakota); South Pearl Creek (South Dakota); Redstone Creek (South Dakota); Rock Creek (South Dakota); Wolf Creek (South Dakota); Platte River (Nebraska); Elkhorn River (Nebraska); Missouri River (South Dakota, Nebraska, Kansas, and Missouri); North Fork Elm Creek (Kansas); South Fork Big Nemaha River (Kansas); Rock Creek (Kansas); Little Platte River (Missouri); Shoal Creek (Missouri); Kaskaskia River (Illinois); and the Mississippi River (Missouri and Illinois). Many of the streams listed above also contain habitat for special concern fish and mussel species. Other streams crossed by the Keystone Mainline route that contain special concern fish and mussel species include the Forest River and Pembina River in North Dakota, and numerous smaller streams in Kansas counties such as Marshal, Nemaha, and Doniphan, as well as Missouri counties such as Lincoln, Audrain, Montgomery, Clinton, and St. Charles.

The types of impacts that could affect sensitive fish and mussel species are similar to those discussed for game fish species. Construction-related impacts on sensitive species occurring at the Platte River, Missouri River (two crossings), Chariton River, Cuivre River (two crossings), Mississippi River, Hurricane Creek, and Kaskaskia River will be minor, since directional drilling will eliminate disturbance within the channel. In contrast, open-cut trenching at other streams listed above will result in alteration of bottom substrates, temporary increased sedimentation, and possible removal of riparian vegetation. The degree of impact will depend upon whether important fish spawning or rearing habitat is altered. For streams containing suitable or marginal habitat for Topeka shiner in Kansas and Missouri, fish surveys indicated that it is unlikely that this species is present at the proposed crossings (Stark 2006b). State critical habitat for Topeka shiner is an issue for North Fork Elm Creek in Kansas. If mussels are present within the trenched area, mortalities could occur. Based on a field survey conducted in the James River in South Dakota, no federally listed mussels are present at the crossing (Perkins 2006). Adult fish are likely to move away from the construction area. Generally, impacts could range from several weeks to several years, depending on the life stages that are affected and whether future spawning will be affected.

Potential sources for hydrostatic testing and dust control water could include the following streams that contain sensitive fish and mussel species: Pembina River, Sheyenne River, Rock Creek, Wolf Creek, James River, Missouri River, Platte River, and the Mississippi River. Specific water volumes that will be withdrawn from these streams are not known at this time but will be quantified as details of the hydrostatic test plan are finalized. Nevertheless, water use from any of these streams will result in a relatively small one-time flow reduction. Water withdrawal is expected to represent a relatively small percentage of base flow conditions. Therefore, impacts on fish or mussel habitat will be considered minor in the mid-size to large streams. A low level impact could occur in the smaller streams such as Rock and Wolf creeks. The discharge of hydrostatic test water will follow state permit requirements, which will eliminate potential water quality effects on sensitive species. As part of the consultation with the USFWS for threatened and endangered species in the Platte River, water use (in acre-feet) must be identified. The depletion is determined by dividing the consumptive use by the duration of the project in years. Depletions are considered minor if the volume is less than 25 acre-feet.

<u>Operation</u>

In order to reduce potential impacts to sensitive wildlife species as a result of maintenance activities, Keystone will consult with the appropriate state wildlife or land management agency prior to the initiation of maintenance activities beyond standard inspection measures.

The USDOT prescribes pipeline design and operational requirements that limit the risk of accidental crude oil releases (leaks or spills) from pipelines. Over the operational life of the Keystone pipeline there will be a very low likelihood of a crude oil release from the pipeline that could injure sensitive wildlife and aquatic species and habitats. On July 1, 2006, Keystone submitted two key documents to the Department of State: a preliminary ERP and a preliminary pipeline risk assessment. The ERP outlines the measures that Keystone will implement in the event of an accident. The preliminary risk assessment evaluates accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

4.2.6 Land Use and Aesthetics

Issues

- Establishment of a new pipeline ROW;
- Damage to agricultural equipment or features (e.g., drainage tiles and irrigation systems) during construction;
- Temporary loss of agricultural productivity during the construction period;
- Visual impacts associated with the construction ROW which include removal of existing vegetation, exposure of bare soils, and earthwork and grading scars;
- Increased noise and dust to nearby residential and commercial areas from pipeline construction activities; and
- Increased noise to nearby residential and commercial areas as a result of pump station operations.

Construction

Private lands make up 99 percent of the lands affected by construction of the proposed Keystone Mainline and Cushing Extension. **Table 4.2-2** summarize the acreage of federal, state, and private land temporarily disturbed by construction of the Keystone Pipeline Project.

Table 4.2-2 Acreage Summary of Federal, State, and Private Lands Affected by Construction of the Keystone Project

	Federal	State	Private	Total
KEYSTONE MAINLINE				
North Dakota	0	13	3,340	3,353
South Dakota	0	8	3,491	3,499
Nebraska	0	0	3,262	3,262
Kansas	0	0	1,497	1,497
Missouri	0	28	4,183	4,211
Illinois	37	0	789	826
Keystone Mainline Subtotal	37	49	16,562	16,648

Table 4.2-2 Acreage Summary of Federal, State, and Private Lands Affected by Construction of the Keystone Project

	Federal	State	Private	Total
CUSHING EXTENSION				
Nebraska	0	0	50	50
Kansas	0	52	3,211	3,263
Oklahoma	0	73	1,187	1,260
Cushing Extension Subtotal	0	125	4,448	4,573
Project Total	37	174	20,020	21,221

Note: Acreage does not include 1,820 acres of disturbance associated with pipe storage/contractor yards or disturbance associated with transmission lines.

The principal land use affected by the Keystone Pipeline Project is agriculture. The proposed Keystone Mainline and Cushing Extension routes cross land that is comprised of approximately 64 percent and 51 percent crop production and land use, respectively. Other land use categories affected by construction of the Keystone Pipeline Project include rangeland, forest, wetland/riparian, water, developed, and barren.

Surface disturbance to various land uses caused by construction of the Keystone Pipeline Project are summarized in **Table 4.2-3**. A relatively small temporary loss of crops and forage land will occur in many agricultural and rangelands during construction. In areas where drainage tile is present, the tiles could be damaged by the installation of the pipeline. Keystone will repair or restore drain tiles, fences, and land productivity, which are temporarily disturbed during pipeline construction, as described in the Plan. The Plan also describes topsoil handling and reclamation practices designed to restore land productivity to its prior use.

Table 4.2-3 Acres of Land Uses Affected by Construction of the Keystone Project

	Developed	Agriculture/ Cropland	Grassland/ Rangeland	Forest	Water	Wetland/ Riparian	Total
KEYSTONE MAINLINE							
North Dakota	348	2,314	379	45	9	258	3,353
South Dakota	447	2,226	544	4	10	268	3,499
Nebraska	280	2,539	652	34	18	39	3,262
Kansas	97	984	570	113	20	113	1,497
Missouri	398	2,102	1,032	538	62	79	4,211
Illinois	131	567	20	63	14	31	826
Keystone Mainline Subtotal	*1,701*	*10,732*	*2,597*	*797*	*133*	*688*	*16,648*
CUSHING EXTENSION							
Nebraska	15	13	16	5	<1	0	50
Kansas	333	1,928	819	94	8	81	3,263
Oklahoma	169	396	591	34	3	67	1,260
Cushing Extension Subtotal	*517*	*2,336*	*1,427*	*133*	*11*	*149*	*4,573*
Project Total	2,218	13,068	4,024	920	144	837	21,221

Note: Acreage does not include 1,820 acres of disturbance associated with pipe storage/contractor yards or disturbance associated with transmission lines.

Residences within 500 feet of the Keystone Mainline and Cushing Extension ROW (see Section 3.8) will experience short-term inconvenience from construction equipment noise and dust for a period of one week to 30 days. During construction, Keystone will be required to comply with any local construction noise requirements. In addition, Keystone has agreed to limit construction activities primarily to daylight hours. Noise and dust impacts from construction activities will be mitigated according to the Plan.

Structures located within 25 feet of the Keystone Mainline construction ROW are summarized in **Table 2.1-6**. The majority of the structures located within 25 feet of the construction ROW are where the Keystone Mainline is co-located with the Platte Pipeline in Missouri.

A total of nine existing recreation and special interest areas are crossed by the proposed Keystone Mainline (**Table 3.8-4**). The Milford State Wildlife Area in the vicinity of MP 50 to MP 54 in Kansas is the only recreation and special interest area crossed by the proposed Cushing Extension route. A total of 50 USFWS wetland easements in North and South Dakota are crossed by the Keystone Mainline (**Table 3.8-5**). Mitigation measures outlined in the Plan will minimize impacts to these areas.

The pipeline will cross Carlyle Lake (a flood control impoundment on the Kaskaskia River) in Fayette County, Illinois. The pipeline will be co-located with other pipelines in the same corridor. Seasonal flooded waterfowl habitats have been created by a series of impoundments surrounded by levees that will be crossed by the pipeline. This area is administered by Illinois Department of Wildlife. Public access for hunting and other recreational uses is provided on the west side of the lake. The public parking lot is located adjacent to the existing pipeline corridor. It is anticipated that public access to this area will be restricted during pipeline construction and special construction measures may be required to cross under the impoundments. Keystone will continue to consult with the USACE and the Illinois Department of Wildlife to determine the best methods for maintaining public access to this recreational area. Keystone has prepared a site-specific crossing plan for the Carlyle Lake Crossing (Appendix D), which will be included in the project's USACE 404 application.

Keystone's preliminary HDD plan will avoid direct land disturbance within the NPS WSR administrative boundary associated with the Missouri River crossing near Yankton, South Dakota. The NPS administers, but does not own, land at the proposed crossing location. The HDD entry point will be located on City of Yankton land on the north shore; the HDD exit point will be located on private land on the south shore. Keystone conducted preliminary discussions with the NPS and the City of Yankton in February 2006. A meeting was held in Yankton on May 19, 2006, to discuss the proposed directional drill under the Missouri River. Preliminary crossing drawings were provided. A Special Use Permit will be required from the NPS to conduct geotechnical drilling near the banks of the river. Keystone filed a Special Use Permit Application to the NPS on August 17, 2006. Approval of this plan by the National Park Service is pending. Keystone submitted copies of NPS consultation documents to the Department of State in the September 15, 2006 filing. A site-specific crossing plan utilizing HDD methods has been developed (Appendix D), which will maintain public access to the river, and avoid disturbance of existing land uses and designations.

Construction of the Keystone Pipeline Project will have temporary impacts on recreational traffic and use patterns during construction activities in special management areas and recreational areas. Sightseers, hikers, wildlife viewers, hunters, etc. will be displaced from the immediate area during construction. Keystone will continue to coordinate with agency managers to minimize conflicts between construction activities and recreational uses for which these special areas were established. These impacts will be of short duration with no long-term impacts.

Visual resource impacts associated with construction of the Keystone Pipeline include removal of existing vegetation, exposure of bare soils, earthwork and grading scars, and landform changes that introduce contrasts. Keystone has aligned the pipeline route to avoid aesthetic features to the extent possible. Visual resource impacts from construction activities will be of short duration with no significant long-term impacts due to implementation of Keystone's mitigation measures outlined in the Plan.

Operation

Certain existing land uses will be converted to long-term utility use for the duration of the pipeline's operation. This conversion represents a long-term future constraint on development of private land because dwellings cannot be placed on the permanent pipeline ROW for the entirety of the ROW lease period. The 50-foot-wide operational ROW will be maintained in an open condition for the life of the pipeline facilities. No other operational impacts are anticipated to agriculture and rangeland or special management areas. If there are to be surface disturbances due to future maintenance activities, these will be reclaimed after the disturbance, utilizing measures described in the Plan. Recreational use access will not be affected by pipeline operations within special management areas.

The impacts of aboveground facilities on visual resources will depend on the location of each individual facility and its visibility from the surrounding area. Keystone has located the pump stations based on hydraulic and engineering design considerations but also has considered impacts on aesthetics and sensitive environmental resources in determining the facility locations. Pump stations are located on private range or agricultural lands. To minimize visual resource impacts from pump stations, Keystone will landscape these areas to provide a visual screen where appropriate.

During operation of the pipeline, the noise impact associated with the electrically driven pump stations will be limited to the vicinity of the facilities. **Table 4.2-4** summarizes the nearest noise sensitive area (NSA) and the number of residences / structures within one mile of each proposed pump station. The proximity of the NSA's ranges from 18 feet at PS 35 to 1,389 feet at PS 31.

Table 4.2-4 Structures within 1 Mile of Pump Stations

State/County	Pump Station	Milepost of Pump Station	Distance to NSA (feet)	Direction from Pump Station	Number of Structures Within 1 Mile of Pump Stations
NORTH DAKOTA					
Walsh	PS15	33.0	1,200	SE	7
Nelson	PS16	75.9	3,523	S-SE	4
Steele	PS17	123.4	2,257	NNW	3
Ransom	PS18	170.2	650	E	10
Dickey	PS19	216.8	1,148	NE	1
Sargent	PS19	216.8	–	–	5
SOUTH DAKOTA					
Brown	PS19	216.8	–	–	5
Day	PS20	262.1	–	–	0
Clark	PS21	308.9	2,700	NE	6
Miner	PS22	356.8	–	–	0
Hutchinson	PS23	404.8	2,650	SE	11
NEBRASKA					
Cedar	PS24	452.7	354	NE	16
Stanton	PS25	499.1	846	NNW	12

Table 4.2-4 Structures within 1 Mile of Pump Stations

State/County	Pump Station	Milepost of Pump Station	Distance to NSA (feet)	Direction from Pump Station	Number of Structures Within 1 Mile of Pump Stations
Butler	PS26	549.5	240	NW	10
Saline	PS27	601.8	1,342	WSW	4
Jefferson	PS28	637.3	2,142	N	6
KANSAS					
Nemaha	PS29	688.2	850	S	19
Doniphan	PS30	736.7	1,043	SW	13
MISSOURI					
Clinton	PS31	782.3	3,400	W	31
Carroll	PS32	829.8	920	SE	17
Chariton	PS33	864.6	813	NW	12
Audrain	PS34	903.8	1,300	S	14
Montgomery	PS35	947.5	1,930	NE	18
St. Charles	PS36	984.8	500	S	17
ILLINOIS					
Madison	PS37	1022.75	253	E	4
Fayette	PS38	1049.8	545	N	7
Kansas					
Dickinson	C30	CE 94.4	1,112	E	8
Cowley	C32	CE 183.4	289	NE	17
Oklahoma					
Kay	C33	CE 228.4	272	SE	37

Note: Manual count from aerial drawings and numbers may differ in actuality due to features that appear to lead to buildings.

Keystone will perform a noise assessment for the proposed pump stations. The assessment will estimate the level of noise reduction over the distances to the listed NSAs.

Noise impacts from the electrically powered pump stations are anticipated to be minor. Noise mitigation measures will be applied if needed to meet noise regulations. The pump stations will be constructed in a manner to minimize potential impacts from noise. Noise mitigation may include construction of berms around the facilities or planting of vegetation screens.

4.2.7 Cultural Resources

Issue

- Construction and operation of the Keystone Pipeline Project and associated facilities potentially could affect NRHP-eligible historic properties such as prehistoric or historic archaeological sites, districts, buildings, structures, and objects.

Construction

Those areas in which impacts are planned or are likely to occur are referred to as the "area of potential effect" or APE. Specifically, the APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of NRHP-eligible sites, if any such sites exist.

Only those cultural resources located in the APE were reviewed to determine if any would be subject to impacts that could affect their eligibility for the NRHP based on NRHP criteria for evaluation. For the proposed Keystone pipeline project, the APE is the 200-foot-wide survey corridor in areas where the proposed pipeline parallels an existing pipeline, the 300-foot-wide survey corridor in greenfield areas, and the footprint of proposed pump stations, plus a 50-foot buffer.

Cultural resources field surveys along selected segments of the pipeline corridor have been ongoing since spring 2006. As a result of the field surveys, several potentially eligible sites were located within the project APE. Avoidance or evaluative testing in order to definitely determine NRHP eligibility was recommended for these sites. For those sites at which avoidance was not feasible, evaluative testing was started in early September 2006. To date, evaluative testing has been started at 14 sites. One of the 14 sites has been determined eligible for the NRHP, three have been determined not eligible, and the results of testing on the remaining 10 sites are pending.

Construction and operation of the proposed pipeline and associated facilities could potentially affect NRHP-eligible sites. These could include prehistoric or historic archaeological sites, districts, buildings, structures, objects, and locations with traditional cultural value to Native Americans or other groups. Project impacts could include: the physical disturbance during construction of archaeological sites located within the project APE; the demolition, removal, or alteration of historic or architecturally significant structures/features; and the introduction of visual or audible elements (e.g., pump stations) that could alter the site's setting. Impacts to NRHP-eligible sites would be mitigated through SHPO- and Department of State-approved data recovery techniques. Mitigation may include, but would not be limited to, one or more of the following measures: 1) avoidance through the use of realignment of the pipeline centerline, relocation of pump stations, or changes in the construction and/or operational design; 2) data recovery, which may include the systematic professional excavation of an archaeological site or the preparation of photographic and/or measured drawings documenting standing structures; and 3) the use of landscaping or other techniques that would minimize or eliminate effects on the historic setting or ambience of standing structures.

Whenever feasible, Keystone will avoid NRHP-eligible sites identified within the project APE. Keystone will consult with the appropriate SHPO(s) to identify measures to avoid adversely affecting these sites. If adverse effects to any NRHP-eligible sites cannot be avoided, Keystone will develop treatment plans for mitigating those effects. Keystone will file avoidance or treatment plans, as appropriate, with the appropriate SHPO(s) and the Department of State.

Construction activities and associated operations could adversely affect undiscovered archaeological sites. If previously undocumented sites are discovered within the construction corridor during construction activities, all work that might adversely affect the discovery will cease until Keystone, in consultation with the appropriate parties, can evaluate the site's eligibility and the probable effects. If the previously unidentified site is recommended as eligible to the NRHP, impacts will be mitigated through an Unanticipated Discovery Plan, which will be included in the cultural resources survey reports prepared for each state.

If construction or other project personnel discover what they believe to be human remains, funerary objects, or items of cultural patrimony on federal land, construction will cease within the vicinity of the discovery and the appropriate agency will be notified of the find. Treatment of any discovered human remains, funerary objects, or items of cultural patrimony found on federal land will be handled in accordance with NAGPRA. Construction will not resume in the area of the discovery until the authorized agency has issued a notice to proceed.

If human remains and associated funerary objects are discovered on state or private land during construction activities, construction will cease within the vicinity of the discovery and the county coroner or sheriff will be notified of the find. Treatment of any discovered human remains and associated funerary objects found on state or private land will be handled in accordance with the provisions of applicable state laws.

Operation

The primary impact of the operation phase of the Keystone Pipeline Project is the potential introduction of visual or audible elements (e.g., pump stations), which could alter the setting associated with historic properties. Keystone will mitigate these operational impacts to NRHP-eligible sites by the use of landscaping or other techniques that will minimize or eliminate effects on the historic setting or ambience of standing structures.

4.2.8 Native American Consultation

Issue

- Construction of the Keystone Pipeline Project potentially could affect NRHP-eligible historic properties, including locations with traditional cultural value to Native Americans or other groups.

Construction

Tribal consultation has been initiated with 44 tribes that were recognized as having a potential past or present affiliation with the proposed project area. To date, the Three Affiliated Tribes (North Dakota) and Sisseton Wahpeton Oyate (South Dakota) are the only tribes that have responded to the initial consultation letters. The tribes expressed interest in the project, travel expenses, the two rock cairns identified during the field surveys, and requested to possibly monitor the rock cairns during construction. Neither tribe identified any TCPs within the project APE. At this time, follow-up phone calls to the tribes have not been conducted. The Department of State has indicated that it will continue consultation with the tribes from this point forward. Keystone forwarded all information regartding its tribal consultation activities to the Department of State.

Efforts to identify places of traditional or religious importance to Native American tribes will continue throughout the environmental review and construction phase of the project. The consultation process will remain open for any tribe that expresses a desire for participation when a TCP may be affected by the proposed project. Any TCP that may be affected by the proposed pipeline project will be treated in accordance with the NHPA, as amended, and its implementing regulations, and other applicable federal statutes and/or tribal laws and policies, as appropriate. No surface disturbance will occur within or immediately adjacent to the boundary of a TCP prior to completion of all consultation required by law. Any such data recovery or mitigation plan will be reviewed and approved by the Department of State and appropriate SHPOs. Tribal representatives will be asked to participate in the development of any such data recovery or mitigation plan in accordance with federal mandates.

Operation

No impacts are anticipated during the operational phase of the project.

4.2.9 Socioeconomics

Issues

- Compensation to landowners for conveyance of easements and restrictions and damage to land and property;
- Construction workforce demands on local infrastructure;
- Fiscal benefits from goods and services purchased locally and associated tax revenue generated; and
- Tax revenues generated by the pipeline.

Construction

Compensation for Damages to Land Use and Property

The Keystone Pipeline Project will be constructed in predominantly rural, agricultural areas. Keystone will acquire pipeline ROW easements from landowners and will provide landowners with monetary compensation for the conveyance of those easements. Construction activities will create the potential for damage to land and property, including drainage tiles, irrigation systems, and fences. Keystone will restore damage or disturbance to lands. Keystone also will repair or restore drain tiles, irrigation systems, fences, and other items and features that are damaged or temporarily disturbed during pipeline construction. Repair and/or monetary compensation for damage to land and property during construction are discussed in detail in the Plan.

Demands on Local Infrastructure

Construction of the Keystone Pipeline Project is proposed to be completed in five spreads: four spreads on the Keystone Mainline and one on the Cushing Extension (see **Table 4.2-5**). Keystone anticipates that it will require approximately 15 months to complete each spread. Work on the Keystone Mainline is proposed to commence in early 2008 and to be completed by September 2009. Work on the Cushing Extension will begin

Table 4.2-5 Construction Spreads Associated with the Keystone Pipeline Project

Spread Number	Location according to Map	Approximate Distance within Construction Spread (miles)
KEYSTONE MAINLINE		
Spread 1	US/Canada Border (Cavalier County, ND) through Clark County, SD	300
Spread 2	Beadle County, SD through Gage County, NE	330
Spread 3	Marshall County, KS to Salisbury, MO (in Chariton County)	215
Spread 4	Salisbury, MO (in Chariton County) to Patoka, IL (in Marion County)	220
CUSHING EXTENSION		
Spread 5	Jefferson County, NE to Cushing, OK (Payne County)	300

in the fall of 2008. Approximately 500 to 600 construction personnel (Keystone employees, contractor employees, construction inspection staff, and environmental inspection staff) are expected to be associated with each spread for a total workforce of approximately 2,500 to 3,000 construction personnel. Additionally, construction of pump stations and delivery facilities will require an additional 20 workers per station for a total of approximately 150 to 200 workers at the peak, since all pump stations will not be constructed simultaneously. Construction of pump stations and delivery stations is to commence in 2008 and be completed in the third-quarter of 2009.

Keystone proposes to hire temporary construction staff from the local population where possible. It is estimated that approximately 10 to 15 percent of the total construction workforce could be hired locally, with the remaining portion (85 to 90 percent or more) consisting of non-local personnel. Keystone estimates that long-term operation of the pipeline will require a total of approximately 20 permanent employees in the U.S.

The project construction period will be relatively short in any given area and most non-local workers will not be accompanied by their families during their work tenure. Consequently, it is expected that most project workers will use temporary housing, such as hotels/motel, RV parks, and campgrounds. Some workers are likely to rent furnished apartments and homes, due to the constrained availability of other accommodations, though this is generally less preferable because landlords and property management companies prefer extended term commitments. Most of the temporary workers will seek housing in the more populated, service-oriented towns located within a reasonable commuting distance to the work site. As the more convenient options fill, workers will seek alternatives, driving further, looking at smaller communities, even using campgrounds in nearby state parks, which typically have limits on the length of occupancy. Furthermore, some individuals may desire to relocate during the term of the project as the active construction area in each spread moves along the pipeline route. The net effect of these factors is that the temporary housing demand will be dynamic.

In the more northern, rural portions of the proposed project (North Dakota and most of South Dakota, Nebraska, and Kansas) it will be more difficult for local housing markets to fill these temporary housing needs due to the more limited availability of temporary housing in close proximity to construction work sites. Construction workers in these areas are likely to drive further to find housing in nearby small towns or rely more heavily on RV parks and campgrounds. Conversely, in the portions of the route through more populated areas such as most of Missouri and Illinois, the local housing markets will be much more likely to absorb the temporary housing needs of construction workers as they will be more likely to find hotels/motels in towns and cities in close proximity to construction work sites.

Other construction-related impacts on local services may include increased demand for permits for vehicle load and width limits and local police assistance during construction at road crossings to facilitate traffic flow. In more rural sections of the proposed route, particularly in North Dakota and most of South Dakota, response times to highway or construction-related accidents may be lengthy given communication, dispatch, and travel time considerations. In these areas, it may be necessary to provide on-site first responder services, however, Keystone will work with the local law enforcement, fire departments, and emergency medical services to determine the best course of action and coordinate for effective emergency response. Plans to deal with these issues will be addressed in the ERP. The degree of impact will vary from community to community, depending on the number of non-local workers and accompanying family members that temporarily reside in each community, the duration of their stay, and the size of the community. Although these factors are too indeterminate and variable to accurately predict the magnitude of impact, the effects will be short-term and, therefore, are not expected to be significant.

Short-term Fiscal Benefits

Taxes that may apply, other than property taxes levied by various state, county, or local taxing jurisdictions, include taxes on gross receipts from the sales of goods and services. These taxes and fees vary by region or locality and will be received only during the construction period (18 months).

Operation

Demands on Local Infrastructure

The limited number of permanent employees associated with the proposed project will result in negligible long-term impacts on public services.

Long-Term Fiscal Benefits

In the operation phase, the pipeline will increase the tax base in the states, counties, and communities crossed. Keystone has estimated that a total of approximately $30.2 million will be paid in property taxes during the first year of pipeline operation for the Keystone Mainline and an additional $16.5 million for the Cushing Extension. Based on 2005 property assessment and tax rate information for each state/county, the distribution by state for the first year of property taxes will be $5.3 million to North Dakota, $6.5 million to South Dakota, $5.2 million to Nebraska, $4.5 million to Kansas, and $8.7 million to Missouri. The state of Illinois does not levy property tax on oil and gas pipelines. The distribution by state for the Cushing Extension will be an additional $0.7 million in Nebraska, $13.6 million in Kansas, and $2.8 million in Oklahoma.

Environmental Justice

Based on a review of the minority population and income status of communities crossed by and in the proximity of the proposed Keystone Mainline and Cushing Extension routes, Keystone has determined that Yankton, South Dakota, and Alton, Illinois, have the most significantly high minority populations on the Keystone Mainline route, while Winfield, Kansas, and Marland, Oklahoma, have the most significantly high minority populations on the Cushing Extension route. The minority populations of concern in both of the cities on the Keystone Mainline route are black. In Winfield Kansas the minority population is Asian or Pacific Islander, and Marland, Oklahoma, has high populations of both Hispanics and Native American or Alaskan Natives. Additionally, several low income communities have been identified along the Keystone Mainline and Cushing Extension routes. The largest and most significant of these low income populations tend to occur in the more heavily populated states of Missouri and Illinois along the Keystone Mainline route, particularly in communities near the greater St. Louis municipal area. Along the Cushing Extension, the lowest income communities were found throughout Oklahoma where the proposed project route passes just west of the Osage Indian Reservation. Risk analyses need to be conducted for all locations identified as having significant minority populations and low income populations. These analyses determine the specific environmental impacts that may affect these populations, including concerns regarding land use and safety. The overall goal is to ensure that risks to residents of these communities are not disproportionately greater than those to which other residents along the pipeline are exposed.

4.2.10 Public Health and Safety

Issues

- Risk of crude oil releases (leaks and spills) during pipeline operations, including the contribution of natural hazards (seismicity and faults, landslides, and subsidence) to this risk and the subsequent potential effects on humans and other sensitive resources such as populated areas, drinking water sources, and ecologically sensitive areas.

Keystone submitted a preliminary risk assessment for the accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State by the first quarter of 2007.

4.3 No Action Alternative

This Environmental Report supports Keystone's application to the Department of State for a Presidential Permit to construct and operate a crude oil pipeline, which crosses the Canada/U.S. border. The Department of State has three courses of action in processing the application. The Department of State may:

1. Grant the permit without conditions;
2. Grant the permit with conditions; or
3. Deny the permit.

If the Department of State denies Keystone's application for a Presidential Permit (the No Action Alternative), the environmental impacts of the proposed action identified in this ER will not occur and the stated objectives of Keystone's proposal will not be met. The Keystone Pipeline Project will not provide needed pipeline capacity to transport WCSB crude oil supplies. The project will not provide the U.S. with a source of stable, secure, and long-term North American crude oil supplies to the Midwest and Gulf Coast markets, and will not decrease U.S. dependence on foreign offshore oil supply. Denying authorization of the Keystone Pipeline Project also could result in U.S. reliance on more expensive and less reliable crude oil supplies.

The No Action Alternative will not necessarily result in an overall reduction of environmental impacts because crude oil likely will continue to be transported to Midwest and Gulf Coast markets by other pipeline routes or alternative transportation methods.

CUMULATIVE IMPACTS

CHAPTER 5

5.0 CUMULATIVE IMPACTS

Cumulative impacts are defined in the Council on Environmental Quality regulations 40 CFR 1508.7 as "…the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency… or person undertakes such other actions." These actions include current and projected area development (e.g., oil and gas), management activities and authorizations on public lands (e.g., range conversion and forestry programs), land use trends, and applicable industrial/infrastructure components (e.g., utility corridors).

Foreseeable construction projects were screened to determine whether they will overlap in time and space with the Keystone Pipeline Project and thus could interact to cause cumulative impacts. Cumulative construction projects include the construction and operation of the Kinder Morgan Rockies Express (REX) Pipeline Project.

5.1 Powerlines

The construction of the electrical transmission and distribution powerlines necessary for the Keystone Pipeline Project will occur during the same timeframe and in the same general area as the Keystone Pipeline Project. Construction activities will be of short duration in any single location. Most powerlines will be co-located with other ROWs (i.e., roadways, pipeline corridors, and existing powerlines) to reduce the overall amount of habitat fragmentation and interference with agricultural operations. The amount of land associated with the powerline ROWs represents a small fraction of available native vegetation in the region. As a consequence, these powerlines do not represent a substantial cumulative disturbance to the environment.

5.2 Existing Platte Pipeline System and the Proposed Kinder Morgan REX Pipeline

The Platte Pipeline has been in place for more than 50 years (in-service since 1952) and the existing ROW has been reclaimed. However, routine maintenance and refurbishment activities along the existing Platte Pipeline ROW will have minimal cumulative impacts on resources when combined with adjacent, new pipeline construction. Any sites required for work on the Platte pipeline will be relatively isolated, located in small, discrete areas, and work will involve small crews for short-time periods. Consequently, cumulative impacts from maintenance activities along the existing Platte Pipeline system are considered to be minimal.

Kinder Morgan recently announced their plans to construct the REX Pipeline. This project calls for building a 42-inch in diameter, 1,350-mile pipeline, capable of carrying up to two billion cubic feet of natural gas per day, from the Cheyenne natural gas pipeline hub in Weld County, Colorado, to another hub in Clarington, Ohio. Pending shipper commitments and regulatory approvals, the portion of the proposed REX Project from Weld County, Colorado, to Audrain County, Missouri, is projected to commence construction in 2007 and be in-service by late 2008.

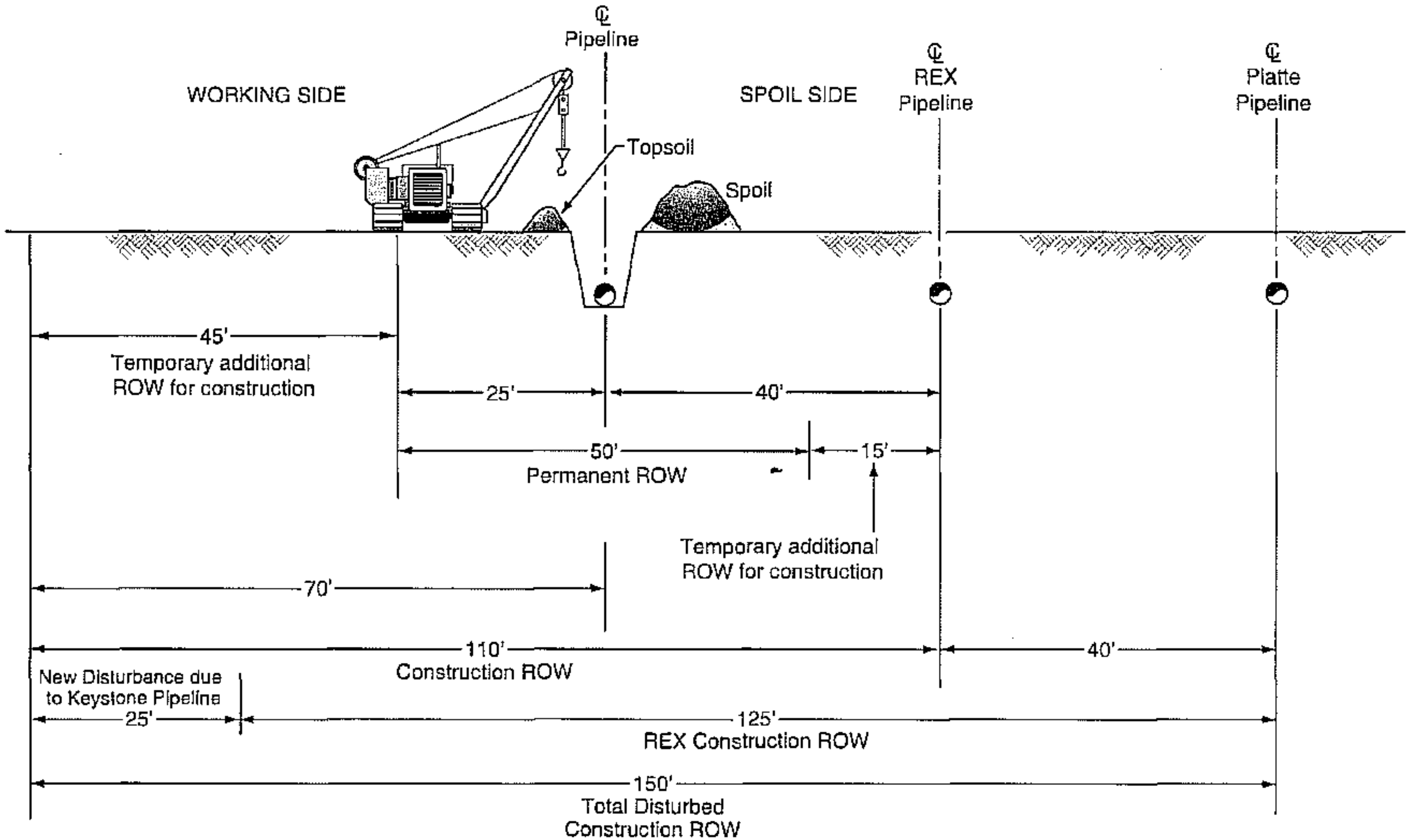
If constructed, the REX pipeline will parallel the existing Platte Pipeline system for much of its length, including the segment that will be co-located with the Keystone Pipeline from the Nebraska-Kansas border to Troy, Missouri (approximately 282 miles). The proposed location of the REX pipeline has been considered in the routing of the Keystone Pipeline.

During construction, most surface disturbance associated with the REX pipeline will be related to the construction of the pipeline, with smaller disturbances associated with the compressor stations. Resources were evaluated to determine if cumulative effects are likely to occur.

The width of the construction disturbance caused by both new pipelines will depend on which side of the existing Platte pipeline that REX and Keystone are constructed. When REX and Keystone are located on the south side of the existing Platte pipeline (**Figure 5.2-1**), the Keystone working side (the side of the construction ROW where equipment excavates the trench and lays the pipe) is located on the outside of the overall construction ROW. When REX and Keystone are located on the north side of the existing Platte pipeline (**Figure 5.2-2**), the location of Keystone's working side is located between REX and the Keystone pipeline. In both cases, the overall width of the combined construction disturbance will be approximately 150 feet. Assuming a co-location distance of 282 miles for the two new pipelines, and a combined construction ROW width of 150 feet, the REX Pipeline Project will disturb approximately 4,272 acres (some of which also was disturbed during construction of the Platte Pipeline) and Keystone will disturb an additional approximate 855 acres for a total disturbance of approximately 5,127 acres.

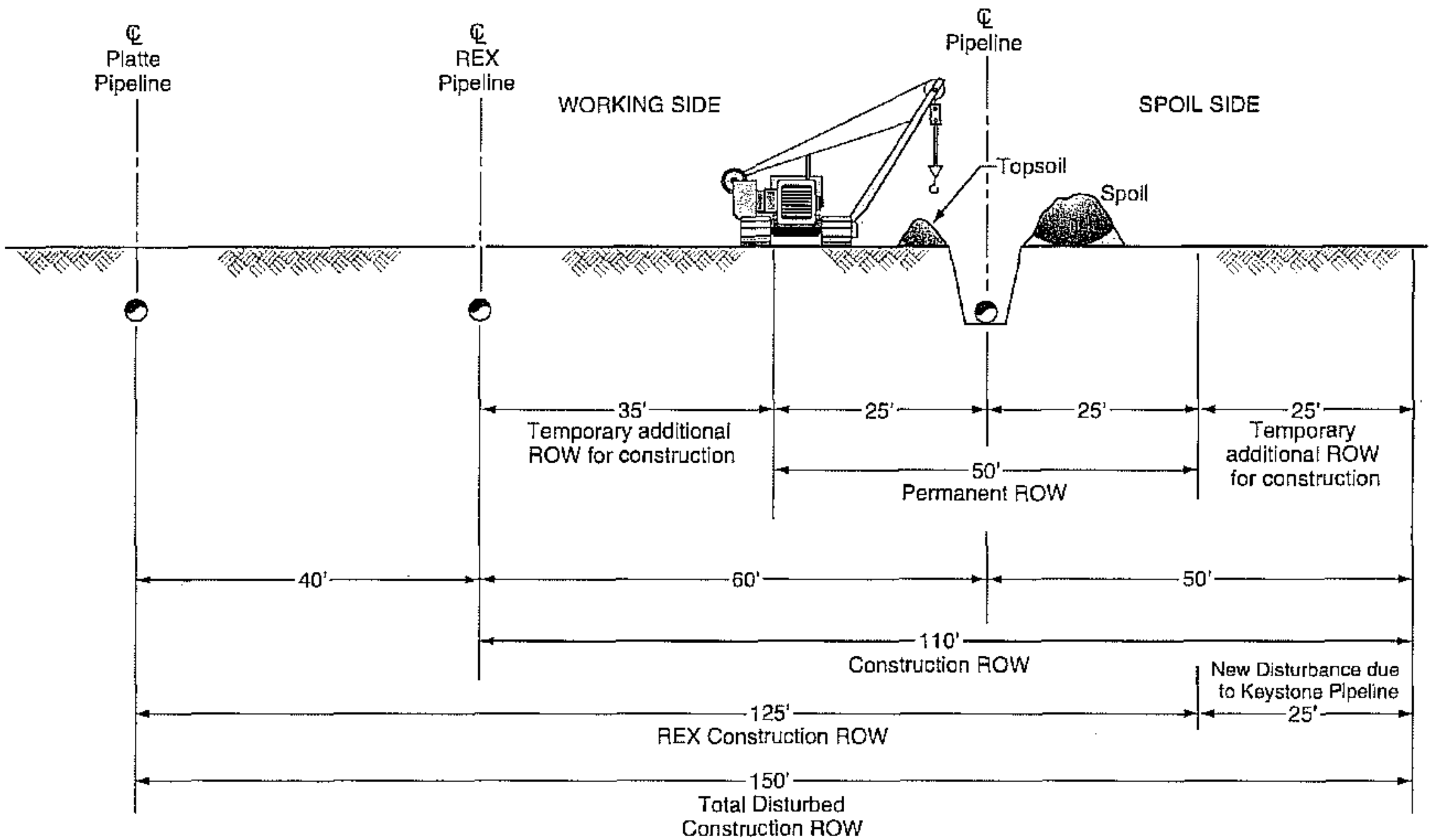
The location of the construction working side will affect the offset distances between adjacent installed pipelines. Where the Keystone pipeline is located north of the existing Platte and REX pipelines, the cumulative width of the permanent easements for the three pipelines will be 140 feet (**Figure 5.2-3**). Where the Keystone pipeline is located south of the existing Platte and REX pipelines, the cumulative width of the permanent easements for the three projects will be 130 feet (**Figure 5.2-4**).

If constructed on schedule, the REX and Keystone pipelines will be constructed in sequential years. As a result, many cumulative impacts due to construction in the same year will be avoided (e.g., construction traffic and work forces). For most resources (e.g., soils, vegetation, water, cultural resources), sequential construction will result in additive impacts. The impacts will occur along parallel and adjacent ROWs and impacts typically will directly overlap. For example, the construction of two pipelines in sequential years will result in the loss of sequential growing seasons on two adjacent strips of agricultural lands.



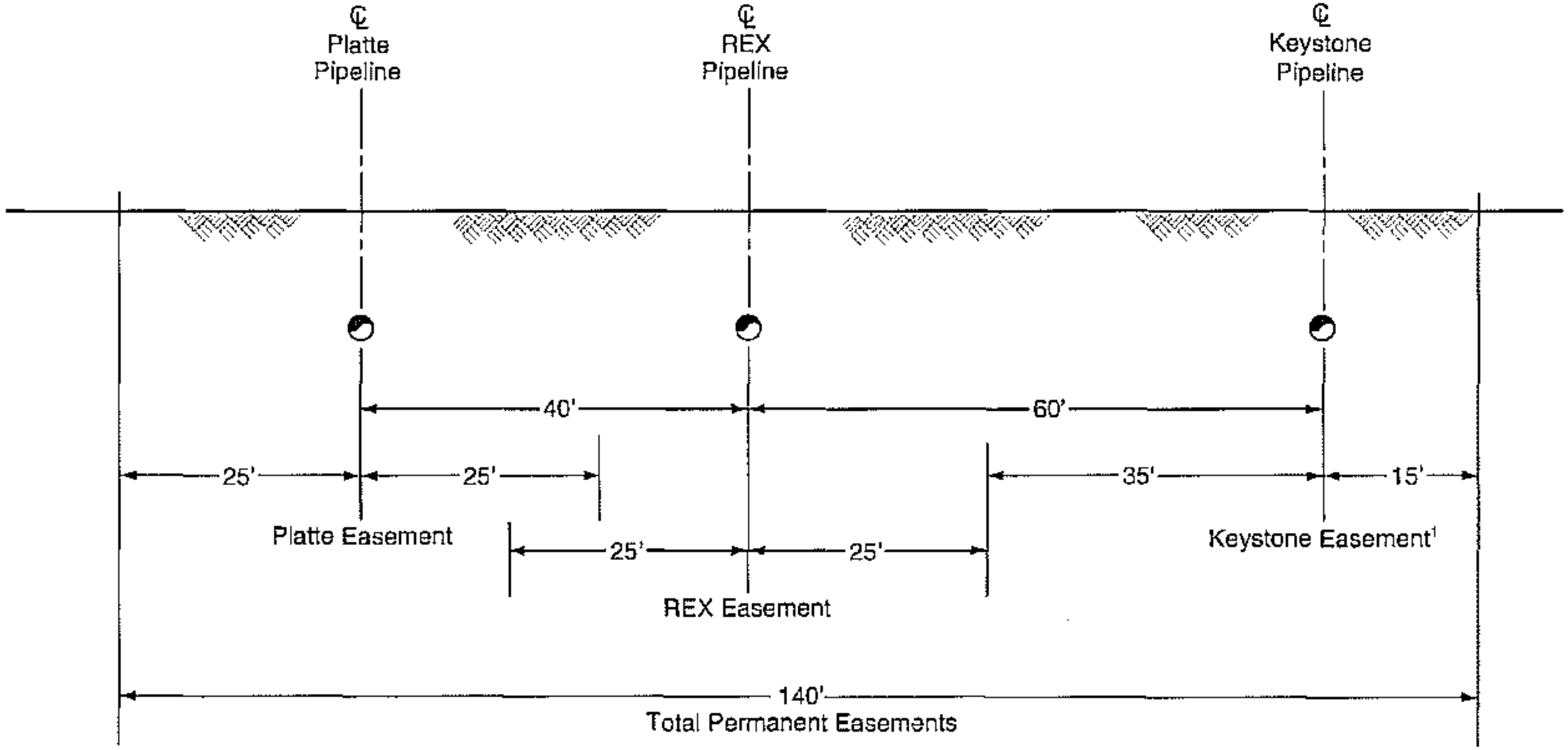
KEYSTONE PIPELINE PROJECT

Figure 5.2-1
Typical 110' Construction Rights-of-Way where Keystone Pipeline is Co-located with REX and Platte Pipelines (Construction Is South of Platte Pipeline)



KEYSTONE PIPELINE
PROJECT

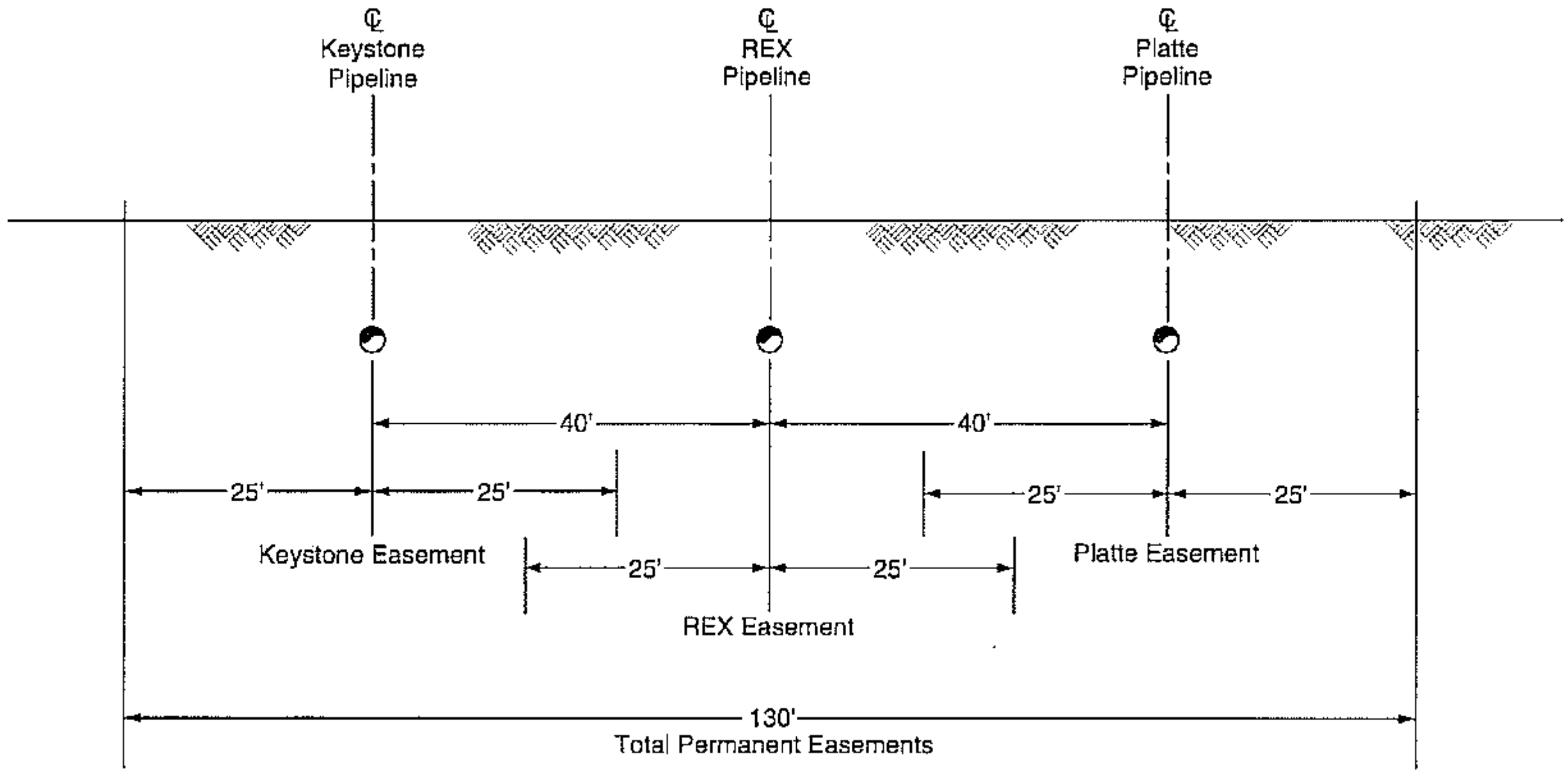
Figure 5.2-2
Typical 110' Construction Rights-of-Way where Keystone Pipeline is Co-located with REX and Platte Pipelines (Construction is North of Platte Pipeline)



[1] Keystone Permanent 50' Easement is not centered on pipe to eliminate 10' gap in permanent easements.

KEYSTONE PIPELINE PROJECT

Figure 5.2-3
Typical Permanent Easements where Keystone Pipeline is Co-located with REX and Platte Pipelines
(Construction is North of Platte Pipeline)



KEYSTONE PIPELINE PROJECT

Figure 5.2-4
Typical Permanent Easements where Keystone Pipeline is Co-located with REX and Platte Pipelines
(Construction is South of Platte Pipeline)

ENVIRONMENTAL IMPACT SUMMARY

CHAPTER 6

6.0 ENVIRONMENTAL IMPACT SUMMARY

Table 6-1 provides a summary of the environmental impacts that are expected to remain after Keystone's BMPs are applied. This impact summary addresses the entire project (Keystone Mainline, Cushing Extension, and ancillary facilities (pump stations, powerlines). These impacts include short-term uses of renewable resources, such as water withdrawn for hydrostatic testing and then discharged back to the land. These impacts also include long-term changes in land use, such as the prohibition of residential structures on the permanent pipeline ROW.

Table 6-1 Impact Summary

Resource	Impact Summary
Air Quality	• Fugitive dust will be generated from ROW construction activities and traffic over the construction period regardless of the dust suppression measures applied. All regions crossed by the project are in attainment for particulate matter and no state-mandated dust control permits will be required. • Operational hydrocarbon emissions from 27 pump stations (23 initial [plus one future] on the Keystone Mainline and three on Cushing Extension) spaced 30 to 50 miles apart will be minimal since pumps will be electric and no new crude oil tanks will be required.
Geology, Minerals, and Paleontology	• Construction and operation of the Keystone pipeline system will limit access to underlying minerals (sand and gravel) for the project life. This limitation will be confined to the width of the permanent pipeline ROW that overlies glacial deposits, or approximately 800 miles. • The Keystone pipeline system will be located over approximately 40 miles of underlying coal seams between Wood River and Patoka, Illinois. This coal is currently being mined with underground methods. The Keystone pipeline will be located within an existing pipeline corridor and will not add a new limitation on access to underlying coal. • Any Pleistocene-era mammalian fossils excavated during construction will not be studied or retrieved.
Soils and Agricultural Production	• A small fraction of the excavated soils in areas with highly erodible soils (2,458 acres) will be lost to increased water and wind erosion acting on disturbed soil surfaces until grass and other herbaceous vegetation is restored (three to five years). • Agricultural cropland and rangeland (including hayland) production will be lost from the construction ROW for the season during construction on approximately 17,094 acres. During the next growing season, production on haylands and pasturelands may be reduced but not completely lost. Long-term productivity will not be impaired.
Water Resources	• Construction across waterbodies will cause local short-term increases in total suspended solids and deposited sediment in 270 perennial streams and rivers. Channel disturbance within the Missouri River (two crossings), Platte River, Chariton River, Cuivre River (two crossings), Mississippi River, Hurricane Creek, and Kaskaskia River will be avoided by using horizontal directional drills to install the pipeline. • Water used for hydrostatic testing of the pipeline will be obtained from surface water resources. The volume for a 50-mile test section of 30-inch pipeline is approximately nine million gallons. Withdrawals rates and volumes will be designed to avoid impacts to aquatic life and downstream water users. Hydrostatic test water will be discharged to the land surface at an approved location. Discharged water may evaporate or infiltrate into the soil or drainage where the water is released.

Table 6-1 Impact Summary

Resource	Impact Summary
	• Pipeline construction will disturb a total of 981 acres of wetlands, river systems and open water. Of this total, approximately 837 acres are wetlands (701 acres palustrine emergent wetlands and 135 acres forested wetlands) and 144 acres are located in river systems and open water. It is estimated that vegetation cover in palustrine emergent wetlands will recover in three to five years; forested wetlands will require 20 to 50 years. No permanent loss of wetlands will occur as a result of this project; however, approximately 55 acres of forested wetland will be permanently converted to herbaceous wetland.
Vegetation	• Pipeline construction will disturb a total of 21,221 acres including 4,024 acres of native and modified grassland and 1,053 acres of upland and forested wetlands. It is estimated that vegetation cover in native and modified grasslands will recover in three to five years, while forests and woodlands will require 20 to 50 years. Trees will not be able to grow on approximately 431 acres of currently forested woodlands during operation to allow aerial surveillance.
Wildlife	• Approximately 1,754 acres of upland and wetland wildlife habitats will be cleared during pipeline construction and then will recover over short- and long-term time frames (see Wetlands and Vegetation above). • Wildlife displacement from the construction ROW is expected to be short-term. No long-term displacement impacts from increased human activity are expected. • There may be a potential loss of bird eggs and young from pipeline clearing activities or increased human presence if these activities occur during the breeding season along the entire length of the pipeline. • Powerlines (ranging in length from one to 27 miles) will be constructed to serve the pump stations. The powerlines represent a collision hazard for waterfowl and other birds similar to existing electrical distribution lines.
Aquatic Resources	• Short-term (one to 10 day) increases in total suspended solids and sediment deposition downstream from channel excavation at open-cut stream crossings will occur in 270 perennial rivers and streams (see Water Resources above).
Sensitive Species	• There will be a potential reduction in sensitive wildlife and aquatic species habitats as the result of pipeline construction. These habitat changes are described for wildlife and aquatic resources above. • Keystone received the USFWS and state wildlife agency lists of species to be evaluated for project effects. The primary listed species to be considered are those associated with the Missouri River and Mississippi River (e.g., Pallid Sturgeon, Least Tern, Piping Plover, Bald Eagle), smaller streams and rivers (e.g., Topeka Shiner, Scaleshell Mussel, Winged Mapleleaf), wetlands and moist prairie (e.g., Western Prairie Fringed Orchid, Prairie Bush Clover), and deciduous forests (e.g., Indiana Bat). In 2006, Keystone initiated habitat and occurrence surveys for several federally listed and state sensitive species, and will continue these surveys in 2007. • Keystone will coordinate with the USFWS and state wildlife agencies to estimate direct and indirect impacts to federally listed and sensitive species, and to identify pipeline route adjustments, and construction procedures that will avoid, or minimize effects to these species. For example, horizontal directional drills of the Missouri and Mississippi rivers will avoid channel and river bank disturbance. Keystone has adjusted its proposed pipeline route at several locations in North and South Dakota to reduce the length of wetland and native prairie crossings.

Table 6-1 Impact Summary

<table>
<tr><th>Resource</th><th>Impact Summary</th></tr>
<tr><td>Land Use (including noise, transportation)</td><td>
Approximately 8,384 acres will not be able to be occupied by residential or other structures within the permanent pipeline ROW and pump station sites over the life of the project. Agricultural uses (cropland) will be allowed to continue as before except at the pump station sites.
Approximately 37 acres of land owned by the USACE will be crossed by the pipeline at Carlyle Lake between Wood River and Patoka, Illinois. Approximately 33 acres of land administered by the NPS at the Missouri River crossing at Yankton, South Dakota, will be crossed by a horizontal directional drill under the river. Approximately 17 acres of land will be crossed by the pipeline at Edward "Ted" and Pat Jones-Confluence Point State Park in Missouri. Small parcels of state land (generally less than 10 acres of surface disturbance) will be crossed in North Dakota, South Dakota, and Missouri. The majority of these state lands are used for wildlife management purposes. Keystone will consult with the state and federal managers of these lands to develop site-specific crossing plans to maintain public access and existing land uses.
Construction noise will be heard to nearby (generally one-half mile or less) residences during daytime construction activities over a period of several weeks.
Long-term operational noise from pump stations will be maintained below community noise level thresholds.
Aboveground facilities (pump stations, powerlines, valves, densitometers) will exist for the life of the project. The majority of these facilities will be located in rural areas. Powerlines will be located along county roads and, therefore, will pass within the view of roadside residences.
Short-term obstruction or temporary disruption to local roads will occur during construction. Major highways will be bored. There would be no long-term impacts to transportation.
</td></tr>
<tr><td>Cultural Resources</td><td>
Keystone developed study plans that were approved by the State Historic Preservation Office in each state crossed by the Keystone project. Keystone then initiated field surveys in 2006 to determine the locations of prehistoric and historic cultural resources that could be affected by surface disturbance caused by pipeline and ancillary facility construction. Cultural resource impacts could include physical disturbance of archaeological sites or architecturally significant structures and features, and introduce visual or audible elements (e.g., pump stations) that would alter the setting of a cultural resource feature.
Impacts to sites that are eligible for the National Register of Historic Places (NRHP) would be mitigated by one or more of the following measures: avoidance through use of pipeline realignments and facility relocations; approved data recovery from sites that cannot be avoided; and use of landscaping or other techniques to minimize or eliminate effects on the historic setting or ambience of standing structures.
Construction activities could adversely affect undiscovered archaeological sites. If previously undocumented sites are discovered within the construction corridor, work that could adversely affect the discovery would cease until consultation with appropriate cultural preservation agencies is completed. If the previously unidentified site is recommended as eligible to the NRHP, impacts will be mitigated through the procedures included in an Unanticipated Discovery Plan.
Treatment of any discovered human remains would be handled in accordance with the guidelines contained in the Native American Grave Protection and Repatriation Act (NAGPRA) or state laws, depending on the age and cultural affiliation of the remains.
</td></tr>
</table>

Table 6-1 Impact Summary

Resource	Impact Summary
	Construction will not resume in an area where human remains are discovered until an authorized agency provides a notice to proceed.
Native American Consultation	• The DOS, as the lead federal agency, will consult with tribes that may have a past or current affiliation with the Keystone Pipeline project area and solicit input. These contacts will be maintained throughout the project permitting process.
Socioeconomic Conditions	• In exchange for monetary compensation, Keystone will acquire easements from landowners to place pipeline facilities on private lands. Keystone also will compensate landowners for property damage resulting from construction and make repairs as needed. • In the short term, construction of the pipeline will provide direct employment of up to 2,500 to 3,000 workers distributed across five to six states at once. Pipeline employees will increase retail sales in local areas along the pipeline route. Demands on local infrastructure will include temporary accommodations and, potentially, emergency services. It is anticipated that workers will commute from larger population centers to the pipeline work sites. • In the long term, operations will increase revenues to the states and counties crossed by the pipeline. It is estimated that the project will pay about $30 million dollars in property taxes in the first year of operation.
Public Health and Safety	• The USDOT prescribes pipeline design and operational requirements that limit the risk of accidental crude oil releases (leaks or spills) from pipelines. Over the operational life of the Keystone Pipeline Project there will be a very low likelihood of a crude oil release from the pipeline that could injure people, drinking water supplies, and ecologically sensitive areas. Keystone submitted a preliminary risk assessment for the accidental release of crude oil from the pipeline. The assessment included the likelihood of crude oil releases and potential for environmental affects, depending upon release volumes and locations. Based on refinements of the route, hydraulic models, and additional engineering information, an updated risk assessment will be submitted to the Department of State in the first quarter of 2007.

ELECTRICAL POWERLINES

CHAPTER 7

7.0 ELECTRICAL POWERLINES

Electrical service requirements for the proposed project include utilizing existing service lines and constructing electrical transmission and distribution powerlines to pump stations and delivery facilities. Because local electrical power providers, not Keystone, will be constructing and operating the electrical powerlines, the electrical power companies will be responsible for obtaining any necessary approvals or authorizations from federal, state, and local governments. While the permitting process for the electrical facilities is an independent process from the pipeline ROW approval process, the construction and operation of these powerlines are considered connected actions under NEPA and, therefore, are evaluated within this Environmental Report for the Keystone Pipeline Project.

7.1 Electrical Powerline Requirements

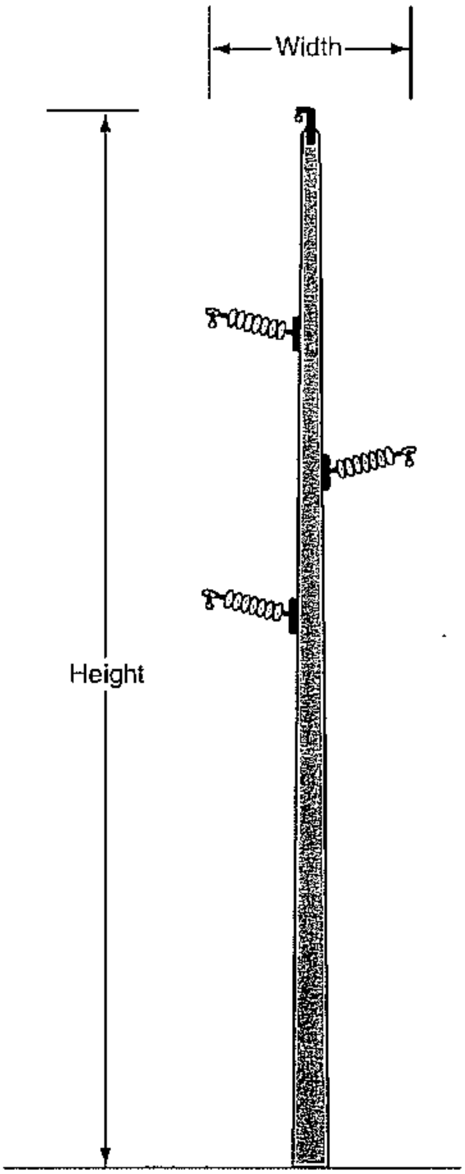
New electrical transmission powerlines (i.e., powerline with voltage of 69 kV or greater) will be constructed to service pump stations along the pipeline route. Other electric power requirements (e.g., valve sites) will be supplied from distribution service drops from adjacent distribution powerlines (i.e., powerline with voltage below 69 kV). Each of these distribution service drops will require the installation of approximately one or two poles and a transformer. The length of these distribution service drops typically will be less than 200 feet. Utilities would restore the work area as required on completion of the new service drop in accordance with local standards. **Figure 7-1** illustrates a typical powerline single pole structure, with size depending on the electrical load the line will carry.

Table 7-1 details the land requirements for the new electrical powerlines associated with the Keystone Pipeline Project pumping stations. Preliminary routing has been identified for each powerline. In general, the entire length of each of these preliminary powerline routes has been placed along an existing county road to minimize interference with adjacent agricultural lands. Alternative routes for all or part of the proposed powerline route were developed. The preliminary powerline proposed and alternative routes that link existing transmission lines to each pump station are illustrated on the Powerline Route Sheets (Appendix C). These routes are subject to change as the pumping station supply requirements are further reviewed with the utilities providing service.

7.2 Electrical Powerline Construction

The construction phases for each electrical powerline will consist of ROW acquisition, ROW clearing, construction, and site restoration and cleanup. The following is a brief summary of the typical steps associated with powerline construction. Actual powerline construction procedures will be developed by each utility to address site specific conditions.

- <u>ROW easements</u>. The electric utilities will obtain any necessary easements.
- <u>ROW clearing</u>. Limited clearing will be required along existing roads in native and tame grasslands and croplands. Some trees may require removal to provide adequate clearance between the conductors and underlying vegetation. Trimming to avoid tree removal may be employed in some locations.
- <u>Powerline Construction</u>. The structures will be delivered on flatbed trucks. A mobile crane or picker truck may be needed to install the poles. Holes will be excavated for structure placement, typically with radial arm diggers. The wooden or steel poles will be directly embedded into the ground and anchors may be required at angles and dead ends. Pulling or reeling areas will be needed for installation of the conductor wires. Conductors (wires) will be attached to the structure using porcelain or fiberglass insulators.



Transmission Line Voltage (kV)	Typical Width (Ft)	Typical Height (Ft)
34.5	4 to 5	40 to 50
69	5 to 7	50 to 60
115	9 to 11	55 to 65
230	12 to 15	65 to 80

KEYSTONE PIPELINE PROJECT

Figure 7-1
Typical Utility
Transmission Structure

Table 7-1 Estimated Land Requirements for the Proposed Electrical Powerlines

Station	County, State	kV	Approximate Length (miles)	Typical Pole/Tower Spacing (feet)
		KEYSTONE MAINLINE		
North Dakota				
Pump Station ML#15	Walsh, ND	69	8.0	330
Pump Station ML#16	Nelson, ND	69	3.2	330
Pump Station ML#17	Steele, ND	69	9.9	330
Pump Station ML#18	Ransom, ND	115	13.7	350
Pump Station ML#19	Sargent, ND	115	26.7	350
South Dakota				
Pump Station ML#20	Day, SD	115	10.7	350
Pump Station ML#21	Clark, SD	69	2.7	330
Pump Station ML#22	Miner, SD	115	4.0	350
Pump Station ML#23	Hutchinson, SD	115	19.4	350
Nebraska				
Pump Station ML#24	Cedar, NE	69	4.0	330
Pump Station ML#25	Stanton, NE	34.5	3.6	300
Pump Station ML#26	Butler, NE	34.5 (Distribution supply)	4.1	300
Pump Station ML#27	Saline, NE	115	1.9	350
Pump Station ML#28	Jefferson, NE	69	8.3	330
Kansas				
Pump Station ML#29	Nemaha, KS	115	5.12	350
Pump Station ML#30	Doniphan, KS	34.5	2.1	300
Missouri				
Pump Station ML#31	Clinton, MO	161	2.1	400
Pump Station ML#32	Carroll, MO	34.5	10.3	300
Pump Station ML#33	Chariton, MO	34.5	0.2	300

Table 7-1 Estimated Land Requirements for the Proposed Electrical Powerlines

Station	County, State	kV	Approximate Length (miles)	Typical Pole/Tower Spacing (feet)
Pump Station ML#34	Audrain, MO	69	0.3	330
Pump Station ML#35	Montgomery, MO	69	8.4	330
Pump Station ML#36	St. Charles, MO	34.5	0.1	300
Illinois				
Pump Station ML#37	Madison, IL	34.5	0.3	300
Pump Station ML#38 (future)	Bond, IL	Not required at this time		
		CUSHING EXTENSION		
Kansas				
Pump Station C#30 (CE#4)	Dickinson, KS	230	2.6	550
Pump Station C#32 (CE#3)	Cowley, KS	138	8.3	370
Oklahoma				
Pump Station C#33 (CE#5)	Kay, OK	138	0.6	370

- Restoration. After the powerline structures are in place and the conductors are strung between the structures, the disturbed areas will be restored. The soil in the disturbed areas will be reshaped and contoured to its original condition. Reseeding will follow landowner requirements. All litter and other remaining materials will be removed from the construction areas and properly disposed.

7.3 Affected Environment and Environmental Consequences

This section addresses the natural and human resources potentially affected by the construction, operation, and maintenance of the proposed electrical transmission and distribution powerlines associated with the Keystone Pipeline Project. Impacts associated with the electrical distribution line service drops are expected to be minimal and comparable to those associated with supplying electricity to the average home or farm.

The proposed and alternative powerline routes were evaluated for potential environmental impacts visible by aerial photography. The focus of this investigation was residential structures and wetland and waterbody crossings (**Table 7-2**). Further environmental review of the powerline routes will be carried out by the electrical utilities as required by local transmission line permitting processes.

Proposed powerline routes in North and South Dakota are located in proximity to prairie potholes, which are notable waterfowl production areas. Other routes cross rivers and riparian areas that are likely to attract raptors and migratory birds. The new electrical powerline segments will incrementally increase the collision potential for migrating and foraging bird species (e.g., raptors and migratory birds [APLIC 1994]). However, collision potential typically is dependent on variables such as the line location in relation to high use habitat areas (e.g., nesting, foraging, and roosting), line orientation to flight patterns and movement corridors, species

Table 7-2 Natural and Human Resources Potentially Affected by Proposed and Alternative Powerline Routes

Pump Station	kV	Proposed Powerline Route: Residences within 500 feet	Proposed Powerline Route: Other Environmental Resources
KEYSTONE MAINLINE			
North Dakota			
Pump Station ML#15	69	0	The initial portion of the route (1,750 feet) from the source line traverses open lands and is not co-located. Crosses a railroad. A number of narrow wooded areas adjacent to the road including riparian woods associated with the South Branch Park River.
Pump Station ML#16	69	0	Goose River crossing is required.
Pump Station ML#17	69	0	The route crosses four rivers or drainage ditches. A number of narrow wooded areas adjacent to the road.
Pump Station ML#18	115	1	About 2 miles not co-located of the route traverses hills between 54th and 56th Streets to cross the Sheyenne River.
Pump Station ML#19	115	0	Passes through wetlands adjacent to existing roads.
South Dakota			
Pump Station ML#20	115	0	The initial portion (1 mile) of the route traverses open land and an existing 345-kV transmission line twice which passes within 2,000 feet of the pump station. Bisects a number of riparian areas.
Pump Station ML#21	69	0	No notable environmental resources.
Pump Station ML#22	115	0	The initial portion (2,200 feet) of the route traverses open land. The route crosses an existing 69-kV line approximately 1 mile from the pump station. Crosses Rock Creek.
Pump Station ML#23	115	0	The initial portion (1.6 miles) of the route traverses open land. The route crosses the James River.
Nebraska			
Pump Station ML#24	69	1	Crosses edges of narrow woodlands adjacent to the road. The route originates at a new substation and crosses the feed line less than 1,500 feet from the pump station.
Pump Station ML#25	34.5	0	Crosses edges of narrow woodlands adjacent to the road.
Pump Station ML#26	34.5	1	Crosses edges of narrow woodlands adjacent to the road.
Pump Station ML#27	115	0	The route crosses a pipeline. Crosses edges of narrow woodlands adjacent to the road.
Pump Station ML#28	69	0	The route crosses a railroad and a creek.
Kansas			
Pump Station ML#29	115	0	The route crosses a railroad. Crosses edges of narrow woodlands adjacent to the road.
Pump Station ML#30	34.5	0	The route crosses a pipeline. Crosses edges of narrow woodlands adjacent to the road.

Table 7-2 Natural and Human Resources Potentially Affected by Proposed and Alternative Powerline Routes

		Proposed Powerline Route	
Pump Station	**kV**	**Residences within 500 feet**	**Other Environmental Resources**
Missouri			
Pump Station ML#31	161	0	The initial portion (1,000 feet) of the route crosses open land. Crosses an abandoned railroad. Crosses edges of narrow woodlands adjacent to the road.
Pump Station ML#32	34.5	0	The route crosses a railroad twice, and a number of narrow woodland tracts adjacent to the road.
Pump Station ML#33	34.5	0	Power source is very close to the proposed pump station. No notable environmental resources.
Pump Station ML#34	69	0	The route crosses a wooded area in parallel (adjacent ROW) to the pipeline towards the pump station.
Pump Station ML#35	69	0	The route crosses an abandoned railroad. Crosses edges of narrow woodlands adjacent to the road.
Pump Station ML#36	34.5	0	Power source is very close to the proposed pump station. No notable environmental impacts.
Illinois			
Pump Station ML#37	34.5	1	Power source is very close to the proposed pump station. No notable environmental resources.
Pump Station ML#38 (future)	Not required at this time	TBD	TBD
CUSHING EXTENSION			
Kansas			
Pump Station C#30	230	0	The route crosses a railroad. A number of windbreak ends adjacent to the road and narrow wooded areas.
Pump Station C#32	138	1	The route crosses a railroad.
Oklahoma			
Pump Station C#33	138	2	Power source is very close to the proposed pump station. No notable environmental resources.

composition, visibility, and line design. In addition, distribution lines that are less than 69 kV but greater than one kV could pose an electrocution hazard for raptor species attempting to perch on the structure. Configurations less than one kV or greater than 69 kV typically do not present an electrocution potential, based on conductor placement and orientation (APLIC 1996).

Potential collision and electrocution impacts to bird species from the Keystone Pipeline Project could be reduced further if electrical service providers agree to implement the following mitigation measures.

- Incorporation of standard, safe designs, as outlined in Suggested Practice for Raptor Protection on Power Lines (APLIC 1996), into the design of electrical distribution lines in areas of identified avian concern to prevent electrocution of raptor species attempting to perch on the power poles and lines. These measures include, but are not limited to, a 60-inch separation between conductors and/or grounded hardware and recommended use of insulating materials and other applicable measures depending on line configuration (APLIC 1996).

- Incorporation of standard raptor-proofing designs, as outlined in Mitigating Bird Collision with Power Lines (APLIC 1994), into the design of the electrical distribution lines to prevent collision to foraging and migrating raptors within the project area, as applicable.

7.4 Cumulative Impacts

Discussion of cumulative impacts from the powerlines associated with the Keystone Pipeline Project are discussed in Chapter 5.0. Other than the Keystone Pipeline Project, no foreseeable construction projects that overlap in space and time with the powerlines were identified.

AGENCY CONSULTATION AND COORDINATION

GLOSSARY

REFERENCES

Agency Consultation and Coordination

FEDERAL

U.S. Army Corps of Engineers – Kansas City District
U.S. Army Corps of Engineers – St. Louis District
U.S. Army Corps of Engineers – Omaha District
U.S. Army Corps of Engineers – North Dakota Regulatory Program
U.S. Army Corps of Engineers – South Dakota Regulatory Program
U.S. Army Corps of Engineers – Nebraska Regulatory Program
U.S. Army Corps of Engineers – Missouri Regulatory Program
U.S. Army Corps of Engineers – Tulsa District
U.S. Fish and Wildlife Service
U.S. Department of Agriculture – NRCS
National Parks Service

NORTH DAKOTA

North Dakota Department of Health
North Dakota Public Service Commission
North Dakota Game and Fish Dept
North Dakota State Heritage Program
NRCS North Dakota State Office
North Dakota State Water Commission/Office of State Engineer
North Dakota State Historical Society/State Historical Preservation Office (SHPO)
North Dakota Board of Registration for Professional Soil Classifiers
North Dakota Farm Service Agency

SOUTH DAKOTA

South Dakota Dept of Environment and Natural Resources
South Dakota Game, Fish and Parks
South Dakota State Heritage Program
South Dakota Public Utilities Commission
South Dakota Office of School and Public Lands
South Dakota Governor's Office of Economic Development
South Dakota Department of Transportation
South Dakota Farm Service Agency
South Dakota State Historical Society/State Historical Preservation Office (SHPO)
NRCS South Dakota State Office

NEBRASKA

Nebraska Dept of Natural Resources
Nebraska Dept of Environmental Quality
Nebraska State Heritage Program
Nebraska Game and Parks Commission
Nebraska Natural Resource District
Nebraska Department of Roads
Nebraska Farm Service Agency

Nebraska State Historical Society/State Historical Preservation Office (SHPO)
NRCS Nebraska State Office

KANSAS

Kansas Department of Health & Environment
Kansas Department of Wildlife and Parks
Kansas State Heritage Program
Kansas Department of Agriculture
Kansas Department of Transportation
Kansas Corporate Commission
Kansas Farm Service Agency
Kansas State Historical Society/State Historical Preservation Office (SHPO)
NRCS Kansas State Office

MISSOURI

Missouri Department of Conservation
Missouri State Heritage Program
Missouri Department of Transportation
Missouri Department of Natural Resources
Missouri Farm Service Agency
Missouri State Historical Society/State Historical Preservation Office (SHPO)
NRCS Missouri State Office

ILLINOIS

Illinois Department of Natural Resources
Illinois Department of Transportation
Illinois Commerce Commission
Illinois Environmental Protection Agency
Illinois Department of Agriculture
Illinois Farm Service Agency
Illinois Historic Preservation Agency (SHPO)
NRCS Illinois State Office

OKLAHOMA

Oklahoma Department of Environmental Quality
Oklahoma Department of Transportation
Oklahoma State Heritage Program
Oklahoma Department of Wildlife Conservation
Oklahoma Farm Service Agency
Oklahoma Archaeological Survey
NRCS Oklahoma State Office

NATIVE AMERICAN CONSULTATION

NORTH DAKOTA

Three Affiliated Tribes
Spirit Lake
Standing Rock Sioux
Turtle Mountain Chippewa

SOUTH DAKOTA

Cheyenne River
Flandreau Santee Sioux Tribe
Oglala Sioux
Rosebud Sioux
Yankton Sioux
Sisseton-Wahpeton Oyate
Crow Creek Sioux
Lower Brule Sioux

NEBRASKA

Omaha Tribe of Nebraska and Iowa
Pawnee Nation of Oklahoma
Santee Sioux Nation
Delaware Nation
Iowa Tribe of Kansas and Nebraska
Iowa Tribe of Oklahoma
Kaw Indian Tribe of Oklahoma
Ponca Tribe of Nebraska
Sac and Fox of the Missouri in Kansas and Nebraska
Sac and Fox Nation of Oklahoma
Sac and Fox Tribe of the Mississippi in Iowa
Winnebago Tribe
Otoe-Missouria Tribe of Indians, Oklahoma

MISSOURI

Iowa Tribe of Kansas and Nebraska
Iowa Tribe of Oklahoma
Sac and Fox of the Missouri in Kansas and Nebraska
Sac and Fox Nation of Oklahoma
Sac and Fox Tribe of the Mississippi in Iowa
Choctaw Nation of Oklahoma
Jena Band of Choctaw Indians
Eastern Shawnee Tribe of Oklahoma
Miami Tribe of Oklahoma
Muscogee (Creek) Nation of Oklahoma
Kaw Indian Tribe of Oklahoma
Delaware Nation
Cherokee Nation of Oklahoma

Quapaw Tribe of Oklahoma
Absentee-Shawnee Tribe of Indians of Oklahoma

ILLINOIS

Peoria Tribe of Indians of Oklahoma
Montana (tribes with traditional ties to the project area)
Crow
Fort Peck
Northern Cheyenne

GLOSSARY

alluvial	material composed of riverbed or delta material.
ancillary facilities	facilities associated with the pipeline system, including pump stations, delivery facilities, valves, etc.
aquifer	a layer of underground sand, gravel, or porous rock in which water collects; a source of groundwater.
barrel	42 gallons of crude oil.
block valve	a valve that can block the flow of crude oil in both directions within the pipeline when closed.
cathodic protection	a method to reduce corrosion by an electrochemical process that makes the pipe the cathode and is thereby protected from corrosion metal loss.
corrosion	an electrochemical process that occurs when steel is exposed to an electrolyte, such as soil or water. Corrosion occurs along the internal or external surface of the pipe and gradually can result in metal loss. Corrosion is reduced by cathodic protection and pipeline coatings. Corrosion is monitored by internal inspection tools (internal and external) and corrosion coupons (internal).
depth of cover	for new construction, the burial depth typically would be 48 inches from the top of the pipe to the natural grade.
distribution powerline	an electrical powerline designed to transmit 69,000 volts (69 kV) or less.
easement	a legal instrument, usually negotiated with the landowner, that is used to convey a right-of-way to the pipeline company. The easement gives the pipeline company the right to operate and maintain its pipeline in the permanent ROW and, in return, compensates the landowner for the use of the land.
eminent domain	the right of the government to take private property for public use after providing just compensation by virtue of the sovereign power over all lands within its jurisdiction.

fugitive dust — a non-point source of air pollution, such as from unpaved roads, agricultural croplands, and construction sites.

High Consequence Areas (HCAs) — OPS-defined areas subject to the Integrity Management Rule. HCAs include high-density population areas, waters where commercial navigation occurs, and areas that are unusually sensitive to environmental damage.

horizontal directional drilling — technology used for vertical drilling has been modified for the horizontal installation of pipelines beneth major obstacles, such as railroads, highways, and large rivers.

hydrostatic testing — Pressure testing of a pipeline to test its structural integrity. Typically the line is tested to at least 125 percent of the MOP and the pressure is held for 8 hours. Hydrostatic testing is a destructive test to evaluate the integrity of the pipe by attempting to cause the failure of critical defects that might be present in the wall of the pipe. A pipe that passes this test is considered safe to operate at pressures less than or equal to the MOP.

impressed current cathodic protection — cathodic protection that uses an external power source to place a small electrical charge on the steel pipe to prevent external corrosion (requires the use of rectifiers).

Integrity Management Rule — as defined in 49 CFR 195.450 and 195.452, this OPS rule increases requirements for inspection, enhanced damage protection, improved emergency response, and other measures to prevent and mitigate pipeline leaks in HCAs.

internal inspection tool — a "smart pig," tools that assess the pipeline's integrity.

kV — kilovolts; 1,000 electrical volts.

LC_{50} — A measure of acute toxicity. The concentration of a compound necessary to cause 50 percent mortality in laboratory test organisms within a predetermined time period (e.g., 96 hours).

L_{dn} — Day-night (average sound) level.

Maximum Operating Pressure (MOP) — a rating indicating the maximum pressure at which a pipeline or segment of a pipeline may be operated under the OPS regulations in normal conditions (40 CFR § 195.406 MOP). The MOP is defined as 80% of the hydrostatic test pressure. It is also called the pressure rating.

meters	devices that measure the amount of crude oil transported and delivered to terminals.
oil sand(s)	a composition of sand, bitumen, mineral rich clays, and water. Bitumen, in its raw state is a black, asphalt-like oil. It requires upgrading to make it transportable by pipeline and usable by conventional refineries.
one-call systems	a system by which operators and other underground utility operators have joined together in state-level one-call notification programs. The program acts as a clearinghouse of information to excavators, which and marks the location of underground utilities prior to excavation.
pigging facility	short sections of pipe controlled by valves that interconnect with the main pipeline to launch and receive cleaning and inspection tools ("pigs") that travel inside the pipeline.
pump station	ancillary facility were pumps are used to maintain pipeline pressure required to move crude oil through the pipeline.
right-of-way (ROW)	a legal right of passage over another's property. Typically, the ROW would consist of a 50-foot-wide permanent ROW and, during construction, an additional 60-foot construction ROW. After construction and reclamation, the permanent ROW would revert to a 50-foot-wide corridor.
SCADA	Supervisory Control and Data Acquisition; computerized system that monitors and analyses the flow rate, temperature, and density of the crude oil within the pipeline every 3 to 5 seconds, notifying operators of any operating abnormalities. The SCADA system is linked to pump stations and allows the operator to remotely close valves.

Sediment Quality Category

Tier 1 — sediment contamination associated with probable adverse effects on aquatic life or human health.

Tier 2 — sediment contamination associated with possible adverse effects on aquatic life or human health.

Tier 3 — sediment contamination with no indication of adverse effects on aquatic life or human health.

smart pig — An internal inspection tool that passes inside a pipe and contains electronic devices capable of measuring pipe integrity.

Specified Minimum Yield Strength (SMYS) — a measure of pipeline strength.

synthetic crude oil — a high-quality product resulting from the mining, extraction, and upgrading of bitumen.

temporary workspace — areas located outside the construction ROW where additional space is required for construction.

terminal — a facility along the pipeline where crude oil is stored and distributed.

transmission powerline — an electrical powerline designed to transmit more than 69,000 volts (69 kV) of energy.

upgrading — The conversion of heavy bitumen into a lighter crude oil by increasing the ratio of to carbon, either by removing carbon (coking) or adding hydrogen (hydroprocessing).

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APPENDICES

Appendix A
Mainline Route Sheets
(Under Separate Cover)

Appendix B
Cushing Extension Route Sheets
(Under Separate Cover)

Appendix C
Powerline Route Sheets
(Under Separate Cover)

Appendix D
Site-Specific Waterbody Crossing Plans
(Under Separate Cover)

Appendix E
Construction Mitigation and Reclamation Plan

KEYSTONE PIPELINE PROJECT

CONSTRUCTION MITIGATION AND RECLAMATION PLAN

TransCanada

In business to deliver

Prepared By

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UNIVERSAL ENSCO, INC.

April 4, 2006

Rev. 3

1.0 INTRODUCTION

The construction mitigation and reclamation requirements described in this Plan apply to work on all project lands including the following:

- Uplands including agricultural (cultivated or capable of being cultivated) lands, pasture lands; range lands; grass lands; forested lands; lands in residential, commercial, or industrial areas; lands in public rights of way; and lands in private rights of way
- Wetlands
- Waterbodies and Riparian lands

Keystone shall implement the construction mitigation and reclamation actions contained in this Plan to the extent that they do not conflict with the requirements of any applicable federal, state and local rules and regulations and other permits and approvals that are obtained by Keystone for the Project. Additionally, Keystone may deviate from specific requirements of this Plan on specific private lands as determined through negotiations with Landowners or as required to suit actual site conditions as determined and directed by Keystone. All work must be in compliance with federal, State, and Local permits.

2.0 GENERAL CONDITIONS

2.1 Training

The Contractor shall ensure that all persons (Contractor's and Subcontractors' Personnel) engaged in work associated with the pipeline's construction are informed of the construction issues and concerns, and that they attend and receive training regarding these requirements as well as all laws, rules and regulations applicable to the work.

Different levels of training shall be required for different groups of Contractor personnel. Contractor supervisors, managers, field foremen and other Contractor personnel designated by Keystone shall attend a full-day, comprehensive environmental training session. All other Contractor personnel shall attend a one-to-two-hour group training session before the beginning of construction, and during construction as environmental issues and incidents warrant. Additional training sessions shall be held for newly assigned personnel.

All Contractor personnel shall attend the training session prior to entering the construction right-of-way. All Contractor personnel shall sign an acknowledgement of having attended the appropriate level of training and shall display a hard hat sticker acknowledging attendance at environmental training. In order to insure successful compliance, Contractor personnel shall attend repeat or supplemental training, if compliance is not satisfactory or as new, significant issues arise.

All visitors and any other personnel without specific work assignments shall be required to attend a brief safety and environmental awareness orientation.

Experienced, well-trained personnel are essential for the successful implementation of this Plan. Keystone and its Contractors shall undergo prevention and response, as well as safety training. The program shall be designed to improve awareness of safety requirements, pollution control laws and procedures and proper operation and maintenance of equipment.

2.2 Advance Notice of Access to Property Prior to Construction

Prior to the start of construction of the pipeline, Keystone shall provide the Landowner or tenant with a minimum of 24 hours prior notice (unless otherwise negotiated with the landowner and as described in the project line list) before accessing his/her property for the purpose of constructing the pipeline. Additionally, the Landowner or tenant shall be provided with Keystone contact information. Landowners may utilize contact information to inform Keystone of any concerns related to the work. Keystone

Prior notice shall first consist of a personal contact or a telephone contact, whereby the Landowner or tenant is informed of Keystone's intent to access the land. If the Landowner or tenant cannot be reached in person or by telephone, Keystone shall mail or hand deliver to the Landowner or tenant's home a dated, written notice of Keystone's intent. The Landowner or tenant need not acknowledge receipt of the written notice before Keystone can enter the Landowner's property.

2.3 Other Notifications

The Contractor shall notify, in writing, both Keystone's Representative and the authority having jurisdiction over any road, railroad, canal, drainage ditch, river, foreign pipeline, or other utility, at least 48 hours (excluding Saturdays, Sundays, and Statutory Holidays), or as specified on the applicable permit(s), prior to commencement of pipeline construction, in order that the said authority may appoint an Inspector to ensure that the crossing is constructed in a satisfactory manner.

The Contractor shall notify Keystone immediately of any spill of a potentially hazardous substance as well as any existing soil contamination discovered during construction.

The Contractor shall immediately notify Keystone of the discovery of previously unreported historic property, other significant cultural materials, or suspected human remains uncovered during pipeline construction activities.

2.4 Damages to Private Property

Pipeline construction activities shall be confined to the construction right-of-way, temporary work space, and additional temporary work space and approved access routes.

Keystone shall reasonably compensate Landowners for any construction-related damages caused by Keystone which occur on or off of the established pipeline construction right-of-way.

Keystone shall reasonably compensate Landowners for damages to private property caused by Keystone beyond the initial construction and reclamation of the pipeline, to include those damages caused by Keystone during future construction, operation, maintenance, and repairs relating to the pipeline.

2.5 Appearance of Worksite

The construction right-of-way shall be maintained in a clean neat condition at all times. At no time shall litter be allowed to accumulate at any location on the construction right-of-way. The Contractor shall provide a daily garbage detail with each major construction crew to keep the construction right-of-way clear of trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, defective materials and all construction and other debris immediately behind construction operations unless otherwise approved by Keystone. Paper from wrapping or coating products or lightweight items shall not be permitted to be scattered around by the wind.

The traveled surfaces of roads, streets, highways, etc. (and railroads when applicable) shall be cleaned free of mud, dirt or any debris deposited by equipment traversing these roads or exiting from the construction right-of-way.

2.6 Access

Prior to the pipeline's installation, Keystone and the Landowner shall reach a mutually acceptable agreement on the route that shall be utilized by the Contractor for entering and exiting the pipeline construction right-of-way should access to the construction right-of-way not be practicable or feasible from adjacent segments of the pipeline construction right-of-way or from public highway or railroad right-of-way.

All construction vehicles and equipment traffic shall be confined to the public roads, private roads acquired for use by Keystone and the construction right of way. If temporary alternative private roads for access are constructed they shall be designed to not impede proper drainage and shall be built to minimize soil erosion.

Sufficiently sized gaps shall be left in all spoil and topsoil wind rows at all temporary private access roads and obvious livestock or wildlife trails unless agreed with the Landowner prior to construction that these access points can be blocked during construction.

All construction related private roads and access points to the right of way shall be marked with signs. Any private roads not to be utilized during construction shall also be marked.

2.7 Above-Ground Facilities

Locations for above-ground facilities shall be selected in a manner so as to be as unobtrusive as reasonably possible to on-going agricultural or other Landowner activities occurring on the lands adjacent to the facilities. If this is not feasible, such facilities shall be located so as to incur the least hindrance to the adjacent agricultural operations (i.e., located in field corners or areas where at least one side is not used for cropping purposes) provided the location is consistent with the design constraints of the pipeline. Additionally, they shall be located to avoid existing drain tile systems to the extent possible.

2.8 Minimum Depth of Cover

The pipeline shall be installed so that the top of the pipe and coating is:

- A minimum depth of 4 feet below the surface of all uplands and wetlands except in consolidated rock where the minimum shall be 3 feet
- A minimum clearance of 1 foot below any existing foreign pipeline, utility, drain tile or any other existing underground facility and a minimum of 4 feet below the surface of all uplands and wetlands. Should any existing foreign pipeline, utility, drain tile or any other existing underground facility owner permit the pipeline to cross above, there must be a minimum 1 foot clearance and a minimum of 4 feet below the surface of all uplands and wetlands
- At a minimum depth of 5 feet below the bottom of road ditches
- At a minimum depth of 5 feet below the bottom of waterbodies including rivers, creeks, streams, ditches and drains. This depth shall normally be maintained over a distance of 15 feet on each side of the waterbody measured from the top of the defined stream channel·

If concrete weights are utilized for negative buoyancy of the pipeline, the minimum depth of cover shall be measured from the top of the concrete weight to the original ground contour.

Depth of cover requirements may be modified by Keystone based on site specific conditions. However, all depths shall be in compliance with all established codes.

2.9 Threatened and Endangered Species

Keystone will contract a qualified biologist to conduct a survey of sensitive species associated with native tall-grass prairie. The biologist will document locations of the sensitive species found during the survey. If sensitive species are identified in the construction right of way, Keystone will work with the relevant regulatory authorities to determine if any additional protection measures would be required. Once construction is complete, disturbance in native prairie will be reclaimed to native prairie species using native seed mixes specified by applicable state and federal agencies with the intent there will be no net loss of native prairie habitat.

A number of sensitive species are associated with native tall-grass prairie, especially where larger remnant tracts are present. In order to minimize impacts to native prairie, no permanent developments such as access roads or pump stations will be constructed in native prairie tracts if possible. Where avoidance of native tall-grass prairie by the pipeline ROW is unfeasible, appropriate surveys will be implemented to ensure populations of sensitive wildlife species are not affected.

Keystone will contract a qualified biologist to conduct a survey of breeding bird habitat within 330 feet (100 meters) from proposed surface disturbance activities that would occur within the breeding season. The biologist will document active nests, bird species, and other evidence of nesting (e.g., mated pairs, territorial defense, birds carrying nesting material, transporting of food). If an active nest for Important Migratory Bird Species (USFWS BCC, PIF Priority Bird Species, State Sensitive Species) is documented during the survey, Keystone will work with the relevant regulatory authorities to determine if any additional protection measures would be required.

Immediately prior to construction activities during the raptor breeding season (February 1 – July 31), breeding raptor surveys will be conducted by a qualified biologist through areas of suitable nesting habitat to identify any potentially active nest sites in the project area. If raptors are identified within 0.5 mile to the construction right of way, Keystone will work with the relevant regulatory authorities to develop mitigation measures. These measures will be implemented on a site-specific and species-specific basis in coordination with state agency wildlife biologists.

Along the ROW within historical range of Indiana bat and gray bat (Missouri, Illinois and eastern Oklahoma), Surveys shall be completed during the roosting season in suitable woodland habitats to determine if any active maternity roosts are present in or near the pipeline ROW. If a maternity roost is located, then applicable mitigation will be developed in consultation with USFWS and state wildlife agency personnel.

Prior to surface disturbance activities within karst terrain, a geological investigation will be completed to determine the presence and type of karst features. The investigation will identify the location, distribution, and dimensions of rock cavities within the potential influence zone of construction. In addition, a qualified biologist will conduct surveys for exposed caves that may contain sensitive resources (e.g., bat roosts and nesting raptors) within 0.25 mile from surface disturbance activities. In the event that cave features or sensitive resources are identified, the USFWS or appropriate state wildlife agency will be contacted and applicable mitigation measures developed.

2.10 Non-Hazardous Waste Disposal

Non-hazardous pipeline construction wastes include human waste, trash, pipe banding and spacers, waste from coating products, welding rods, timber skids, cleared vegetation, stumps, rock and all other construction debris.

All waste which contains (or at any time contained) oil, grease, solvents, or other petroleum products falls within the scope of the oil and hazardous substances control, clean up and disposal procedures. This material shall be segregated for handling and disposal as hazardous wastes.

The Contractor shall be responsible for human wastes to be handled and disposed of exclusively by means of portable self-contained toilets during all construction operations. Wastes from these units shall be collected by a licensed Contractor for disposal only at licensed and approved facilities.

The Contractor shall remove all trash from the construction right-of-way on a daily basis unless otherwise approved or directed by Keystone.

The Contractor shall dispose of all drill cuttings and drilling mud at a Keystone-approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by Keystone, hauling to an approved licensed landfill, or other site approved by Keystone.

The Contractor shall remove all extraneous vegetative, rock and other natural debris from the construction right-of-way by the completion of clean-up

The Contractor shall remove all trash and wastes from Contractor yards, pipe yards and staging areas when work is completed at each location.

The Contractor shall dispose of all waste materials at licensed waste disposal facilities. Wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

2.11 Hazardous Wastes

The Contractor shall ensure that all hazardous and potentially hazardous materials are transported, stored and handled in accordance with all applicable legislation. Workers exposed to or required to handle dangerous materials shall also be trained in accordance with the applicable legislation and the manufacturer's recommendations.

The Contractor shall dispose of all hazardous materials at licensed waste disposal facilities. Hazardous wastes shall not be disposed of in any other fashion such as un-permitted burying or burning.

All transporters of oil, hazardous substances, and hazardous wastes shall be licensed and certified according to the applicable state vehicle code. Incidents on public highways shall be reported to the appropriate agencies.

All hazardous wastes being transported off-site shall be manifested. The manifest shall conform to requirements of the appropriate state agency. The transporter shall be licensed and certified to handle hazardous wastes on the public highways. The vehicles as well as the drivers must conform to all applicable vehicle codes for transporting hazardous wastes. The manifest shall conform to regulations of the DOT 49 CFR 172.101, 172.202, and 172.203.

If toxic or hazardous waste materials or containers are encountered during construction, the Contractor shall stop work immediately to prevent disturbing or further disturbing the waste material and shall immediately notify Keystone. The Contractor shall not restart work until clearance is granted by Keystone.

2.12 Noise Control

The Contractor shall minimize noise during non-daylight hours and within 1 mile of residences or other noise-sensitive areas such as hospitals, motels or campgrounds. Keystone shall attempt to abide by municipal bylaws regarding noise near residential and commercial/industrial areas. The Contractor shall provide notice to Keystone if noise levels are expected to exceed bylaws for a short duration.

The Contractor shall minimize noise in the immediate vicinity of herds of livestock or poultry operations, which are particularly sensitive to noise.

Keystone shall install noise attenuation, if necessary, to ensure that noise levels from Keystone's above-ground facilities comply with the applicable state or local standards.

2.13 Weed Control

The Contractor shall thoroughly clean all construction equipment, including timber mats, prior to moving the equipment to the job site to limit the potential for the spread of noxious weeds, insects and soil-borne pests. The Contractor shall clean the equipment with high-pressure washing equipment.

Prior to construction, Keystone will mark all areas of the right of way which contain infestations of noxious, invasive species or soil borne pests. Such marking will clearly indicate the limits of the infestation along the right of way. During construction, the Contractor shall clean the tracks, tires, and blades of equipment by hand (track shovel) or compressed air to remove excess soil prior to movement of equipment out of weed and/or soil-borne pest infested areas.

The Contractor shall use mulch and straw or hay bales that are free of noxious weeds for temporary erosion and sediment control.

The Contractor shall implement pre-construction treatments such as mowing prior to seed development or herbicide application to areas of noxious weed infestation prior to other clearing, grading, and trenching or other soil disturbing work at the identified locations as indicated on the construction drawings.

The Contractor shall apply herbicides, where required, within 1 week, or as deemed necessary for optimum mortality success, prior to disturbing the area by clearing, grading, trenching or other soil disturbing work. Herbicides shall be applied by applicators appropriately licensed or certified by the state in which the work is conducted. All herbicides applied preconstruction shall be non-residual or shall have a significant residual effect no longer than 30 days. Herbicides applied during construction shall be non-residual.

The Contractor shall not use herbicides in or within 100 feet of a wetland or waterbody.

After pipeline construction, on any construction right-of-way over which Keystone has jurisdiction as to the surface use of such land (i.e., valve sites, metering stations, pump stations, etc.), Keystone shall provide for weed control to limit the potential for the spread of weeds onto adjacent lands used for agricultural purposes. Any weed control spraying performed by Keystone shall be done so by a State licensed pesticide applicator.

Keystone shall be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to above-ground facilities when the Landowners must control weeds on their land which can be reasonably determined to have spread from land with Keystone's above-ground facilities.

2.14 Dust Control

The Contractor shall at all times control air borne dust levels during construction activities to levels acceptable to Keystone. The Contractor shall employ water trucks, sprinklers or calcium chloride as necessary to reduce dust to acceptable levels. Utilization of calcium chloride would be limited to roads.

Dust shall be strictly controlled where the work approaches dwellings, farm buildings and other areas occupied by people and when the pipeline parallels an existing road or highway. This shall also apply to access roads where dust raised by construction vehicles may irritate or inconvenience local residents. The speed of all Contractor vehicles shall be controlled while in these areas.

The Contractor shall take appropriate precautions to prevent fugitive emissions caused by sand blasting operations from reaching any residence or public building. The Contractor shall place curtains of suitable material, as necessary, to prevent wind-blown particles from sand blasting operations from reaching any residence or public building.

2.15 Off Road Vehicle Control

Keystone shall offer to Landowners or managers of forested lands to install and maintain measures to control unauthorized vehicle access to the construction right-of-way where appropriate. These measures may include the following unless otherwise approved or directed by Keystone based on site specific conditions or circumstances:

- Signs;
- Fences with locking gates;
- Slash and timber barriers, pipe barriers, or boulders lined across the construction right-of-way; and
- Conifers or other appropriate trees or shrubs across the construction right-of-way.

2.16 Fire Prevention and Control

The Contractor shall comply with all Federal, State, County and Local fire regulations pertaining to burning permits and the prevention of uncontrolled fires. The following mitigative measures shall be implemented to prevent fire hazards and control of fires:

- A list of relevant Authorities and their designated representative to contact shall be maintained on the construction site by construction personnel
- Adequate fire fighting equipment in accordance with the regulatory requirements shall be available on site.
- The level of forest fire hazard shall be posted at the construction office (where visible for all workers) and make them aware of it and related implications.
- The Contractor shall provide equipment to handle any possible fire emergency. This shall include, although not be limited to, water trucks, portable water pumps, chemical fire extinguishers, hand tools such as shovels, axes, chain saws, etc. and heavy equipment adequate for the construction of fire breaks when required.
- Specifically, the Contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew that is engaged in work such as welding, cutting, grinding, burning of brush or vegetative debris, etc.
- In the event of a fire, the Contractor shall immediately use resources required to contain the fire. The Contractor shall then notify local emergency response personnel.
- All tree clearing activities are to be carried out in accordance with local rules and regulations for the prevention of forest fires.
- Burning shall be done in compliance with state and/or county regulations and in the center of the right of way and in small piles to avoid overheating or damage to trees or other structures along the right of way.
- Flammable wastes shall be removed from the construction site on a regular basis.
- Flammable materials kept on the construction site must be stored in approved containers away from ignition sources.
- Smoking shall be prohibited around areas with flammable products.
- Smoking shall be prohibited on the construction site when the fire hazard is high.

2.17 Road and Railroad Crossings

Railroad and highway crossings shall be bored or where permitted by the local road authorities having jurisdiction, open-cut. The pipeline shall be installed without casing unless required by permit. Generally, secondary and unimproved roads, public and private roads, shall be open-cut.

The Contractor shall maintain access across all open-cut roads during construction where an alternate bypass is not available.

At all road crossings and/or contiguous construction where workers and equipment are working, approaching traffic shall be cautioned to reduce speed by road signs. All signage shall be in accordance with crossing permits and state or county highway regulations.

2.18 Adverse Weather

The Contractor shall restrict certain construction activities and work in cultivated agricultural areas in excessively wet soil conditions to minimize rutting and soil compaction. In determining when or where construction activities should be restricted or suspended during wet conditions, the Contractor shall consider the following factors:

- the extent that rutting may cause mixing of topsoil with subsoil layers or damage to tile drains.
- excessive buildup of mud on tires and cleats.
- excessive ponding of water at the soil surface.
- the potential for excessive soil compaction.

The Contractor shall implement mitigative measures as directed by Keystone in order to minimize rutting and soil compaction in excessively wet soil conditions which may include:

- restricting work to areas on the spread where conditions are not prohibitive.
- using low ground weight or wide-track equipment or other low impact construction techniques.
- limiting work to areas that have adequately drained soils or have a cover of vegetation such as sod, crops or crop residues sufficient to prevent mixing of topsoil with subsoil layers or damage to drain tiles.
- installing geotextile material or construction mats in problem areas.

3.0 SPILL PREVENTION AND CONTAINMENT

Spill prevention and containment applies to the use and management of hazardous materials on the construction right-of-way and all ancillary areas during construction. This includes the refueling or servicing of all equipment with diesel fuel, gasoline, lubricating oils, grease, hydraulic and other fluids during normal upland applications and special applications within 100 feet of perennial streams or wetlands.

3.1 Spill Prevention

3.1.1 Staging Areas

Staging areas (including Contractor yards and pipe stockpile sites) shall be set up for each construction spread. Hazardous materials at staging areas shall be stored in compliance with federal and state laws. The following spill prevention measures shall be implemented by the Contractor:

- Contractor fuel trucks shall be loaded at existing bulk fuel dealerships or from bulk tanks set up for that purpose at the staging area. In the former case, the bulk dealer is responsible for preventing and controlling spills;

- Fuels and lubricants shall be stored only at designated staging areas. Storage of fuel and lubricants in the staging area shall be at least 100 feet away from the water's edge. Refueling and lubrication of equipment shall be restricted to upland areas at least 100 feet away from stream channels and wetlands;
- Contractors shall be required to perform all routine equipment maintenance at the staging area and recover and dispose of wastes in an appropriate manner;
- Temporary liners and berms and/or dikes (secondary containment) shall be constructed around the above-ground bulk tanks, so that potential spill materials shall be contained and collected in specified areas isolated from any waterbodies. Tanks shall not be placed in areas subject to periodic flooding or washout;
- Drivers of tank trucks are responsible for safety and spill prevention during tank truck unloading. Procedures for loading and unloading tank trucks shall meet the minimum requirements established by the Department of Transportation;
- Warning signs requiring drivers to set brakes and chock wheels shall be displayed at all tanks. Proper grounding of equipment shall be undertaken during fuel transfer operations. Drivers shall observe and control the fueling operations at all times to prevent over-filling the temporary tank;
- Prior to departure of any tank truck, all vehicle outlets shall be closely examined by the driver for leakage, and tightened, adjusted or replaced to prevent liquid leakage while in transit;
- A supply of sorbent and barrier materials sufficient to allow the rapid containment and recovery of any spill shall be maintained at the construction staging areas. Sorbent and barrier materials shall also be utilized to contain runoff from contaminated areas;
- Shovels and drums shall be kept at each of the individual staging areas. In the event that small quantities of soil become contaminated, shovels shall be utilized to collect the soil and the material shall be stored in 55 gallon drums. Large quantities of contaminated soil may be bio-remediated on-site, subject to government approval, or collected utilizing heavy equipment, and stored in drums or other suitable containers prior to disposal. Should contamination occur adjacent to staging areas as a result of runoff, shovels and/or heavy equipment shall be utilized to collect the contaminated material. Contaminated soil shall be disposed of in accordance with state and federal regulations;
- Temporary above-ground tanks shall be subject to visual inspection on a monthly basis and when the tank is refilled. Inspection records shall be maintained. Operators shall routinely keep tanks under close surveillance and potential leaks or spills shall be quickly detected;
- Visible fuel leaks shall be reported to the Contractors' designated representative and corrected as soon as conditions warrant. Keystone's designated representative shall also be informed;
- Drain valves on temporary tanks shall be locked to prevent accidental or unauthorized discharges from the tank.

Keystone may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

3.1.2 Construction Right-of-way

Rubber-tired vehicles (pick-up trucks, buses) shall normally refuel at the construction staging areas or commercial gas stations. Tracked machinery (backhoes, bulldozers) shall be refueled and lubricated on the construction right-of-way. Equipment maintenance shall be conducted in staging areas when practical. When impractical, repairs to equipment can be made on the construction right of way when approved by Keystone's representative.

The following preventive measures apply to refueling and lubricating activities on the construction right-of-way:

- Construction activities shall be conducted to allow for prompt and effective clean up of spills of fuel and other hazardous materials. Each construction crew, including clean-up crews shall have on hand sufficient tools and material to stop leaks and supplies of absorbent and barrier materials to allow rapid containment and recovery of spilled materials and must know and follow the procedure for reporting spills;
- Refueling and lubrication of construction equipment shall be restricted to upland areas at least 100 feet away from stream channels and wetlands. Where this is not possible (e.g., trench dewatering pumps), the equipment shall be fueled by designated personnel with special training in refueling and spill containment and clean up. The Environmental Inspector shall ensure that signs are installed identifying restricted areas;
- Spent oils, lubricants, filters, etc. shall be collected and disposed of at an approved location in accordance with state and federal regulations;
- Equipment shall not be washed in streams.

Keystone may allow modification of the above specifications as necessary to accommodate specific situations or procedures. Any modifications must still comply with all applicable regulations and permits.

3.2 Contingency Plans

The Contractor shall develop emergency response procedures for all incidents (e.g., spills, leaks, fires) involving hazardous materials which could pose a threat to human health and/or the environment. The procedures shall address activities in all work areas, as well as during transport to and from the construction right-of-way and to any disposal or recycling facility.

3.3 Equipment

The Contractor shall retain emergency response equipment that shall be available at all areas where hazardous materials are handled or stored. This equipment shall be readily available to respond to a hazardous material emergency. Such equipment shall include, but not be limited to, the following:

- first aid kit/supplies
- phone or communications radio
- protective clothing (tyvek suit, gloves, goggles, boots)
- hand held fire equipment
- absorbent material and storage containers
- non-sparking bung wrench and shovel
- brooms and dust pan

Hazardous material emergency equipment shall be carried in all mechanic and supervisor vehicles. This equipment shall include, at a minimum:

- first aid kit/supplies
- phone or communications radio
- 2 sets of protective clothing (tyvek suit, gloves, goggles, boots)
- 1 non-sparking shovel
- 6 plastic garbage bags (20 gallon)
- 10 absorbent socks and spill pads
- hand held fire extinguisher
- barrier tape
- 2 orange reflector cones

Fuel and service trucks shall carry a minimum of 20 pounds of suitable commercial sorbent material.

The Contractor shall inspect emergency equipment weekly, and service and maintain equipment regularly. Records shall be kept of all inspections and services.

3.4 Emergency Notification

Emergency notification procedures between the Contractor and Keystone shall be established in the preplanning stages of construction, and the Keystone representative shall be identified to serve as contact in the event of a: spill during construction activities. In the event of a spill which meets government reporting criteria, the Contractor shall notify the Keystone representative immediately who, in turn, shall notify the appropriate regulatory agencies.

If a spill occurs into navigable waters of the United States, Keystone shall notify the National Response Center (NRC) at 1 800-424-8802. For spills which occur on public lands, into surface waters or into sensitive areas the appropriate governmental agency's district office shall also be notified.

3.5 Spill Containment and Countermeasures

In the event of a spill of hazardous material, Contractor personnel shall:

- notify the appointed Keystone representative;
- identify the product hazards related to the spilled material and implement appropriate safety procedures, based on the nature of the hazard;

- control danger to the public and personnel at the site;
- implement spill contingency plans and mobilize appropriate resources and manpower;
- isolate or shutdown the source of the spill;
- block manholes or culverts to limit spill travel;
- initiate containment procedures to limit the spill to as small an area as possible, to prevent damage to property or areas of environment concern (e.g., watercourses);
- commence recovery of the spill and clean-up operations.

When notified of a spill, the Keystone representative shall immediately ensure that:

- action is taken to control danger to the public and personnel at the site;
- spill contingency plans are implemented and that necessary equipment and manpower are mobilized;
- measures are taken to isolate or shutdown the source of the spill;
- all resources necessary to contain, recover and clean up the spill are available;
- any resources requested by the Contractor from Keystone are provided;
- the appropriate agencies are notified. For spills which occur on public lands, into surface waters or into sensitive areas the appropriate federal or state managing office office shall also be notified and involved in the incident.

On a land spill, berms shall be constructed with available equipment to physically contain the spill. Personnel entry and travel on contaminated soils shall be minimized. Sorbent materials shall be applied or, if necessary, heavily contaminated soils shall be removed to an approved facility. Contaminated sorbent materials and vegetation shall also be disposed of at an approved facility.

On a spill threatening a water body, berms and/or trenches shall be constructed to contain the spill prior to entry into a water body. Deployment of booms, skimmers and sorbent materials shall be necessary if the spill reaches the water. The spilled product shall be recovered and the contaminated area shall be cleaned up with in consultation with spill response specialists and appropriate government agencies.

4.0 UPLANDS (AGRICULTURAL, FOREST, PASTURE, RANGE AND GRASS LANDS)

4.1 Interference with Irrigation Systems

If existing irrigation systems (pivot, wheel or other type spray irrigation systems), irrigation ditches, or sheet flow irrigation shall be impacted by the construction of the pipeline, the following mitigative measures shall be implemented unless otherwise approved or directed by Keystone:

- If it is feasible and mutually acceptable to Keystone and the Landowner or Landowner's designate, temporary measures shall be implemented to allow an irrigation system to continue to operate across land on which the pipeline is also being constructed.

- If the pipeline and/or temporary work areas intersect an operational (or soon to be operational) pivot or other spray irrigation system, Keystone shall establish with the Landowner or Landowner's designate an acceptable amount of time the irrigation system may be out of service or if, as a result of pipeline construction activities, an irrigation system interruption results in crop damages, either on the pipeline construction right-of-way or off the construction right-of-way, the Landowner shall be reasonably compensated for all such crop damages.
- If the pipeline and/or temporary work areas intersect an operational sheet flow irrigation system, Keystone shall establish with the Landowner or Landowner's designate an acceptable amount of time the irrigation system may be out of service or if, as a result of pipeline construction activities, an irrigation system interruption results in crop damages, either on the pipeline construction right-of-way or off the construction right-of-way, the Landowner shall be reasonably compensated for all such crop damages.
- Irrigation ditches that are active at the time of construction shall not be stopped or obstructed except for the length of time to install the pipeline beneath the ditch (typically, one day or less) unless otherwise approved or directed by Keystone.

4.2 Clearing

The objective of clearing is to provide a clear and unobstructed right of way for efficient construction of the pipeline. The following mitigative measures shall be implemented:

- construction traffic shall be restricted to the construction right-of-way, existing roads and approved private roads
- construction right-of-way boundaries including pre-approved temporary workspace shall be clearly staked to prevent disturbance to unauthorized areas
- if crops are present, they shall be mowed or disced to ground level unless an agreement is made for the Landowner to remove for personal use.
- burning is prohibited on cultivated land.
- construction right of way at timber shelterbelts in agricultural areas shall be reduced to the minimum necessary to construct the pipeline

4.3 Topsoil Removal and Storage

The objective of topsoil handling is to maintain topsoil capability by conserving topsoil for future replacement and reclamation and to minimize the degradation of topsoil from compaction, rutting, loss of organic matter, or soil mixing so that successful reclamation of the right of way can occur. The following mitigative measures shall be implemented during topsoil removal and storage unless otherwise approved or directed by Keystone based on site specific conditions or circumstances However, all work shall be conducted in accordance with applicable permits.

- In cultivated agricultural lands, unless otherwise specified by the Landowner, the actual depth of the topsoil shall be stripped from the area to be excavated above the pipeline to a maximum of 12 inches. When grading is required, the topsoil shall be removed from the entire area to be graded and stored. When grading is required, the topsoil shall be removed from the entire area to be graded and stored.
- In non-cultivated agricultural lands, the actual depth of topsoil shall be stripped from the area to be excavated above the pipeline. When grading is required, the topsoil shall be removed from the entire area to be graded and stored.
- Stripped topsoil is to be stockpiled in a windrow along the edge of the right of way. The Contractor shall perform its work in order to minimize the potential for subsoil and topsoil to be mixed.
- Under no circumstances shall the Contractor use topsoil to fill a low area
- If required due to excessively windy conditions, following the removal of the topsoil, topsoil piles shall be tackified using either water or a suitable tackifier.
- The surface drainage network in the vicinity of the right of way shall be maintained by keeping gaps in the rows of topsoil in order to prevent any accumulation of water on the land.
- Topsoil shall not be utilized to construct ramps at road or waterbody crossings.

4.4 Grading

The objective of grading is to develop a right of way that allows the safe passage of equipment and meets the bending limitations of the pipe. The following mitigative measures shall be implemented during grading unless otherwise approved or directed by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- All grading shall be undertaken with the understanding that original contours and drainage patterns shall be re-established during clean up.
- Agricultural areas that have been land formed with terraces shall be surveyed to establish pre-construction contours to be utilized for restoration of the terraces after construction.
- On steep slopes, or wherever erosion potential is high, temporary erosion control measures shall be implemented.
- Bar ditches adjacent to existing roadways that shall be crossed during construction shall be adequately ramped with grade or ditch spoil to prevent damage to the road shoulder and ditch.
- Where the construction surface remains inadequate to support equipment travel, timber mats, timber riprap or other method shall be used to stabilize surface conditions.

The Contractor shall limit the interruption of the surface drain network in the vicinity of the right of way, using the appropriate methods:

- Providing gaps in the rows of subsoil and topsoil in order to prevent any accumulation of water on the land.
- Preventing obstructions in furrows, furrow drains and ditches.
- Installing flumes and ramps in furrows, furrow drains and ditches to facilitate water flow across the construction right of way and allow for construction equipment traffic.
- Installing flumes over the trench for any watercourse where flow is continuous during construction.

4.5 Temporary Erosion and Sediment Control

4.5.1 General

Temporary erosion and sediment control measures shall be installed immediately after initial disturbance of the soil and maintained throughout construction (on a daily basis) and reinstalled as necessary until replaced by permanent erosion control structures or restoration of the construction right-of-way is complete.

Specifications and configurations for erosion and sediment control measures may be modified by Keystone as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

The Contractor shall inspect all temporary erosion control measures at least daily in areas of active construction or equipment operation, weekly in areas with no construction or equipment operation, and within 24 hours of each significant rainfall event. The Contractor shall repair all ineffective temporary erosion control measures as expediently as practicable.

4.5.2 Sediment Barriers

Sediment barriers shall be constructed of silt fence, staked hay or straw bales, compacted earth (e.g., driveable berms across travel lanes), sand bags, or other appropriate materials.

The Contractor shall install sediment barriers in accordance with **Details 1 and 2** or as otherwise approved or directed by Keystone. The aforementioned sediment barriers may be used interchangeably or together depending on site specific conditions. In most cases, silt fences shall be utilized where longer sediment barriers are required.

Sediment barriers shall be installed below disturbed areas where there is a hazard of off-site sedimentation. These areas include:

- The base of slopes adjacent to road crossings
- The edge of the construction right-of-way adjacent to and up gradient of a roadway, flowing stream, spring, wetland or impoundment
- At trench or test water discharge locations where required

- Where waterbodies or wetlands are adjacent to the construction right-of-way, the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way
- Across the entire construction right-of-way at flowing waterbody crossings
- Right-of-way immediately upslope of the wetland boundary at all standard (saturated or standing water) wetland crossings as necessary to prevent sediment flow into the wetland. Sediment control barriers are not required at "dry" wetlands
- Along the edge of the construction right-of-way within standard (saturated or standing water) wetland boundaries as necessary to contain spoil and sediment within the construction right-of-way. Sediment control barriers are not required at "dry" wetlands

Sediment barriers placed at the toe of a slope shall be set with sufficient distance from the toe of the slope, if possible, in order to increase ponding volume.

Sediment control barriers shall be placed so as not to hinder construction operations. If silt fences or straw bale sediment barriers in lieu of driveable berms are placed across the entire construction right-of-way at waterbodies, wetlands, or upslope of roads, a provision shall be made for temporary traffic flow through a gap for vehicles and equipment to pass within the structure. Immediately following each day's shutdown of construction activities, a row of straw bales or a section of silt fence shall be placed across the up-gradient side of the gap with sufficient overlap at each end of the barrier gap to eliminate sediment bypass flow, followed by bales tightly fitted to fill the gap. Following completion of the equipment crossing, the gap shall be closed using silt fence or straw bale sediment barrier.

The Contractor shall maintain straw bale and silt fence sediment barriers by removing collected sediment and replacing damaged bales. If sediment loading is greater than approximately 40% full behind a straw bale or silt fence sediment barrier, or if directed by Keystone, sediment shall be removed and placed in an area where it shall not reenter the barrier. If straw bale filters cannot be cleaned out due to access problems, the Contractor shall place a new row of sediment barriers upslope.

The Contractor shall use mulch and straw bales that are free of noxious weeds. Mulch or straw bales that contain evidence of noxious weeds or other undesirable species shall be rejected by the Contractor.

The Contractor shall remove sediment barriers except those needed for permanent erosion and sediment control during clean up of the construction right-of-way.

4.5.3 Trench Plugs

The Contractor shall use trench plugs at the edge of flowing waterbody crossings and at the edge of wetlands with standing water to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody. Trench plugs shall be of sufficient size to withstand upslope water pressure.

4.5.4 Temporary Slope Breakers (Water Bars)

The Contractor shall not install temporary slope breakers (water bars) in cultivated land.

The Contractor shall install temporary slope breakers on slopes greater than approximately 5% in non-cultivated lands where the base of the slope is less than 50 feet from waterbody, wetland, and road crossings at the following recommended spacing:

Slope (%)	Spacing (feet)
5 - 15	300
>15 - 30	200
>30	100

The gradient of each slope breaker shall be 2 to 8 percent.

Temporary slope breakers shall be constructed of soil, silt fence, staked straw bales, sand bags or similar materials authorized by Keystone.

The Contractor shall direct the outfall of each temporary slope breaker to a stable, well vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction right-of-way as shown in **Detail 3.** The outfall of each temporary slope breaker shall be installed to prevent sediment discharge into wetlands, waterbodies, or other sensitive resources.

Specifications and configurations for temporary slope breakers may be modified by Keystone as necessary to suit actual site conditions. However, all work shall be conducted in accordance with applicable permits.

4.5.5 Drainage Channels or Ditches

Drainage channels or ditches shall be used on a limited basis to provide drainage along the construction right-of-way and toe of cut slopes as well as to direct surface runoff across the construction right-of-way or away from disturbances and onto natural undisturbed ground. Channels or ditches shall be constructed by the Contractor during grading operations. Where there is inadequate vegetation at the channel's or ditch's outlet, sediment barriers, check berms or other appropriate measures shall be used to control erosion.

4.5.6 Temporary Mulching

The Contractor shall install temporary mulch before seeding if construction or restoration activity is interrupted for extended periods. The Contractor shall not apply temporary mulch in cultivated areas unless specifically requested by the Landowner. The Contractor shall not apply mulch within wetland boundaries.

Temporary mulch applied on slopes shall be spread uniformly to cover at least 75 percent of the ground surface at an approximate rate of 2 tons/acre of straw or its equivalent. Mulch application on slopes within 100 feet of waterbodies and wetlands shall be increased to an approximate rate of 3 tons/acre of straw or equivalent

4.5.7 Tackifier

When inordinately windy conditions result in excessive topsoil movement and topsoil piles wetted with water is not preventing wind erosion, the Contractor shall temporarily suspend topsoil handling operations and apply a tackifier to topsoil stockpiles at the rate recommended by the manufacturer.

Should construction traffic, cattle grazing, heavy rains, or other related construction activity disturb the tackified topsoil piles and there is a potential for wind erosion, additional tackifier shall be applied by the Contractor.

4.6 Stringing

The objective of stringing is to place the line pipe along the construction right of way for bending and welding in an expedient and efficient manner.

The Contractor shall utilize one or more of the following mitigation measures as applicable and when necessary to reduce compaction on the working side of the right of way or as directed by Keystone. However, all work shall be conducted in accordance with applicable permits.

- Prohibiting access by certain vehicles.
- Using only machinery possessing low ground pressure (tracks or extra-wide tires).
- Control access thus minimizing the frequency of all vehicle traffic.
- Hastening drainage through digging drainage ditch to re-establish surface drainage as required.
- Using timber riprap, matting, or geotextile fabric overlain with soil.
- Stopping construction entirely for a period of time.

4.7 Trenching

The objective of trenching is to provide a ditch of sufficient depth and width with a bottom to continuously support the pipeline. During trenching operations, the following mitigative measures shall be implemented unless otherwise approved or directed by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- Segregating subsoil materials from topsoil in separate, distinct rows with a separation that shall limit any admixing of topsoil and subsoil during handling of these materials.
- Gaps must be left in the spoil piles that coincide with breaks in the strung pipe to facilitate natural drainage patterns and to allow the passage of livestock or wildlife.
- Trenching operation shall be followed as closely as practicable by lower-in and backfill operations to minimize the length of time the ditch is open
- Construction debris (e.g., welding debris) and other garbage shall not be deposited in the ditch.

Should blasting be necessary for removal of rock, the following mitigation measures shall be implemented:

- Where blasting is required, operations shall be done accordingly to laws and regulations governing explosives.
- Prior to using explosives, the Contractor shall advise residents of the immediate area, in order to prevent any risk of accidents or undue disturbances.
- Blasting mats or subsoil shall be piled over the trench line to prevent any rocks from being blown outside the construction right of way.
- Each blasting location shall be cleared and cleaned up before and after all blasting operations
- Blasting shall be carried out during regular daylight working hours.

4.7.1 Trench Dewatering/Well Points

The Contractor shall make all reasonable efforts to discharge trench water in a manner that avoids damage to adjacent agricultural land, crops and pasture. Damage includes, but is not limited to the inundation of crops for more than 24 hours, deposition of sediment in ditches, and the deposition of gravel in fields or pastures.

If trench dewatering is necessary in an area where salt damage to adjacent crops is evident, the Keystone Inspector shall conduct a field conductivity test on the trench water before it is discharged. If the conductivity of the trench water is determined to potentially affect soil quality, it shall not be discharged to areas where salt damage to crops is evident, but shall be directed as feasible so that water flows over a well vegetated, non-cropland area or through an energy dissipater and sediment barrier, then directed to nearby ditches or brackish wetlands or waterbodies.

When pumping water from the trench for any reason the Contractor shall ensure that adequate pumping capacity and sufficient hose is available to permit dewatering as follows:

- No heavily silt-laden trench water shall not be allowed to enter a waterbody or wetland directly but shall instead be diverted through a well vegetated area, a geotextile filter bag or a permeable berm (straw bale or Keystone approved equivalent); and
- Trench water shall not be disposed of in a manner which could damage crops or interfere with the functioning of underground drainage systems.

The Contractor shall screen the intake hose and keep the hose either one foot off the bottom of the trench or in a container to minimize entrainment of sediment.

4.8 Welding, Field Joint Coating, and Lower In

The objectives of welding, field joint coating and lower in are to provide continuous segments of pipeline, to provide corrosion protection to the weld areas of the pipeline, and to place the pipeline in the center of the trench, without stress, at the required depth of cover. The following mitigative measures shall be followed during pipe welding, field joint coating, and lower in, unless otherwise specified by Keystone in response to site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- Shavings produced during bevelling of the line pipe are to be removed immediately following this operation to ensure that livestock and wildlife do not ingest this material. When welding operations have created a continuous line of pipe that may be left on the right of way for an extended period of time due to construction or weather constraints, a gap in the welded pipe shall be provided to allow for access at farm road crossings and also for passage of livestock and/or wildlife.
- Prior to the application of epoxy powder, urethane epoxy or other approved pipe coatings, a tarp shall be placed underneath the pipe to collect any overspray of epoxy powder and/or liquid drippings. Excess powder and/or liquid or other hazardous materials (e.g. brushes, rollers, gloves, etc.) shall be continuously collected and removed from the construction right-of-way.

4.9 Padding and Backfilling

The objective of padding (when required) and backfilling is to cover the pipe with material that is not detrimental to the pipeline and pipeline coating. The following mitigative measures shall be utilized during backfilling, unless otherwise approved or directed by Keystone based on site specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Excessive water accumulated in the trench shall be eliminated prior to backfilling.
- In the event it becomes necessary to pump water from open trenches, the Contractor shall pump the water and discharge it into existing water drainages in a manner that shall avoid damaging adjacent agricultural land, crops, and/or pasture.
- If it is impossible to avoid water-related damages (including inundation of crops for more than 24 hours, deposition of sediment in ditches and other water courses, and the deposition of gravel in fields, pastures, and any water courses), Keystone shall reasonably compensate the Landowners for the damages or shall correct the damages so as to restore the land, crops, pasture, water courses, etc. to their pre construction condition.
- All pumping of water shall comply with existing drainage laws and local ordinances relating to such activities and provisions of the Clean Water Act.
- Prior to backfilling, all drain tile shall be permanently repaired, inspected and the repair documented as described in Section 5.5
- Prior to backfilling, trench breakers shall be installed on slopes where required to minimize the potential for water movement down the ditch and potential subsequent erosion.
- In backfilling the trench, the stockpiled subsoil shall be placed back into the trench before replacing the topsoil.
- Topsoil shall not be utilized for padding the pipe.
- Backfilling shall be done without mixing spoil with topsoil.
- Backfill shall be compacted to a minimum of 90% of pre-existing conditions where the trench line crosses tracks of wheel irrigation systems (pivots).
- To reduce the potential for ditch line subsidence, spoil shall be replaced and compacted by backhoe bucket and/or by the wheels or tracks of equipment traversing down the trench.
- The top 4 feet or the actual depth of top cover, whichever is less, within the pipeline trench, bore pits, or other excavations shall not be backfilled with soil containing rocks of any greater concentration or size than existed prior to the pipeline's construction.

4.10 Clean Up

The objective of clean up activities shall be to prepare the right of way and other disturbed areas to approximate pre-activity ground contours where appropriate and to replace spoil and stockpiled material in a manner which preserves soil capability and quality to a degree reasonably equivalent to the original or that of representative undisturbed land. The following mitigative measures shall be utilized during clean up, unless otherwise approved or directed by Keystone based on specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- Clean up shall occur immediately following backfilling operations when weather allows it.
- All garbage and construction debris (i.e., lathing, ribbon, welding rods, pipe bevel shavings, pipe spacer ropes end caps, pipe skids, etc.) shall be collected and disposed of at approved disposal sites.

- The right of way shall be re-contoured with spoil material to approximate pre-construction contours and as necessary to limit erosion and subsidence. Loading of slopes with unconsolidated spoil material shall be avoided during slope re-contouring. Topsoil shall be replaced after re-contouring of the grade with subsoil. The topsoil shall be replaced on the subsoil storage area and over the trench so that after settling occurs, the topsoil's approximate original depth and contour (with an allowance for settling) shall be achieved.
- Surface drainage shall be restored and re-contoured to conform to the adjacent land drainage system.
- Erosion control structures such as permanent slope breakers and cross ditches shall be installed on steep slopes where necessary to control erosion by diverting surface run-off from the right of way, to stable and vegetated off right of way areas.
- After construction, all temporary access shall be returned to prior construction conditions unless specifically agreed with the Landowner or otherwise specified by Keystone.
- Installation of warning signs, aerial markers, and cathodic protection test leads in locations that shall not impair farming operations and are acceptable to the Landowner
- All bridges, fences and culverts existing prior to construction shall be restored to meet or exceed approximate pre-construction conditions. Caution shall be utilized when re-establishing culverts to ensure that drainage is not improved to a point that would be detrimental to existing waterbodies and wetlands.
- All temporary gates installed during construction shall be replaced with permanent fence unless otherwise requested by the Landowner.

4.11 Reclamation and Re-vegetation

The objectives of reclamation and re-vegetation are to return the disturbed areas to approximately pre-construction use and capability. This involves the treatment of soil as necessary to preserve approximate pre-construction capability and the stabilization of the work surface in a manner consistent with the initial land use. The following mitigative measures will be utilized unless otherwise approved or directed by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

4.11.1 Relieving Compaction

- Compaction shall be alleviated on all agricultural land traversed by construction equipment. Cropland that has been compacted shall be ripped a minimum of 3 passes at least 18 inches deep and all pasture and woodland shall be ripped or chiseled a minimum of three passes at least 12 inches deep.
- Areas of the construction right of way that were stripped for topsoil salvage shall be ripped a minimum of 3 passes (in cross patterns) prior to topsoil replacement. The approximate depth of ripping shall be 18 inches (or a lesser depth if damage may occur to existing drain tile systems). Following ripping, the subsoil surface shall be graded

smooth and any subsoil clumps broken up (disc and harrow) in an effort to avoid topsoil mixing.

- The decompacted construction right of way shall be tested by the Contractor at regular intervals for compaction in agricultural and residential areas disturbed by construction activities. Tests shall be conducted on the same soil type under similar moisture conditions in undisturbed areas immediately adjacent to the right of way to approximate pre-construction conditions. Penetrometers or other appropriate devices shall be used to conduct tests
- Topsoil shall be replaced to pre-existing depths once ripping and discing of subsoil is complete. Topsoil compaction on cultivated fields shall be alleviated by cultivation.
- If there is any dispute between the Landowner and Keystone as to what areas need to be ripped or chiseled, the depth at which compacted areas should be ripped or chiseled, or the necessity or rates of lime and fertilizer application, the appropriate county Soil and Water Conservation District's opinion shall be considered by Keystone and the Landowner.

Plowing under of organic matter including wood chips, manure, or planting of a new crop, such as alfalfa, to decrease soil bulk density and improve soil structure or any other measures in consultation with the Soil Conservation service shall be considered if mechanical relief of compaction is deemed not satisfactory.

4.11.2 Rock Removal

- In agricultural land, rocks that are exposed on the surface due to construction activity shall be removed from the right of way prior to and after topsoil replacement to an equivalent quantity, size and distribution of rocks to that of adjacent lands.
- Clearing of rocks may be carried out with a mechanical rock picker or by manual means, provided that preservation of topsoil is assured. Rock removed from the right of way shall be hauled off the Landowner's premises or disposed of on the Landowner's premises at a location that is mutually acceptable to the Landowner and to Keystone.

4.11.3 Soil Additives

If site specific conditions warrant and if agreed to by the Landowner, the Contractor shall apply amendments (fertilizer and soil pH modifier materials and formulations) that are commonly used for agricultural soils in the area in which they are applied and in accordance with written recommendations from the local soil conservation authority, land management agencies, or Landowner. Amendments shall be incorporated into the normal plow layer as soon as possible after application.

4.11.4 Seeding

- The final seed mix shall be based on input from the local Soil Conservation Services and the availability of seed at the time of reclamation. The Landowner may request specific seeding requirements during easement negotiations.
- Certificates of seed analysis are required for all seed mixes to limit the introduction of noxious weeds.
- Seed not utilized within 12 months of seed testing shall be approved by Keystone prior to use.Seeding shall follow clean up and topsoil replacement as closely as possible. Seed shall be applied to all disturbed surfaces (except cultivated fields unless requested by the Landowner) as indicated on the Consruction Drawings
- If mulch was applied prior to seeding for temporary erosion control, the Contractor shall remove and dispose of the excess mulch prior to seedbed preparation to ensure that seedbed preparation equipment and seed drills do not become plugged with excess mulch; to ensure that seed can adequately contact the soil surface; and to ensure that seed incorporation or soil packing equipment can operate without becoming plugged with mulch.
- The Contractor may evenly re-apply and anchor (straw crimp) the removed temporay mulch on the construction right-of-way following seeding.
- Identified seeding areas shall be seeded at a rate appropriate for the region and stability of the reclaimed surface. Seeding rates shall be based on Pure Live Seed.
- Weather conditions, construction right-of-way constraint, site access, and soil type shall influence the seeding method to be used (i.e., drill seeding versus broadcast seeding). All areas seeded by the Contractor, except for temporary cover crops, shall be drill seeded unless the right of way is too steep to facilitate drill seeding. Temporary cover crop seed shall be broadcast.
- The Contractor shall delay seeding as necessary until the soil is in the appropriate condition for drill seeding.
- The Contractor shall use a Truax (brand) or equivalent-type drill seeder equipped with a cultipacker designed and equipped to apply grass and grass-legume seed mixtures with mechanisms such as seed box agitators to allow even distribution of all species in each seed mix, with an adjustable metering mechanism to accurately deliver the specified seeding rate and with a mechanism such as depth bands to accurately place the seed at the specified depth.
- The Contractor shall operate drill seeders at an appropriate speed so the specified seeding rate and depth is maintained.
- The Contractor shall calibrate drill seeders so that the specified seeding rate is planted. The row spacing on drill seeders shall not exceed 8 inches.
- The Contractor shall plant seed at depths cosistent with the local or regional agricultural practices.
- Broadcast or hydro seeding used, in lieu of drilling, shall utilize double the recommended seeding rates. Where seed is broadcast, the Contractor shall use a harrow, cultipacker or other equipment

immediately following broadcasting to incorporate the seed to the specified depth and to firm the seedbed.

- The Contractor shall delay broadcast seeding during high wind conditions if even distribution of seed is impeded.
- The Contractor shall hand rake all areas that are too steep, or otherwise cannot be safely harrowed or cultipacked, in order to incorporate the broadcast seed to the specified depth.
- Hydro-seeding may be used, on a limited basis, where the slope is too steep or soil conditions do not warrant conventional seeding methods. Fertilizer, where specified, may be included in the seed, virgin wood-fiber, tackifier and water mixture. When hydro-seeding, virgin wood-fiber shall be applied at the rate of approximately 3,000 pounds per acre on an air-dry weight basis as necessary to provide at least 75% ground cover. Tackifier shall consist of biodegradable, vegetable-based material and shall be applied at the rate recommended by the manufacturer. The seed, mulch and tackifier slurry shall be applied so that it forms a uniform, mat-like covering of the ground.
- Keystone shall work with Landowners to discourage cattle from using the construction right-of-way during the first growing season by utilization of temporary fencing or deferred grazing.

4.11.5 Permanent Erosion and Sediment Control

The Contractor shall restore all existing Landowner soil conservation improvements and structures disturbed by pipeline construction to the approximate pre-construction line and grade. Soil conservation improvements and structures include, but are not limited to, grassed waterways, toe walls, drop inlets, grade control works, terraces, levees and farm ponds.

4.11.5.1 Trench Breakers

The Contractor shall install trench breakers in steep terrain where necessary to limit the potential for trench line erosion and at the base of slopes adjacent to waterbodies and wetlands.

Trench breakers shall be constructed of materials such as sand bags, sand/cement bags, bentonite bags, or polyurethane foam by the Contractor **(Detail 7)**. The Contractor shall not use topsoil in trench breakers.

4.11.5.2 Permanent Slope Breakers (Water Bars)

Permanent slope breakers (water bars) shall be constructed of soil or, in some instances, sand bags.

The Contractor shall construct permanent slope breakers (water bars) on the construction right-of-way where necessary to limit erosion, except in cultivated and residential areas. Slope breakers shall divert surface runoff to adjacent stable vegetated areas or to energy-dissipating devices as shown on **Detail 3.** Permanent slope breakers (water bars) shall be installed as specified on the Construction Drawings or generally with a minimum spacing as shown on the following table:

Slope (%)	Spacing (feet)
5 - 15	300
>15 – 30	200
>30	100

The gradient (fall) for each slope breaker shall be two percent (2%) to eight percent (8%) unless otherwise approved by Keystone based on site specific conditions.

The Contractor shall construct slope breakers to divert surface flow to a stable, well-vegetated area. In the absence of a stable area, the Contractor shall construct appropriate energy-dissipating devices at the end of the slope breaker and beyond the area disturbed by construction. .

4.11.5.3 Mulching

The Contractor shall apply mulch on all areas with high erosion potential and on slopes greater than 8 percent unless otherwise approved by Keystone based on site specific conditions or circumstances. The Contractor shall spread mulch uniformly over the area to cover at least 75 percent of the ground surface at an approximate rate of 2 tons/acre of straw or its equivalent.

Mulch application includes straw mulch or hydro mulch and tackifier. The Contractor shall not apply mulch in cultivated areas unless requested by the Landowner.

The Contractor shall use mulch that is free of noxious weeds.

The Contractor shall apply mulch immediately following seeding. The Contractor shall not apply mulch in wetlands.

If a mulch blower is used, the majority of strands of the mulching material shall not be shredded to less than 8 inches in length to allow anchoring. The Contractor shall anchor mulch immediately after application to minimize loss by wind and water.

When anchoring (straw crimping) by mechanical means, the Contractor shall use a tool specifically designed for mulch anchoring with flat, notched disks to properly crimp the mulch to a depth of approximately 2 to 3 inches. A regular farm disk shall not be used to crimp mulch.

In soils possessing high erosion potential, the Contractor may be required to make two passes of the mulch-crimping tool, passes must be as perpendicular to the others as possible.

When anchoring with liquid mulch binders (tackifiers), the Contractor shall use a biodegradable tackifier derived from a vegetable-based, organic source. The Contractor shall apply mulch binders at rates recommended by the manufacturer.

The Contractor shall limit the use of liquid mulch binders (tackifiers) for anchoring straw and the use of hydromulch and tackifier to areas that are too steep or rocky to safely or effectively operate mechanical mulch-anchoring tools.

4.11.5.4 Erosion Control Matting

Erosion control matting shall be applied where shown on the Construction Drawings as shown on **Detail 4.** The Contractor shall anchor the erosion control matting with staples or other approved devices.

The Contractor shall use erosion control matting made of biodegradable, natural fiber such as straw or coir (coconut fiber).

The Contractor shall prepare the soil surface and install the erosion control matting to ensure it is stable and the matting makes uniform contact with the soil of the slope face or stream bank underneath with no bridging of rills, gullies or other low areas.

4.11.5.5 Riprap and Stream Bank Stabilization

In most cases, the banks and streambeds of waterbodies shall be restored to their approximate original contours. Erosion protection shall be applied as specified in the construction drawings.

Generally most restored banks will be protected through the use of flexible channel liners installed as specified in **Detail 19.**

If the original stream bank is excessively steep and unstable and/or flow conditions are severe, a more stable final contour may be specified and alternate stabilization measures may be installed.

Alternate stabilization measures may consist of rock rip rap, or bio-stabilization or engineered structures such as brush layering, logwalls, cribwalls, or vegetated geo-grids. See **Details 20, 22, 23, and 24.**

Stream bank riprap structures shall consist of a layer of stone, underlain with approved filter fabric or a gravel filter blanket. Riprap shall extend from the stabilized streambed to the top of the stream bank, where practicable, native rock shall be utilized.

4.11.6 Fences

Upon completion of all backfilling, clean-up and restoration including mulching and seeding of the construction right-of-way, permanent repairs shall be made to all fences by using either the original material or good quality new material similar to existing fences.

Early or historic fences shall be carefully reassembled by hand from the original material. Where the original material has deteriorated to a state that makes it unsalvageable, replacement material similar to the original shall be used if possible.

4.11.7 Right-of-way and Pipeline Markers

Upon completion of all backfilling, clean-up and restoration including mulching and seeding of the construction right-of-way and during the time when the Contractor is making permanent repairs to fences, the Contractor shall install pipeline markers on each side of all roads, railroads, fence lines, stream crossings and other areas where the pipeline markers do not conflict with intended land use.

4.12 Pasture and Range Lands

The following mitigative measures shall be implemented in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- Access across the right of way during construction shall be provided at locations requested by Landowners, if practicable.
- Bevel shavings produced during pipe bevel operations are to be removed immediately to ensure that livestock and wildlife do not ingest this material.
- Litter and garbage shall be collected and removed from the construction site at the end of the day's activities.
- Temporary gates shall be installed at fence lines for access to the construction right of way. These gates shall remain closed at all times. Upon completion of construction, the temporary gates shall be removed and the permanent fence replaced.

- Feeding or harassment of livestock or wildlife is prohibited.
- Construction personnel shall not be permitted to have firearms or pets on the construction right-of-way.
- All food and wastes shall be stored and secured in vehicles and/or appropriate facilities.
- Areas of disturbance in native range shall be seeded with a native seed mix after topsoil re-placement.
- Improved pasture shall be seeded with a seed mix approved by individual Landowners.

4.13 Forested Lands

Mitigation measures are required to ensure that pipeline construction activities have a minimal impact on forested lands and their habitat.

Clearing, grubbing and grading of trees, brush and stumps shall be performed in accordance with the following mitigative measures in addition to the requirements previously stated in Sections 4.1 thru 4.11 unless otherwise approved or directed by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- Prior to the start of clearing activity, right of way boundaries including pre-approved temporary workspaces shall be clearly staked to prevent disturbance to unauthorized areas.
- If trees are to be removed from the construction right-of-way, Keystone shall consult with the Landowner or Landowner's designate to see if there are trees of commercial or other value to the Landowner. Timber shall be salvaged as per Landowner request.
- If there are trees of commercial or other value to the Landowner, Keystone shall allow the Landowner the right to retain ownership of the trees with the disposition of the trees to be negotiated prior to the commencement of land clearing and included in the easement agreement.
- If not performed by the Landowner, the construction right of way Contractor shall salvage all merchantable timber from designated areas.
- Tree stumps shall be grubbed only 5 feet either side of the trench line and where necessary for grading a level surface for pipeline construction equipment to operate safely
- Keystone shall follow the Landowner's or Landowner designate's desires as stated in the easement agreement regarding the disposal of trees, brush, and stumps of no value to the Landowner by burning, burial, etc., or complete removal from any affected property.
- Timber salvage operations shall use cut off-type saw equipment. Felling shall be undertaken in a manner that minimizes butt shatter, breakage and off right of way disturbance. Skidders or alternate equipment shall be used to transport salvaged logs to stacking sites.
- Trees shall be felled in such a way that they fall toward the centre line of the right of way to avoid breaking trees and branches off right of way. Leaners or felled trees that inadvertently fall into adjacent undisturbed vegetation shall be salvaged.
- Trees and slash falling outside the right of way shall be recovered and disposed of

- Salvaged logs shall be limbed and topped before removal from the construction right-of-way. Log decks (if required) shall be oriented to best facilitate loading by picker trucks and be located adjacent to the working side of the right of way where possible.
- The Contractor shall not be allowed to dispose of woody debris in wooded areas along the pipeline right of way.
- Pruning of branches hanging over the right of way shall be done only when necessary for construction. Any branch that is broken or seriously damaged should be cut off near its fork and the collar of the branch preserved.
- All tree wastes, stumps, tree crowns, brushes, branches and other forest debris shall be either burned, chipped (using a mobile chipper) or removed from the right of way according to Keystone instructions contained in the specific mitigation measures. Burial of this waste material on the site by the Contractor shall require the Landowner's specific authorization. Chips must not be spread over cultivated land. However, they may be spread and incorporated with mineral soil over the forest floor at a density that shall not prevent re-vegetation of grass.
- Stump removal and brush clearing shall be done with bulldozers equipped with brush rakes to preserve organic matter.
- Decking sites shall be established, approximately 2000 feet apart in timbered areas, on sites located on approved temporary workspace in existing cleared areas, in non-merchantable stands of timber or, if no other options are available, in merchantable timber stands. Deck sites shall be appropriately sized to accommodate the loading equipment.
- The Contractor shall remove decked timber from the construction right-of-way and transport to a designated all weather access point or mill if the Landowner does not want the timber.

4.14 Residential and Commercial/Industrial Areas

4.14.1 Residential Area

The principal measures that shall be used to mitigate impacts on existing residential areas include the following unless otherwise directed or approved by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- notifying Landowners prior to construction;
- posting warning signs as appropriate
- reducing the width of construction right of way, if practicable, by eliminating the construction equipment passing lane, reducing the size of work crews, or utilizing the "stove pipe" or "drag section" construction techniques;
- removing fences, sheds, and other improvements as necessary for protection from construction activities;
- preserving, to the extent possible, mature trees and landscaping while ensuring the safe operation of construction equipment;
- fencing the edge of the construction work area adjacent to a residence for a distance of 100 feet on either side of the residence to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area;

- limiting the hours during which operations with high-decibel noise levels (i.e., drilling and boring) can be conducted;
- limiting dust impact through prearranged work hours and by utilizing dust minimization techniques;
- ensuring that construction proceeds quickly through such areas (thus, minimizing exposure to nuisance effects such as noise and dust);
- maintaining access and traffic flow during construction activities, particularly for emergency vehicles;
- cleaning up construction trash and debris daily;
- fencing or plating open ditches during non-construction activities;
- immediately after backfilling the trench, restoring all lawn areas, shrubs, specialized landscaping, fences and other structures, etc. within the construction work area consistent with its pre-construction appearance or the requirements of the Landowner. Restoration work shall be done by personnel familiar with local horticultural and turf establishment practices;
- If the pipeline centerline is within 25 feet of a residence, ensuring that the trench is not excavated until the pipe is ready for installation and that the trench shall be backfilled immediately after pipe installation.

4.14.2 Commercial / Industrial Area

Commercial/industrial areas traversed by the pipeline would be subjected to both short and long-term impacts similar to residential areas. Temporary, short-term construction impacts may include disruption, inconvenience, and loss of potential revenues.

The principal measures that shall be used to mitigate impacts on existing commercial/industrial areas are as follows unless otherwise directed or approved by Keystone based on site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- notifying business owners prior to construction;
- reducing the width of construction right of way, if practicable, by eliminating the construction equipment passing lane, reducing the size of work crews, or utilizing the "stove pipe" or "drag section" construction techniques;
- removing fences and other improvements as necessary for protection from construction activities;
- fencing the edge of the construction work area adjacent to a business for a distance of approximately 100 feet on either side of the commercial/industrial building to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area;
- preserving, to the extent possible, mature trees and landscaping while ensuring the safe operation of construction equipment;
- limiting the hours during which operations with high-decibel noise levels (i.e., drilling and boring) can be conducted;
- limiting dust impact through prearranged work hours and by utilizing dust minimization techniques;

- ensuring that construction proceeds quickly through such areas (thus, minimizing exposure to nuisance effects such as noise and dust);
- maintaining access and traffic flow during construction activities, particularly for emergency vehicles;
- cleaning up construction trash and debris daily;
- fencing or plating open ditches during non-construction activities;
- immediately after backfilling the trench, restoring all lawn areas, shrubs, specialized landscaping, fences and other structures, etc. within the construction work area consistent with its pre-construction appearance or the requirements of the business owner. Restoration work shall be done by personnel familiar with local horticultural and turf establishment practices;
- If the pipeline centerline is within 25 feet of a commercial/industrial building, ensuring that the trench is not excavated until the pipe is ready for installation and that the trench shall be backfilled immediately after pipe installation.

4.14.3 Site – Specific Plans

For any residence or commercial/industrial building closer than 25 feet to the construction work area, Keystone shall prepare a site-specific construction plan. The plan shall include:

- a description of construction techniques to be used;
- a dimensioned site plan that shows, as a minimum:
  - the location of the residence or commercial/industrial area in relation to the new pipeline;
  - the edge of the construction work area;
  - the edge of the new permanent construction right-of-way; and
  - other nearby topographical obstacles including landscaping, trees, structures, roads, parking areas, or ditches/streams, etc.
- a description of how Keystone would ensure that the trench is not excavated until the pipe is ready for installation and that the trench is backfilled immediately after pipe installation.

Figure 1 represents a typical site specific plan.

4.14.4 Landowner Complaint Resolution Procedure

Keystone shall implement a Landowner complaint procedure as follows:

- Landowners should first contact the construction spread office to express their concern over restoration and/or mitigation of environmental damages on their property. The Construction Manager, or his designated representative, shall respond to the Landowner within approximately 24 hours of receipt of the phone call.
- If the Landowner has not received a response or are not satisfied with the response, they can then contact Keystone's representative at XXX-

XXX-XXXX. The Landowners should expect a response within 48 hours.

- If the Landowner has not received a response or is not satisfied with the response, they should contact Keystone's Hotline at XXX-XXX-XXXX.

4.15 Operations and Maintenance

Operations and maintenance programs such as vegetation management, pipeline maintenance, integrity surveys, hydrostatic testing or other programs may have an impact on the final reclamation of the right of way. To ensure that the integrity of the facility and land surface reclamation of the right of way is maintained after completion of construction and that regulatory requirements are adhered to during operations, the following measures shall be implemented unless otherwise directed by Keystone in response to site specific conditions or circumstances. However, all work shall be conducted in accordance with applicable permits.

- Keystone shall monitor the pipeline right of way and all stream crossings for erosion or other potential problems that could affect the integrity of the pipeline. Any erosion identified shall be reclaimed as expediently as practicable by Keystone or by compensation of the Landowner to reclaim the area.
- Trench depressions on ditch line which may interfere with natural drainage, vegetation establishment or land use shall be repaired as expediently as practicable by Keystone or by compensation of the Landowner to repair the area.
- Post construction monitoring inspections shall be conducted of disturbed areas after the first growing season to determine the success of revegetation. Areas which have not been successfully re-established shall be revegetated by Keystone or by compensation of the Landowner to reseed the area. If, after the first growing season, revegetation is successful, no additional monitoring shall be conducted.
- In non-agricultural areas, revegetation shall be considered successful if, upon visual survey, the density and cover of non-nuisance vegetation are similar in density and cover to adjacent undisturbed lands.
- In agricultural areas, revegetation shall be considered successful if crop yields are similar to adjacent undisturbed portions of the same field.
- Restoration shall be considered successful if the surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless requested otherwise by the Landowner or land managing agency), revegetation is successful, and drainage has been restored.
- Weed control measures shall be implemented as required in conjunction with the Landowner.
- Keystone shall be responsible for correcting all tile line repairs or irrigation systems that fail due to pipeline construction, provided those repairs were made by Keystone. Keystone shall not be responsible for tile line repairs which Keystone compensates the Landowner to perform.
- When requested by Landowners, in cultivated land, Keystone shall monitor the yield of land impacted by construction with the help of agricultural specialists. If alterations are indicated from that of adjacent lands, Keystone

will compensate the Landowner for reduced yields and shall implement procedures to return the land to equivalent capability.

- In residential areas, Landowners may use the right-of-way provided they do not interfere with the rights granted to Keystone. Trees or bushes, structures, including houses, toolsheds, garages, poles, guy wires, catch basins, swimming pools, trailers, leaching fields, septic tanks, and any other objects not easily removable, shall not be permitted on the permanent construction right-of-way without the written permission of Keystone, because they could impair access for maintenance of the pipeline.
- Keystone shall maintain communication with the Landowner and or tenant throughout the operating life of the pipeline to allow expedient communication of issues and problems as they occur. Keystone shall provide the Landowners with corporate contact information for these purposes. Keystone shall work with Landowners to prevent excessive erosion on lands disturbed by construction. Reasonable methods shall be implemented to control erosion. This may not be implemented if the property across which the pipeline is constructed is bare cropland which the Landowner intends to leave bare until the next crop is planted.
- If the Landowner and Keystone cannot agree upon a reasonable method to control erosion on the Landowner's property, the recommendations of the appropriate county Soil and Water Conservation District shall be considered by Keystone and the Landowner.

5.0 DRAIN TILE SYSTEMS

5.1 General

If underground drainage tile is damaged by the pipeline installation, it shall be repaired in a manner that assures the tile line's proper operating condition at the point of repair. Keystone may elect to negotiate a fair settlement with the affected county or Landowner for repair of the damaged drain tile. In the event the Landowner chooses to have the damaged tile repaired by Keystone, the Contractor shall follow these guidelines and procedures to identify the location of drain tiles; to mitigate damages to drain tiles prior to and during construction; to repair drain tiles damaged during installation of the pipeline; to inspect the proper repair of drain tiles; and to provide post-construction monitoring to determine any impacts caused by repair of drain tiles. Since all public and private drain tile systems are unique, i.e., varying age, depth of cover, type of material, geometry on the land, etc., it is not possible to develop a standard procedure for resolving each county's or Landowner's drain tile issues. These guidelines provide a basis on which to develop site specific methodology to mitigate damage and to repair drain titles affected by construction of the Keystone pipeline. Actual measures will be developed based on site specific information unique to specific installations. However, all work will be conducted in accordance with applicable permits.

5.2 Identification and Classification of Drain Tile Systems

Personnel shall attempt to identify and classify existing drain tile systems by meeting with local public officials and county engineers, and meeting with individual private Landowners and/or tenants.

5.2.1 Publicly Owned Drain Tiles

Personnel shall identify and meet with the responsible county or local authority responsible for publicly owned drain tiles. Publicly owned drain tiles shall be identified and documented onto Keystone's 1" = 2000' USGS quad strip maps and additional data collected for input into an electronic spreadsheet by county; township, range, and section; responsible agency; and size, type, and depth of cover (if known). This data shall be cross referenced to the centerline survey to be completed by Keystone. Additionally, any public records including maps or easement instruments on the drain tiles shall be acquired as well as any requirements of the local authority for installation of the Keystone pipeline.

5.2.2 Privately Owned Drain Tiles

Right-of-way agents shall meet with Landowners and tenants of privately owned land along Keystone's pipeline route. As a minimum, the right-of-way agents shall ascertain the data concerning drain tiles outlined on a Landowner questionnaire. The questionnaire requests data concerning type of drain tile system; size, type of material and depth of cover; preference for repair of drain tiles; and identification of local drain tile contractors. These data shall be collected into an electronic spreadsheet for utilization by right-of-way personnel in negotiating payments for easements and damages and by engineering/construction personnel for inclusion in specifications for the construction contractor.

5.3 Mitigation of Damage to Drain Tile Systems

Keystone shall undertake mitigation measures to reduce damage to publicly and privately owned drain tile systems prior to and during installation of the pipeline.

5.3.1 Non-interference with Drain Tile

Keystone's pipeline shall be installed at a depth of cover and elevation to not interfere with the elevation and grade of existing drain tiles where practicable. Where not practicable, Keystone shall pursue alternative mitigation measures mutually acceptable to the Landowner and jurisdictional agencies. Typically, the pipeline shall be installed below the elevation of drain tiles with a minimum clearance of 12 inches. **Detail 25**, Typical ROW Layout/Soil Handling, represents a typical drain tile crossing by the pipeline with additional temporary work space to facilitate handling of topsoil and trench spoil created by the additional depth of cover for the pipeline.

5.3.2 Non-disturbance of Drain Tile Mains

Publicly owned and privately owned drain tile mains shall be identified through the processes identified in Section 5.2. Drain tile mains are essential to the overall drainage system of a land area and may cause the pipeline construction Contractor excessive pumping/dewatering of the pipe trench unless temporarily repaired and maintained until permanently repaired.

Keystone shall review drain tile mains and consider their size, flow rate, type of material, depth of cover, and geographic location. If determined to be practicable and reasonable for construction, the drain tile main shall not be cut and repaired during mainline installation (a pipe section shall be left out and installed by a tie-in crew without damaging the drain tile main).

5.3.3 Relocation or Replacement of Existing Drain Tiles Prior to Construction

In many instances, drain tile systems that have been installed after the installation of adjacent existing pipelines, were installed with "headers" parallel to the existing pipeline with periodic jumpovers as depicted on **Detail 26**, Header/Main Crossovers of Keystone Pipeline. The distance of these headers from the existing pipeline may vary.

Some of these drain tile headers may be most effectively relocated and/or replaced to the east of the Keystone pipeline and the existing header capped and made into a single drain tile as depicted on **Detail 27**, Relocate/Replace Drainage Header/Main. This could reduce the number of drain tile crossings on a particular Landowner by a significant quantity, thereby reducing the risk that repairs will fail.

5.3.4 Future Drain Tiles/Systems

Personnel shall attempt to determine where public agencies and private Landowners or tenants are proposing to install drain tile systems in the future to the extent possible. These locations shall be input into an electronic spreadsheet by county; township, range, and section; Landowner or responsible public agency; and proposed size and depth of cover. Keystone shall endeavor to construct the pipeline at a depth and elevation to accommodate the future installation of the proposed drain tile systems.

5.3.5 Other Mitigation Measures

Other mitigation measures that may be implemented during installation of the pipeline are as follows:

- Not removing topsoil from the working side of the construction right-of-way to prevent crushing of drain tile by heavy equipment
- Spreading ditch and spoil side topsoil (not subsoil) over the working side to provide additional soil depth to protect existing drain tiles.
- The Contractor shall restrict the work, if practicable, of the pipe lower-in crew if ground conditions are too wet to adequately support the heavy equipment.
- Travel of heavy equipment shall be limited to the working lane of the construction right-of-way where possible.

- Travel of heavy equipment shall be limited to one pass over the drain tile per work crew where possible.
- Should tile be crushed on the working side of the right of way, the topsoil would be removed and replaced during the drain tile replacement.

5.4 Responsibility for Repair of Drain Tile Systems

Temporary and permanent drain tile repairs shall be the responsibility of the Contractor. The physical repairs shall be made by qualified and experienced drain tile repair personnel.

5.4.1 Local Drain Tile Contractor Repair

Keystone shall identify and qualify local drain tile contractors in the geographical area of the pipeline route from interviews with local public officials and Landowners/tenants as well as the drain tile contractors. The preferred responsibility for permanent repair of drain tiles shall be for the pipeline Contractor to subcontract the supervision and repair to local reputable drain tile contractors that are acceptable to the local Landowners/tenants.

5.4.2 Pipeline Contractor Repair

In the event local drain tile contractors are not available to subcontract the supervision and repair, responsibility for permanent repair shall be with the pipeline contractor's supervision, equipment, and labor.

5.4.3 Landowner/Tenant Repair

Keystone shall allow the Landowner or tenant responsibility for the permanent repair of his drain tiles if requested during negotiations for the easement and if not precluded by jurisdictional regulatory agencies. The Landowner/tenant shall be requested to ensure their ability to coordinate and complete the drain tile repair in a timely manner to accommodate the pipeline Contractor to allow the pipeline Contractor to completely backfill the damaged drain tile for repair by Landowner/tenant in the immediate future. Keystone shall require that its representative be present to ensure the permanent drain tile repairs are made in accordance with the minimum requirements of this manual.

5.5 Drain Tile Repairs

The Contractor shall endeavour to locate all tile lines within the construction right-of-way prior to and during the pipeline's installation so repairs can be made if necessary.

5.5.1 Temporary Repairs During Construction

Drain tiles damaged/cut by excavation of the pipeline trench shall be marked with a lath and ribbon in the spoil bank. Care shall be taken to locate markers where the chance of disturbance shall be minimized and a written record maintained of each drain tile crossing. A work crew following the pipeline trench crew shall complete a temporary repair to allow continuing flow. **Detail 28**, Temporary Drain Tile Repair, depicts the materials and installation to complete the temporary repair. If a drain tile line shall not be temporarily repaired, the open ends of the drain tile shall be screened to prevent entry of foreign materials and small animals.

5.5.2 Permanent Repairs

Permanent repairs shall be made for all drain tiles damaged by installation of the pipeline.

5.5.2.1 Ditch Line Only Repairs

If water is flowing through a damaged tile line, the tile line shall be immediately and temporarily repaired until such time that permanent repairs can be made. If tile lines are dry and water is not flowing, temporary repairs are not required if the permanent repair is made within 7 days of the time damage occurred. The temporary repair shall be removed just prior to lowering-in the pipeline.

Drain tiles must be permanently repaired before the pipeline trench is backfilled and within 14 days of construction completion, weather and soil conditions permitting. All tile lines shall be repaired with materials of the same or better quality as that which was damaged. The drain tile marker shall not be removed until the tile repairs have been inspected, approved, and accepted by Keystone's inspectors, the Counties' inspectors, where applicable, and/or the Landowner or tenant. **Detail 29**, Permanent Repair Method of Drain Tiles, depicts the minimum materials and installation to complete a permanent repair.

5.5.2.2 Ditch Line and Temporary Work Space Repairs

Prior to making the permanent drain tile repair, the Contractor shall probe a segmented sewer rod with a plug that is not more than 15% smaller than the internal diameter of the drain tile to determine if additional damage has occurred to the drain tile. If the probe does not freely insert into the drain tile across the temporary workspace of pipeline construction, the Contractor shall excavate, expose and repair the damaged drain tile to its original or better condition.

5.6 Inspection/Acceptance of Drain Tile Repairs

Drain tile repairs shall be inspected by Keystone pipeline construction inspectors, County inspectors, as applicable, and the Landowner or tenant or their representative.

Keystone pipeline shall designate inspector(s) for the sole purpose and responsibility for inspection of repair of drain tiles. These inspectors shall be, if possible, employed from local drain tile installation contractors, local farmers with extensive drain tile experience, or previously employed or retired employees of local jurisdictions familiar with drain tile installation and repair. In the event that a sufficient quantity of inspectors from the prior described sources are not available, Keystone shall conduct in-the-field training seminars on drain tile repair for additional inspection personnel.

Inspection personnel shall observe the permanent repair of all drain tiles to ensure utilization of the proper type and size of replacement drain tile; the drain tile is installed at the proper grade; the drain tile is properly supported; backfill beneath the drain tile is properly placed and compacted; and the replacement drain tile is properly tied into the existing drain tile. The inspections shall be documented on the Drain Tile Inspection Report Forms.

A drain tile repair shall not be accepted until Keystone's construction inspector AND the Landowner or tenant or their designated representative approves the inspection form.

6.0 WETLAND CROSSINGS

6.1 General

Aboveground facilities shall not be located in a wetland, except where the location of such facilities outside of wetlands would preclude compliance with U.S. Department of Transportation pipeline safety regulations.

Wetland boundaries shall be clearly marked in the field with signs and/or highly visible flagging during construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the measures of Section 7 shall be implemented to the extent practicable.

A "dry" wetland typically has groundwater level existing some depth below the surface. Trench excavations are typically stable and normal in width. Equipment can traverse the wetland without the support of mats or timber rip-rap.

A "standard" wetland environment typically has soils that are saturated and non-cohesive. Difficult trenching conditions are likely resulting in excessively wide trenches. In these wetland environmental types, supplemental support in the form of timber rip-rap or prefabricated equipment mats may be required for construction equipment to safely and efficiently operate.

A "flooded" wetland involves the presence of standing water over much of the wetland area. Equipment typically cannot traverse the wetland and must generally move around that portion of the area. Access is typically limited to marsh backhoes or equipment working from flexi floats or equivalent.

Keystone may allow modification of the following specifications as necessary to accommodate site specific conditions or procedures. Any modifications must still comply with all applicable regulations and permits.

6.2 Easement and Workspace

The Contractor shall maintain wetland boundary markers in place during construction in all areas and until permanent seeding are completed in non-cultivated areas.

The width of the construction right-of-way shall be reduced to 85 feet or less in "standard" wetlands unless non-cohesive soil conditions require utilization of a greater width.

The Contractor shall locate all extra work areas (such as staging areas and additional spoil storage areas) at least 10 feet away from wetland boundaries, where topographic conditions permit.

The Contractor shall limit clearing of vegetation between extra work areas and the edge of the wetland to the construction right-of-way and limit the size of extra work areas to the minimum needed to construct the wetland crossing.

6.3 Vehicle Access and Equipment Crossing

The only access roads, other than the construction right-of-way, that the Contractor shall use in wetlands are those existing roads shown on the Construction Drawings.

The Contractor's construction equipment operating in saturated wetlands or wetlands with standing water shall be limited to that needed to clear the construction right-of-way, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction right-of-way to the extent practicable

If equipment must operate within a wetland containing standing water or saturated soils, the Contractor shall use the following methods for equipment access unless otherwise approved by Keystone based on site specific conditions:

- Wide-track or balloon-tire construction equipment.
- Conventional equipment operated from timber and slash (riprap) cleared from the right of way, timber mats, or prefabricated equipment mats

6.4 Temporary Erosion and Sediment Control

The Contractor shall install sediment barriers across the entire construction right-of-way immediately upslope of the wetland boundary at all standard wetland crossings, as necessary, to prevent sediment flow into the wetland. Sediment barriers must be properly maintained by the Contractor throughout construction and reinstalled as necessary. In the travel lane, these may incorporate removable sediment barriers or driveable berms. Removable sediment barriers can be removed during the construction day, but shall be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent The Contractor shall maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. The

Contractor shall not install sediment barriers at wetlands designated as "dry" unless otherwise specified by Keystone.

Where standard wetlands are adjacent to the construction right-of-way, the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to prevent a sediment flow into the wetland.

6.5 Wetland Crossing Procedures

The following general mitigative procedures shall be followed by the Contractor in all wetlands unless otherwise approved or directed by Keystone based on site specific conditions. However, all work shall be conducted in accordance with applicable permits.

- Minimizing the duration of construction-related disturbance within wetlands to the extent practicable.
- Attempting to use no more than two layers of timber riprap to stabilize the construction right-of-way.
- Cutting vegetation off at ground level leaving existing root systems in place and remove it from the wetland for disposal.
- Limiting pulling of tree stumps and grading activities to directly over the trench line. Not grading or removing stumps or root systems from the rest of the construction right-of-way in wetlands unless safety-related construction constraints require removal of tree stumps from under the working side of the construction right-of-way.
- Segregating the top 12 inches of topsoil from the area disturbed by trenching in standard wetlands, where practicable. After backfilling is complete, restoring topsoil to its approximate original stratum.
- Dewatering the trench in such a manner that does not cause erosion and heavily silt-laden water does not flow directly into any wetland or waterbody.
- The Contractor shall avoid sand blasting in wetlands to the extent practicable. If sandblasting is performed within a wetland, the Contractor shall place a tarp or suitable material in such a way as to collect as much waste shot as possible and dispose of the collected waste. The Contractor shall clean up all visible deposits of wastes and dispose of the waste at an approved disposal facility.
- Removing all timber riprap and prefabricated equipment mats upon completion of construction.
- Locating hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.
- Locating hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.
- Not storing hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities in a wetland, or within 100 feet of any wetland boundary.
- Attempting to refuel all construction equipment in an upland area at least 100 feet from a wetland boundary. If construction equipment must be refueled in a wetland or within 100 feet of any wetland boundary, follow the procedures outlined in Section 3.

- Where the pipeline trench may drain a wetland, the Contractor shall construct trench breakers and/or seal the trench to maintain the original wetland hydrology.
- After backfilling is complete, restoring the segregated topsoil to its approximate original location over the trench.

Specific procedures for each type of wetland crossing method are listed below and shall be designated on the Construction Drawings but may be modified depending on site conditions at the time of construction. However, all work shall be conducted in accordance with applicable permits.

6.5.1 "Dry" Wetland Crossing Method

Topsoil shall be segregated. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace.

The "dry" wetland crossing procedure depicted in **Detail 8** shall be used where this type of wetland is identified on the Construction Drawings. The following are exceptions to "standard" wetland crossing methods:

- The width of the construction right-of-way for upland construction is maintained through the wetland.
- Where extra work areas (such as staging areas and additional spoil storage areas) are designated on the Construction Drawings, they may be placed no closer than 10 feet from the wetland's edge.
- Sediment barriers are not required across or along the edges of the construction right-of-way.
- If the wetland is cultivated, the topsoil shall be stripped using the trench and spoil side method at the same depth as the adjacent upland areas
- Seeding requirements for agricultural lands shall be applied to farmed wetlands.

6.5.2 "Standard" Wetland Crossing Method

Topsoil stripping is impracticable due to the saturated nature of the soil. Pipe stringing and fabrication may occur within the wetland adjacent to the trench line or adjacent to the wetland in a designated extra workspace. Based upon the length of a standard wetland crossing and presence of sufficient water to float the pipe, the Contractor may elect to install a standard wetland crossing utilizing the "push/pull" method.

The standard wetland crossing procedure depicted in **Detail 9** shall be used where this type of wetland is identified on the Construction Drawings.

Procedures unique to standard wetlands include:

- Limiting construction right of way width to a maximum of 85 feet unless site conditions warrant a wider width
- Utilizing low ground pressure construction equipment or support equipment on timber rip rap or timber mats
- Installing sediment barriers across the entire right of way where the right of way enters and exits the wetland

6.5.3 Flooded "Push/Pull" Wetland Crossing Method

In these wetlands, standing surface water or high groundwater levels are present. Difficult trenching conditions may exist, and trench widths of up to 35 feet are common. Topsoil stripping is impossible due to the flooded conditions. Pipe stringing and fabrication is required adjacent to the wetland in a designated extra workspace. And the pipe pushed and/or pulled with floatation into place.

The "Push/Pull" Wetland crossing procedure as depicted in **Detail 10** shall be used where water is sufficient to float the pipeline in the trench and other site conditions allow.

Clean metal barrels or styrofoam floats may be used to assist in the flotation of the pipe. Metal banding shall be used to secure the barrels or floats to the pipe. All barrels, floats and banding shall be recovered and removed upon completion of lower-in. Back fill shall not be allowed before recovery of barrels, floats and banding.

6.6 Restoration and Reclamation

All timber riprap, timber mats, and prefabricated equipment mats shall be removed upon completion of construction. The Contractor shall replace topsoil, as applicable, and spread to its original contours in the wetland as possible with no crown over the trench. Any excess spoil shall be removed from the wetland. The Contractor shall stabilize wetland edges and adjacent upland areas by establishing permanent erosion control measures and re-vegetation, as applicable, during final clean up.

For each standard wetland crossed, the Contractor shall install a permanent slope breaker and trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. The Contractor shall locate the trench breaker immediately upslope of the slope breaker.

In the absence of detailed re-vegetation plans or until the appropriate seeding season for permanent wetland vegetation in standard wetlands, the Contractor shall apply a temporarily cover crop on the construction right-of-way at a rate adequate for germination and ground cover using annual ryegrass or oats unless standing water is present. The Contractor shall apply the temporary cover crop during final clean up. For farmed wetlands, apply seeding requirements for agricultural lands or as required by the Landowner.

The Contractor shall not use fertilizer, lime or mulch in wetlands unless required in writing by the appropriate land management or state agency.

6.7 Operations and Maintenance

Vegetation maintenance shall not be conducted over the full width of the permanent right-of-way in wetlands. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 30 feet wide may be maintained in an herbaceous state. In addition, trees within 30 feet of the pipeline greater than 15 feet in height may be selectively cut and removed from the permanent right-of-way.

Herbicides and pesticides shall not be used in or within 100 feet of a wetland except as allowed by the appropriate land management agency or state agency.

The success of wetland re-vegetation shall be monitored after construction until wetland re-vegetation is successful except in circumstances where property is purchased and developed.

Wetland re-vegetation shall be considered successful if the cover of herbaceous and/or woody species is at least 80 percent of the type, density, and distribution of the vegetation in adjacent wetland areas that were not disturbed by construction. If re-vegetation is not successful at the end of 3 years, a remedial re-vegetation plan shall be developed in consultation with a professional wetland ecologist to actively re-vegetate the wetland. Re-vegetation efforts shall continue until wetland re-vegetation is successful.

7.0 WATERBODIES AND RIPARIAN LANDS

7.1 General

The Contractor shall comply with requirements of all permits issued for the waterbody crossings by Federal, State or local agencies.

"Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

- "Minor Waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of construction.
- "Intermediate Waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of construction.
- "Major Waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of construction.

In the event a waterbody crossing is located within or adjacent to a wetland crossing, the Contractor shall implement the provisions of Section 6, Wetland Crossings, to the extent practicable.

The Contractor shall supply and install advisory signs in a readily visible location along the construction right-of-way, a distance of approximately 100 feet on each side of the crossing and on all roads which provide direct construction access to waterbody crossing sites. Signs shall be supplied, installed, maintained and then removed upon completion of the project. Additionally, signs shall be supplied and installed by the Contractor on all intermediate and major waterbodies accessible to recreational boaters warning boaters of pipeline construction operations.

The Contractor shall not store hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating within approximately 100 feet of any waterbody. The Contractor shall not refuel construction equipment within 100 feet of any waterbody. If the Contractor must refuel construction equipment within 100 feet of a waterbody, it must be done in accordance with the requirements outlined in Section 3.

Throughout construction, the Contractor shall maintain adequate flow rates to protect aquatic life and to prevent the interruption of existing downstream uses.

Keystone may allow modification of the following specifications as necessary to accommodate specific situations or procedures. Any modifications must comply with all applicable regulations and permits.

7.2 Easement and Work Space

The permanent easement, temporary work space, additional temporary work space and any special restrictions shall be depicted on the Construction Drawings. The work shall be contained within these areas and be limited in size to the minimum required to construct the waterbody crossing.

The Contractor shall locate all extra work areas (such as staging areas and additional spoil storage areas) at least 10 feet from the water's edge if practicable.

At all waterbody crossings, the Contractor shall install flagging across the construction right-of-way at least 10 feet from the banks prior to clearing and ensure that riparian cover is maintained where practicable during construction.

7.3 Vehicle Access and Equipment Crossings

The Contractor shall inspect equipment for fluid leaks prior to entering or crossing over waterbodies.

Equipment bridges are not required at minor waterbodies unless dry crossing procedures are specified or unless the waterbody supports a state designated fishery.

Equipment crossings shall be constructed as described in **Details 16, 17 and/or 18.**

Equipment crossings shall be perpendicular to drainage bottoms whenever possible.

The Contractor shall be responsible for the installation, maintenance and removal of all temporary access crossings including portable bridges, bridges made from timber or mats, flumes, culverts, sand bags, subsoil, or coarse granular material and riprap.

The Contractor shall ensure that culverts and flumes are sized and installed of sufficient diameter to accommodate the existing flow of water and those that may potentially be created by sudden runoffs. Flumes shall be installed with the inlet and outlet at natural grade if possible.

Where bridges, culverts or flumes are installed across the working area, the Contractor shall be responsible for maintaining them (e.g. preventing collapse, clogging or tilting). All flumes and culverts shall be removed as soon as possible upon completion of construction

The width of the temporary access road across culverts and flumes and the design of the approaches and ramps shall be adequate for the size of vehicle and equipment access required. The ramps shall be of sufficient depth and constructed to prevent collapse of the flumes, and the approaches on both sides of the flume shall be feathered.

Where culverts are installed for access and a waterbody is expected or possibly shall be constructed by the dry flume method, the culvert shall be of sufficient length to convey the stream flow through the construction zone.

The Contractor shall maintain equipment bridges to minimize soil from entering the waterbody.

7.4 Waterbody Crossing Methods

Construction methods pertinent to waterbody crossings are presented below. Selection of the most appropriate method at each crossing shall be depicted on the Construction Drawings but may be amended or changed based on site-specific conditions (i.e., environmental sensitivity of the waterbody, depth and rate of flow, subsurface soil conditions, site specific construction considerations, and the expected time and duration of construction) at the time of crossing. Each waterbody crossing shall be accomplished using one of the following construction methods:

- Non-flowing Open Cut Crossing Method - **(Detail 11)**
- Flowing Open Cut Crossing Method – Minor, Intermediate or Major Waterbody - **(Detail 12)**
- Flowing Open Cut Crossing – Dry Flume Method - **(Detail 13)**
- Flowing Open Cut Crossing – Dry Dam and Pump Method - **(Detail 14)**
- Horizontal Directional Drill Crossing - **(Detail 15)**
- Horizontal Bore Crossing - **(Detail 21)**

7.4.1 Non-flowing Open Cut Crossing Method

The Contractor shall utilize the Non-flowing Open Cut Crossing Method (**Detail 11**) for all waterbody crossings (ditches, gullies, drains, swales, etc.) with no perceptible flow at the time of construction. Should site conditions change and the waterbody is flowing at the time of construction, the Contractor shall install the crossing utilizing the flowing open cut crossing method unless otherwise approved by Keystone.

7.4.2 Flowing Open Cut Crossing Method of Minor, Intermediate and Major Waterbodies

For minor waterbody crossings, except where the flume method is used, the Contractor shall complete construction in the waterbody (not including blasting, if required) as shown on **Detail 12** within 24 hours if practicable.

For intermediate waterbodies, the Contractor shall attempt to complete trenching and backfill work within the waterbody (not including blasting if required) within 48 hours if practicable as shown on **Detail 12.**

The Contractor shall construct each major waterbody crossing in accordance with a Site Specific Plan as shown in the Construction Drawings. The Contractor shall complete in-stream construction activities as expediently as practicable.

7.4.3 Flowing Open Cut Crossing – Dry Flume Method

Where required, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Flume Method as shown on **Detail 13** with the following "dry ditch" techniques:

- flume pipe shall be installed after blasting (if necessary), but before any trenching;
- sand bag or sand bag and plastic sheeting diversion structure or equivalent shall be used to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required in order to achieve an effective seal);
- flume pipe(s) shall be aligned to prevent bank erosion and streambed scour;
- flume pipe shall not be removed during trenching, pipe laying, or backfilling activities, or initial streambed restoration efforts; and
- all flume pipes and dams that are not also part of the equipment bridge shall be removed as soon as final clean up of the stream bed and bank is complete

7.4.4 Flowing Open Cut Crossing – Dry Dam and Pump Method

Where specified in the construction drawings, the Contractor shall utilize the Flowing Open Cut Crossing – Dry Dam and Pump Method as shown on **Detail 14**. The dam and pump crossing method shall meet the following performance criteria:

- sufficient pumps shall be used to maintain 1.5 times the flow present in the stream at the time of construction;
- at least one back up pump must be available on site;
- dams shall be constructed with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
- screen pump intakes shall be installed;
- streambed scour shall be prevented at pump discharge; and dam and pumps shall be monitored to ensure proper operation throughout the waterbody crossing.

7.4.5 Horizontal Directional Drill Crossings

Where required, the horizontal directional drill method **as shown on Detail 15** shall be utilized for designated major and sensitive waterbodies. The Contractor shall construct each directional drill waterbody crossing in accordance with a Site Specific Plan as shown in the Construction Drawings.

Drilling fluids and additives utilized during implementation of a directional drill shall be non-toxic to the aquatic environment.

The Contractor shall develop a contingency plan to address a frac-out during a directional drill. The plan shall include instructions for monitoring during the directional drill and mitigation in the event that there is a release of drilling fluids. Additionally, the waterbody shall be monitored downstream by the Contractor for any signs of drilling fluid.

The Contractor shall dispose of all drill cuttings and drilling mud at a Keystone-approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by Keystone, hauling to an approved licensed landfill, or other site approved by Keystone.

7.4.6 Horizontal Bore Crossings

Where required, the horizontal bore method **as shown on Detail 21** shall be utilized for crossing waterbodies. The Contractor shall construct each horizontal bore waterbody crossing in accordance with a Site Specific Plan as shown in the Construction Drawings.

7.5 Clearing

Except where rock is encountered and at non flowing open cut crossings, all necessary equipment and materials for pipe installation must be on-site and assembled prior to commencing trenching in a waterbody. All staging areas for materials and equipment shall be located at least 10 feet from the waterbody edge. The Contractor shall preserve as much vegetation as possible along the waterbody banks while allowing for safe equipment operation.

Clearing and grubbing for temporary vehicle access and equipment crossings shall be carefully controlled to minimize sediment entering the waterbody from the construction right-of-way.

Clearing and grading shall be performed on both sides of the waterbody prior to initiating any trenching work. All trees shall be felled away from watercourses.

Plant debris or soil inadvertently deposited within the high water mark of waterbodies shall be promptly removed in a manner that minimizes disturbance of the waterbody bed and bank. Excess floatable debris shall be removed above the high water mark from areas immediately above crossings.

Vegetation adjacent to waterbodies which are to be installed by horizontal directional drill or boring methods shall not be disturbed except by hand clearing as necessary for drilling operations.

7.6 Grading

The construction right-of-way adjacent to the waterbody shall be graded so that soil is pushed away from the waterbody rather than towards it when possible.

In order to minimize disturbance to woody riparian vegetation within extra workspaces adjacent to the construction right-of-way at waterbody crossings, the Contractor shall minimize grading and grubbing of waterbody banks. Grubbing shall be limited to the ditchline plus an appropriate width to accommodate the safe installation of vehicle access and the crossing to the extent practicable.

7.7 Temporary Erosion and Sediment Control

The Contractor shall install sediment barriers across the entire construction right-of-way at all flowing waterbody crossings.

The Contractor shall install sediment barriers immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete.

Where waterbodies are adjacent to the construction right-of-way, the Contractor shall install sediment barriers along the edge of the construction right-of-way as necessary to contain spoil and sediment within the construction right-of-way.

7.8 Trenching

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

All equipment and materials shall be on site before trenching in the active channel of all minor waterbodies containing state designated fisheries, and in intermediate and major waterbodies. All activities shall proceed in an orderly manner without delays until the trench is backfilled and the stream banks stabilized. The Contractor shall not begin in-stream activity until the in-stream pipe section is complete and ready to be installed in the waterbody.

The Contractor shall use trench plugs at the end of the excavated trench to prevent the diversion of water into upland portions of the pipeline trench and to keep any accumulated upland trench water out of the waterbody. Trench plugs must be of sufficient size to withstand upslope water pressure.

The Contractor shall conduct as many in-stream activities as possible from the banks of the waterbodies. The Contractor shall limit the use of equipment operating in waterbodies to that needed to construct each crossing.

The Contractor shall place all spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings in the construction right-of-way at least 10 feet from the water's edge or in additional extra work areas. No trench spoil, including spoil from the portion of the trench across the stream channel, shall be stored within a waterbody unless the crossing cannot be reasonably completed without doing so.

The Contractor shall install and maintain sediment barriers around spoil piles to prevent the flow of spoil into the waterbody.

Spoil removed during ditching shall be used to backfill the trench usually with a backhoe, clamshell or a dragline working from the waterbody bank. Sand, gravel, rockshield, or fill padding shall be placed around the pipe where rock is present in the channel bottom.

7.9 Pipe Installation

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

A "free stress" pipe profile shall be used at all minor, intermediate, and major waterbodies with gradually sloping stream banks. The "box bend" pipe profile shall be used for intermittent and major waterbodies with steep stream banks.

The trench shall be closely inspected to confirm that the specified cover and that adequate bottom support can be achieved, and shall require Keystone approval prior to the pipe being installed. Such inspections shall be performed by visual inspection and/or measurement by a Keystone Representative. In rock trench, the ditch shall be adequately padded with clean granular material to provide continuous support for the pipe.

The pipe shall be pulled into position or lowered into the trench and shall, where necessary, be held down by weights, as-built recorded and backfilled immediately to prevent the pipe from floating.

The Contractor shall provide sufficient approved lifting equipment to perform the pipe installation in a safe and efficient manner. As the coated pipe is lowered in, it shall be prevented from swinging or rubbing against the sides of the trench. Only properly manufactured slings, belts and cradles suitable for handling coated pipe shall be used. All pipes shall be inspected for coating flaws and/or damage as it is being lowered into the trench. Any damage to the pipe and/or coating shall be repaired.

7.10 Backfilling

The following requirements apply to all waterbody crossings except those being installed by the non-flowing open cut crossing method.

Trench spoil excavated from waterbodies shall be used to backfill the trench across waterbodies.

After lowering-in has been completed, but before backfilling, the line shall be re-inspected to ensure that no skids, brush, stumps, trees, boulders or other debris is in the trench. If discovered, such materials or debris shall be removed from the trench prior to backfilling.

For each major waterbody crossed, the Contractor shall install a trench breaker at the base of slopes near the waterbody unless otherwise directed by Keystone based on site specific conditions. The base of slopes at intermittent waterbodies shall be assessed on-site and trench breakers installed only where necessary.

Slurred muck or debris shall not be used for backfill. At locations where the excavated native material is not acceptable for backfill or must be supplemented, the Contractor shall provide granular material approved by Keystone.

If specified in the Construction Drawings, the top of the backfill in the stream shall be armored with rock riprap or bio-stabilization materials as appropriate.

7.11 Stabilization and Restoration of Stream Banks and Slopes

The stream bank contour shall be re-established. All debris shall be removed from the streambed and banks. Stream banks shall be stabilized and temporary sediment barriers shall be installed within 24 hours of completing the crossing if practicable.

Approach slopes shall be graded to an acceptable slope for the particular soil type and surface run off controlled by installation of permanent slope breakers. Where considered necessary, the integrity of the slope breakers shall be ensured by lining with erosion control blankets.

Immediately following reconstruction of the stream banks, the Contractor shall install seed and flexible channel liners on waterbody banks as shown in **Detail 19**.

If the original stream bank is excessively steep and unstable and/or flow conditions are severe or if specified on the Construction Drawings, the banks shall be stabilized with rock riprap, gabions, stabilizing cribs, or bio-stabilization measures to protect backfill prior to reestablishing vegetation.

Stream bank riprap structures shall consist of a layer of stone, underlain with approved filter fabric or a gravel filter blanket in accordance with **Detail 20.** Riprap shall extend from the stabilized streambed to the top of the stream bank, where practicable, native rock shall be utilized.

Bio-stabilization techniques which may be considered for specific crossings are shown in **Details 22, 23, and 24.**

The Contractor shall remove equipment bridges as soon as possible after final clean up.

8.0 HYDROSTATIC TESTING

8.1 Testing Equipment Location

The Contractor shall provide for the safety of all pipeline construction personnel and the general public during hydrostatic test operations by placing warning signs in populated areas.

The Contractor shall locate hydrostatic test manifolds 100 feet outside wetlands and riparian areas to the maximum extent practicable.

8.2 Test Water Source and Discharge Locations

Keystone is responsible for acquiring all permits required by federal, state and local agencies for procurement of water and for the discharge of water used in the hydrostatic testing operation. Keystone shall provide the Contractor with a copy of the appropriate withdrawal/discharge permit for hydrostatic test water. The Contractor shall keep the water withdrawal/discharge permit on site at all times during testing operations.

Any water obtained or discharged shall be in compliance with permit notice requirements and with sufficient notice for Keystone's Testing Inspector to make water sample arrangements prior to obtaining or discharging water. In some instances sufficient quantities of water may not be available from the permitted water sources at the time of testing. Withdrawal rates may be limited as stated by the permit. Under no circumstances shall an alternate water source be used without prior authorization from Keystone.

The Contractor shall be responsible for obtaining any required water analyses from each source to be used in sufficient time to have a lab analysis performed prior to any filling operations. The sample bottle shall be sterilized prior to filling with the water sample. The analysis shall determine the pH value and total suspended solids. Each bottle shall be marked with:

- Source of water with pipeline station number
- Date taken
- Laboratory order number

- Name of person taking sample

Staging/work areas for filling the pipeline with water shall be located a minimum of 50 feet from the waterbody or a wetland boundary if topographic conditions permit. The Contractor shall install temporary sediment filter devices adjacent to all streams that runoff may enter.

The Contractor shall screen the intake hose to prevent the entrainment of fish or debris. The hose shall be kept off the bottom of the waterbody. Refueling of construction equipment shall be conducted a minimum distance of 100 feet from the stream or a wetland. Pumps used for hydrostatic testing within 100 feet of any waterbody or wetland shall be operated and refueled in accordance with Section 3.

The Contractor shall maintain adequate flow rates in the waterbody to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

The Contractor shall not use chemicals in the test water. The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film or sheen on the surface of the receiving water.

Potential hydrostatic water sources for the mainline and the Cushing Extension are as follows:

Table 1 – Mainline Drainage Basins and Water Sources

Drainage Basins & Water Sources	Approximate Location Where Pipeline Crosses Water Source (Mile Post)
Pembina River	7
Tongue River	17
Carter Creek	24
Branch Forest River	46
Sheyenne River	167
Logen Dam	290
Nat'l Wildlife Prod. Area	351
Rock Creek	358
Lutz Lake	363
Wolf Creek	387
James River	417
Missouri River	431
Elk Horn River	498
Shell Creek	527
Platte River	537
Big Blue River	568
West Fork Big Blue River	587
Big Blue River	652
Missouri River	743
Grand River	834
Mussel Fork River	850
Mussel Fork River	856
Silver Creek (East Fork)	865
South Fork Salt River	912
Culver River	972
Pardenne Creek Runs Into Miss. River	988
Mississippi River	1014
Cahokie Creek	1020
Shoal Creek	1048

Table 2 – Cushing Extension Drainage Basins and Water Sources

Drainage Basins & Water Sources	Approximate Location Where Pipeline Crosses Water Source (Mile Post)
Little Blue River	4.2
Republican River	52.1
Smokey Hill River	76.2
Cottonwood River	117.0
Whitewater River	158.0
Stewart Creek (0.3 mile upstream of Walnut River)	185.1
Arkansas River	206.1
Salt Fork Arkansas River	238.5
Cimarron River	284.4

Selected road, railroad, and river crossing pipe sections may be specified to be pre-tested for a minimum of 4 hours. The water for pre-testing of any road and railroad crossings shall be hauled by a tanker truck from an approved water source. Water for pre-testing of a river crossing may be hauled or taken from the respective river if it is an approved water source. Since the volume of water utilized in these pretests shall be relatively small, the water shall be discharged overland along the construction right-of-way and allowed to soak into the ground utilizing erosion and sediment control mitigative measures.

Selection of final test water sources will be determined based on site conditions at the time of construction and applicable permits.

8.3 Filling the Pipeline

After final positioning of the pipe, the Contractor shall fill the pipe with water. Pipe ends shall not be restrained during the fill. The fill pump shall be set on a metal catch pan of sufficient dimensions to contain all leaking lubricants or fuel and prevent them from entering the water source. The suction inlet must be placed in a screened enclosure located at a depth that shall not allow air to be drawn in with the water. The screened enclosure shall be such that the fill water is free of organic or particulate matter.

The Contractor shall provide a filter of the backflushing or cartridge type with a means of cleaning without disconnecting the piping. The filter shall have the specifications of 100 mesh screen. If the cartridge type is used, a sufficient quantity of cartridges shall be on hand at the filter location. The Contractor shall install the filter between the fill pump and the test header. The Contractor shall be responsible for keeping the backflush valve on the filter closed during the filling operation. The Contractor shall be responsible for the proper disposal of materials backflushed from the filter or filter cartridges. The Contractor shall not be allowed to backflush the filter into the stream or other water source.

During water-filling of the pipeline, the Contractor shall employ the use of fill pumps capable of injecting water into the pipeline at a maximum rate of approximately 0.7 to 1.0 mile per hour, except as limited by permits or the maintenance of adequate flow rates in the waterbody, as indicated approximately as follows:

Nominal OD	Max. GPM
30"	3000

The Contractor shall restrict flow rates if necessary to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

8.4 Dewatering the Pipeline

The Contractor shall comply with state-issued NPDES permits for discharging test water.

The Contractor shall not discharge any water containing oil or other substances that are in sufficient amounts as to create a visible color film on the surface of the receiving water.

The Contractor shall not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate Federal, State, and local permitting agencies grant written permission.

The Contractor shall calculate, record and provide to Keystone the day, date, time, location, total volume, maximum rate and methods of all water discharged to the ground or to surface water in association with hydrostatic testing.

The Contractor shall regulate the pig velocity discharge rate (3000 gpm maximum), use energy dissipation device(s), and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive stream flow. Water must be disposed of using good engineering judgment so that all federal, state, and local environmental standards are met. Dewatering lines shall be sufficient strength and be securely supported and tied down at the discharge end to prevent whipping during this operation.

To reduce the velocity of the discharge, The Contractor shall utilize an energy-dissipating device described as follows:

8.4.1 Splash Pup

A splash pup consists of a piece of large diameter pipe (usually over 20" O.D.) of variable length with both ends partially blocked that is welded perpendicularly to the discharge pipe. As the discharge hits against the inside wall of the pup, the velocity is rapidly reduced and the water is allowed to flow out either end. A variation of the splash pup concept, commonly called a diffuser, incorporates the same design, but with capped ends and numerous holes punched in the pup to diffuse the energy.

8.4.2 Splash Plate

The splash plate is a quarter section of 36-inch pipe welded to a flat plate and attached to the end of a 6-inch discharge pipe. The velocity is reduced by directing the discharge stream into the air as it exits the pipe. This device is also effective for most overland type discharge.

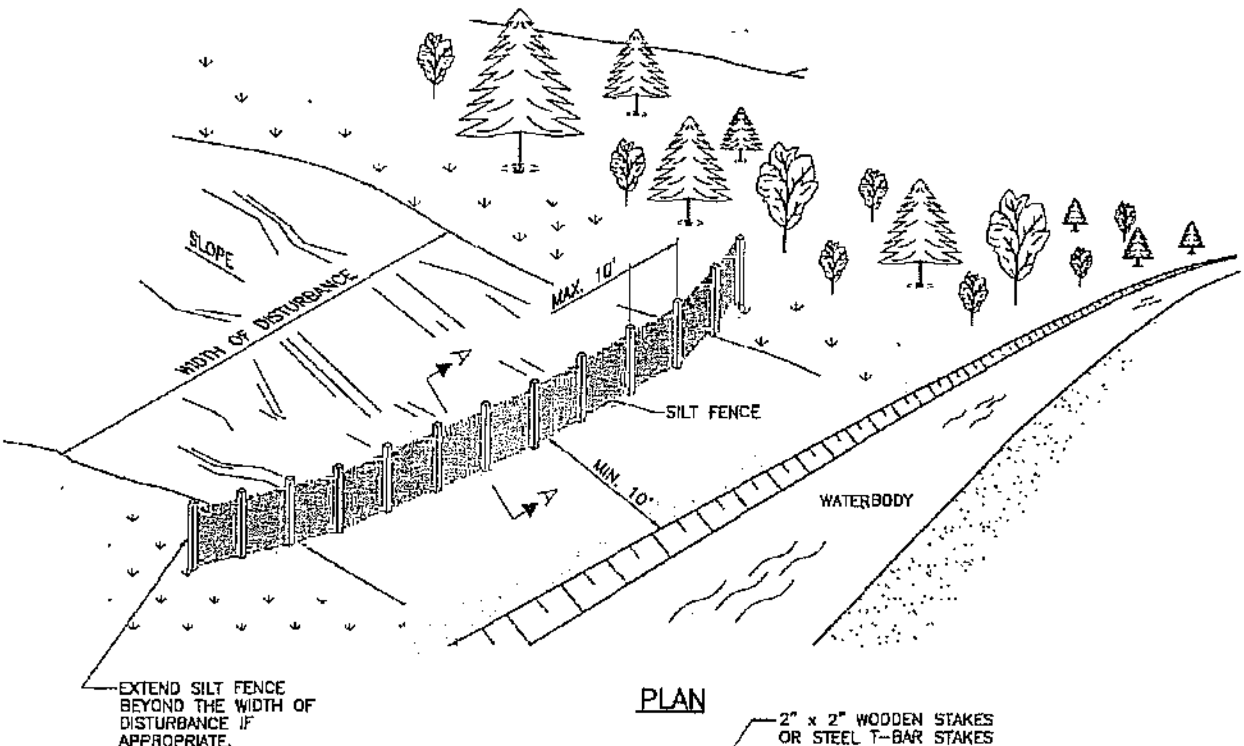
8.4.3 Plastic Liner

In areas where highly erodible soils exist or in any low flow drainage channel, it is a common practice to use layers of visqueen (or any of the new construction fabrics currently available) to line the receiving channel for a short distance. One anchoring method may consist of a small load of rocks to keep the fabric in place during the discharge.

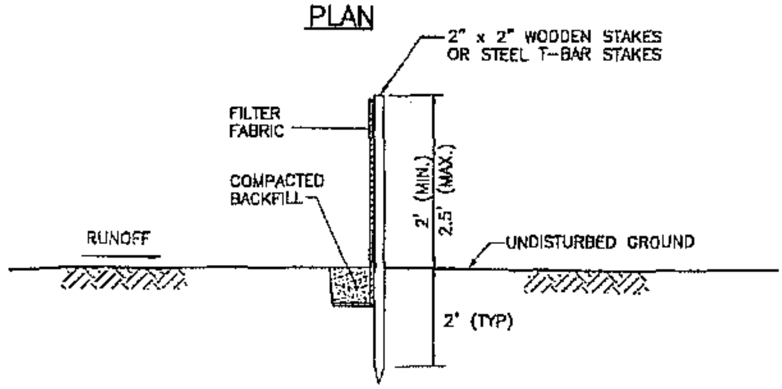
8.4.4 Straw Bale Dewatering Structure

Straw bale dewatering structures are designed to dissipate and remove sediment from the water being discharged. Straw bale structures are used for on-land discharge of wash water and hydrostatic test water and in combination with other energy dissipating devices for high volume discharges. A straw bale dewatering structure is shown in Detail 6.

9.0 DRAWINGS AND FIGURES



PLAN



SECTION A-A

NOTES:

1. MATERIAL SHOULD BE WOVEN GEOTEXTILE FABRIC SUCH AS EXXON GTF 180 OR MIRAFI 600X, OR AN APPROVED EQUIVALENT. SECONDARY REINFORCEMENT, SUCH AS A CONSTRUCTION BARRIER FENCE OR WIRE MESH CAN ALSO BE USED BEHIND THE FILTER FABRIC.
2. SILT FENCE TO BE REINFORCED WITH 2" x 2" WOODEN STAKES OR STEEL T-BAR STAKES PLACED EVERY 8' OR CLOSER AS CONDITIONS REQUIRE.
3. ATTACH FILTER FABRIC AT EACH POST AT A MINIMUM OF 3 LOCATIONS.
4. THE FILTER FABRIC MINIMUM LENGTH OF 1' IS TO BE ANCHORED IN A TRENCH WITH WELL COMPACTED BACKFILL OVER THE FABRIC TO PREVENT UNDERMINING.
5. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE SILT FENCE SHALL BE TURNED AND EXTENDED UPSLOPE.
6. SILT FENCES ARE TO BE CHECKED AND MAINTAINED ON A REGULAR BASIS. REMOVE ANY BUILD-UP OF SEDIMENT.
7. WHERE ANCHORING CONDITIONS FOR THE SILT FENCE ARE POOR, PLACE STRAW BALES ON DOWNSTREAM SIDE OF THE SILT FENCE.
8. INSTALLATION TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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TYPICAL SILT FENCE BARRIER

NO.	REVISION	DATE
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PROJECT: 50386E

DETAIL 1

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K-00-P-7000-300	ALS	JTG	RG

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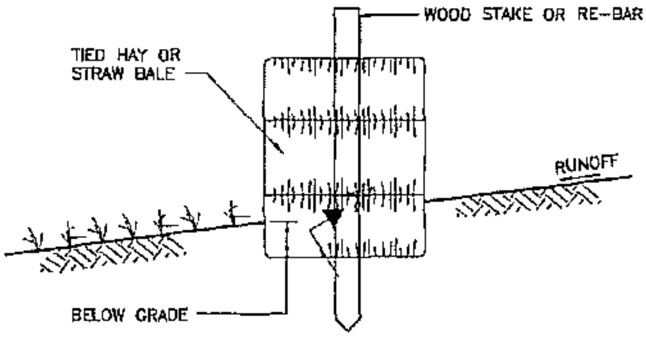
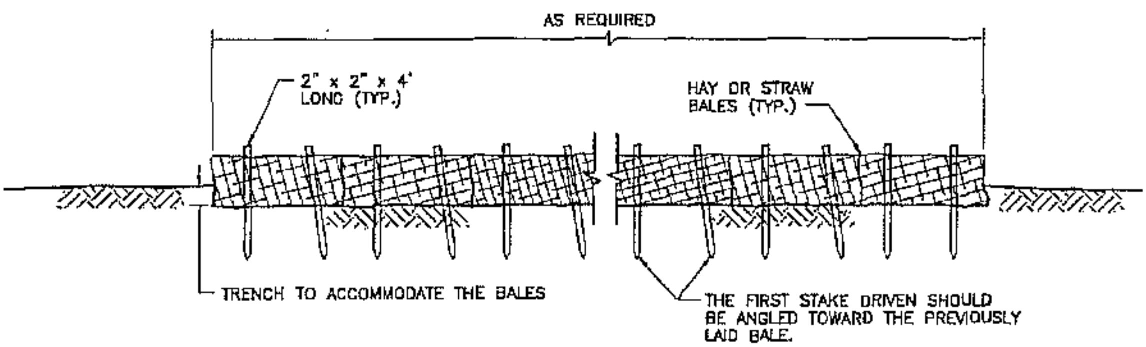


SECTION



SECTION

NOTES:

1. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF THE STRAW BALE BARRIER SHOULD BE TURNED AND EXTENDED UPSLOPE.
2. EACH BALE SHOULD BE SECURED BY AT LEAST 2 STAKES. THE FIRST STAKE IN EACH BALE SHALL BE DRIVEN TOWARD THE PREVIOUSLY LAID BALE TO FORCE THE BALES TOGETHER. ANY GAPS CAN BE FILLED IN BY WEDGING LOOSE STRAW BETWEEN THE BALES. STAKES SHOULD BE DRIVEN. REBAR OR STANDARD "T" OR "U" STEEL POSTS CAN BE USED AS STAKES, BUT IT SHOULD BE NOTED THAT THEY MAY POSE A HAZARD TO EQUIPMENT IF THE BALES DISINTEGRATE.
3. COMPACT THE EXCAVATED SOIL AGAINST THE UPHILL SIDE OF THE BARRIER TO PREVENT PIPING.
4. STRAW OR HAY BALE BARRIERS REQUIRE CONTINUAL MAINTENANCE TO REMOVE COLLECTED SEDIMENT AND REPLACE DAMAGED BALES. PAY CLOSE ATTENTION TO THE REPAIR OF DAMAGED BALES, END RUNS AND UNDERCUTTING BENEATH BALES.
5. TO ELIMINATE POSSIBLE END FLOW, BOTH ENDS OF STRAW OR HAY BALE RUNS SHOULD BE TURNED AND EXTENDED UPSLOPE
6. INSTALLATION TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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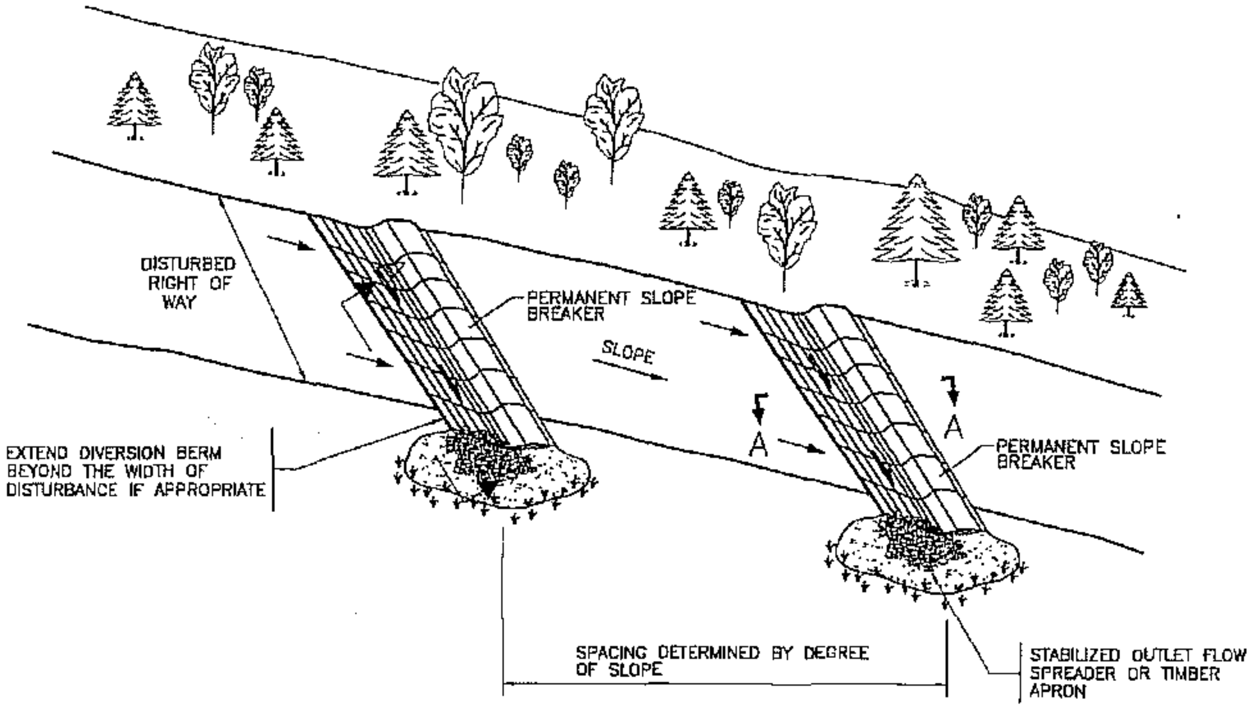
TYPICAL STRAW OR HAY BALE BARRIER

PROJECT: 50368E

DETAIL 2

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-300	ALS	JTG	RG

LAST PLOT DATE: Tue, 04 Apr 2006 – 3:55pm



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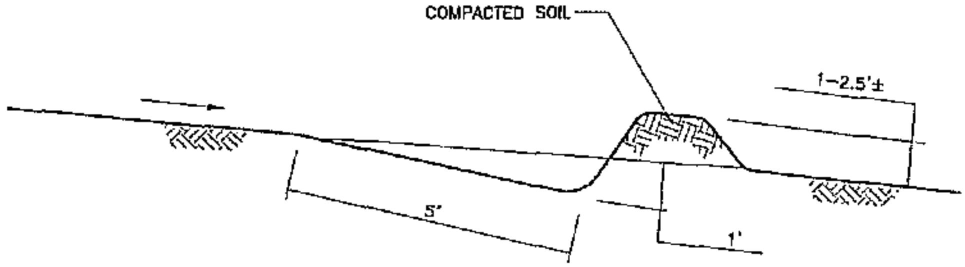

SECTION A–A

PERMANENT SLOPE BREAKER DETAIL

NOTES:

1. PERMANENT SLOPE BREAKERS TO PROVIDE POSITIVE DRAINAGE TO A STABILIZED OUTLET.
2. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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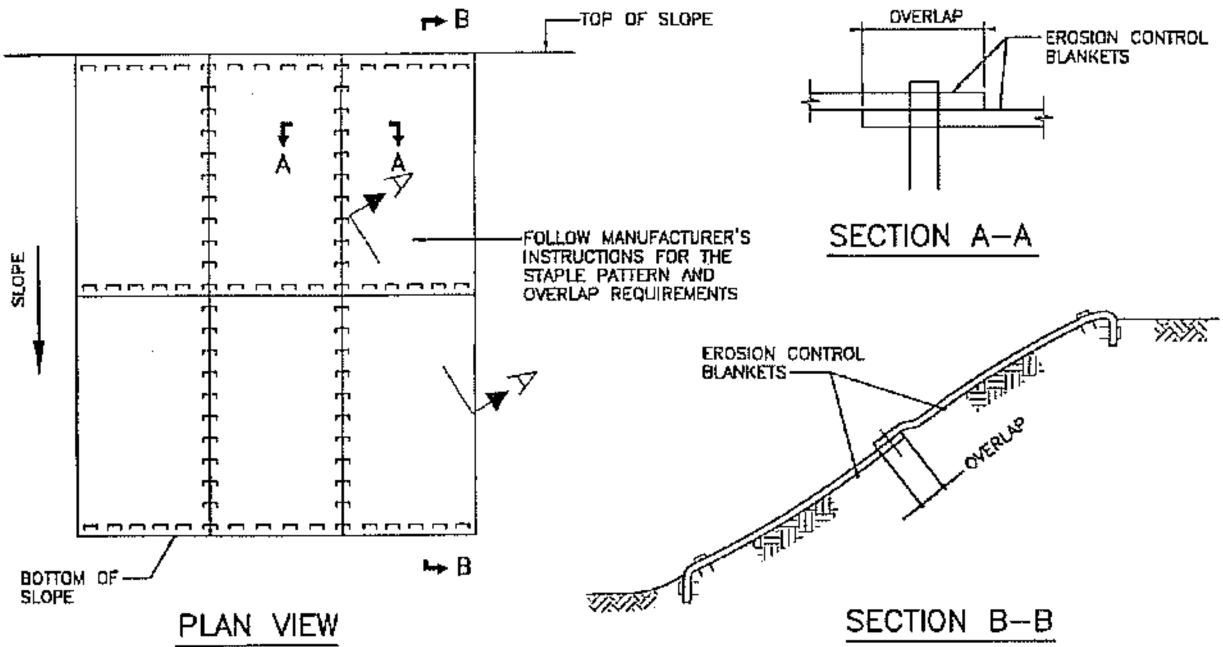
PERMANENT SLOPE BREAKERS (WATER BARS)

PROJECT: [illegible]

DETAIL 3

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-300	ALS	JTG	RG

LAST PLOT DATE: [illegible]



NOTES:

1. INSTALL MATTING IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SOIL BEFORE INSTALLING MATTING, INCLUDING GRADING, REMOVAL OF LARGE ROCKS AND DEBRIS, AND THE APPLICATION OF SEED AND FERTILIZER IF NOT USING PRE-SEEDED MATTING.
3. EROSION CONTROL MATTING SHALL EXTEND COMPLETELY ACROSS DISTURBED AREAS TO PROTECT ERODIBLE SURFACES.
4. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE MATTING IN A TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
5. ROLL THE MATTING DOWN THE SLOPE IN THE DIRECTION OF THE WATER FLOW.
6. AS AN ALTERNATIVE TO STAPLES, WOODEN STAKES CAN BE USED.
7. ENSURE COMPLETE CONTACT BETWEEN THE MATTING AND THE SLOPE FACE. ADDITIONAL STAPLES CAN BE USE TO ELIMINATE GAPS.
8. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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EROSION CONTROL MATTING INSTALLATION

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DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY	PROJECT	
K-00-P-7000-300	ALS	JTG	RG	503816	DETAIL 4

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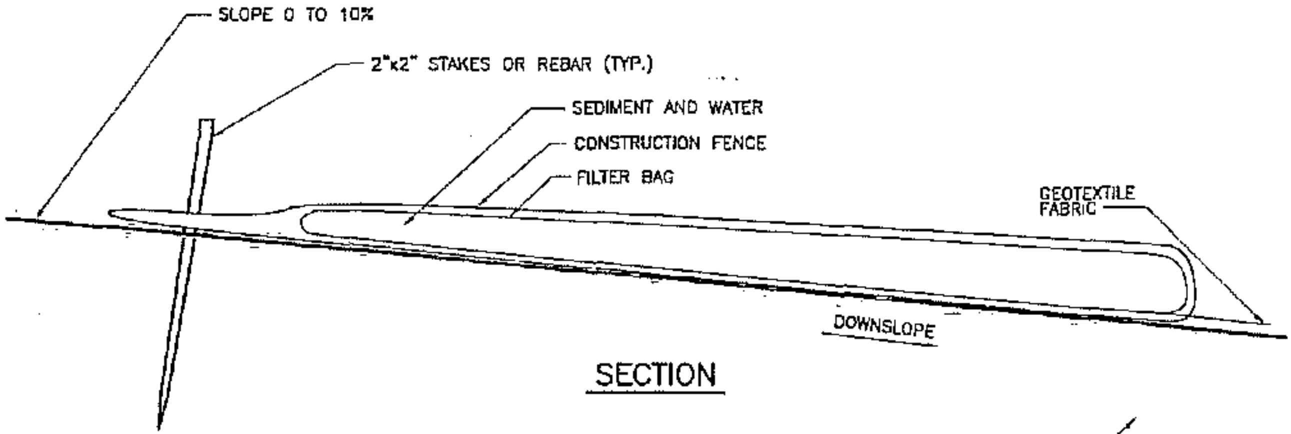

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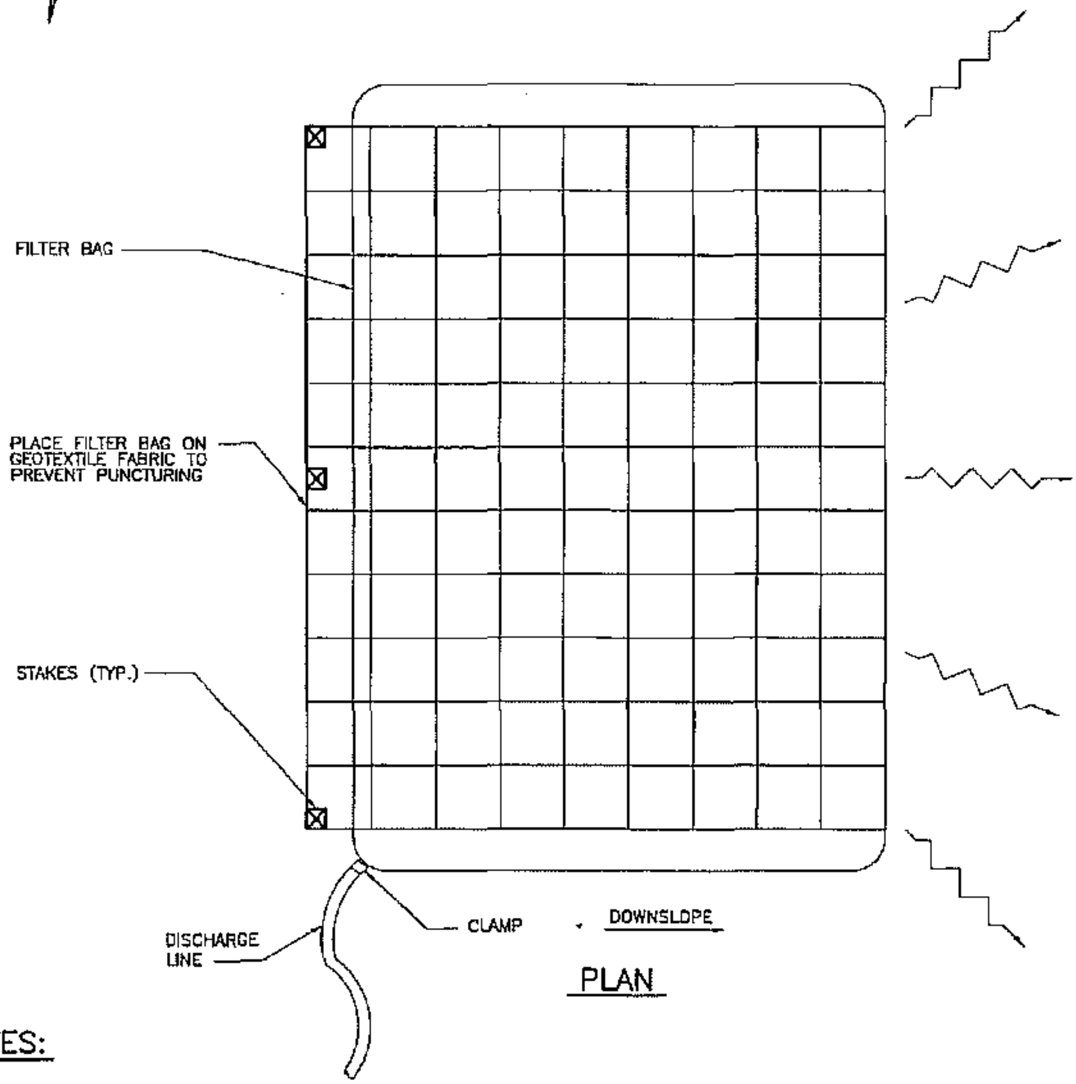

PLAN

NOTES:

1. MANUFACTURED FILTER BAGS ARE A SUITABLE ALTERNATIVE TO STRAW BALE STRUCTURES FOR TRENCH DEWATERING. FILTER BAGS SHALL BE INSTALLED AS SPECIFIED BY THE MANUFACTURER.
2. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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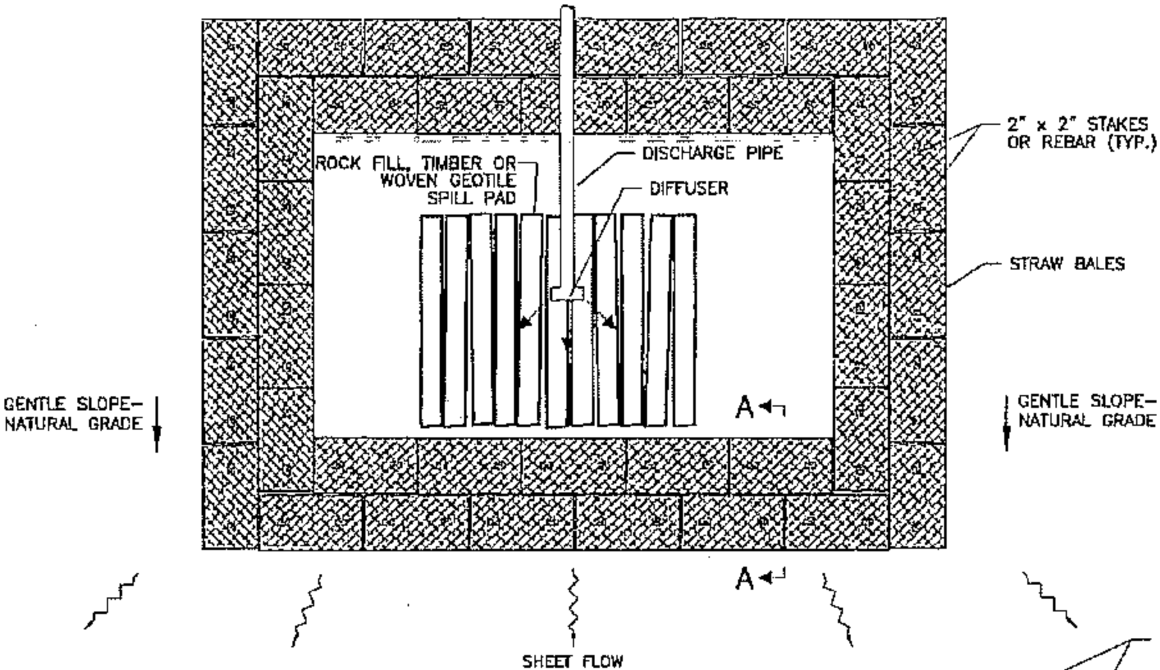
TYPICAL DEWATERING FILTER BAG

PROJECT: 503808

DETAIL 5

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-100	ALS	JTG	RG

LAST PLOT DATE: [illegible]



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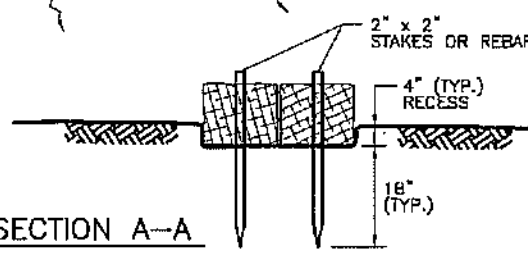

SECTION A–A

NOTES:

1. INSTALL A STRAW BALE DEWATERING STRUCTURE WHEREVER IT IS NECESSARY AND AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR TO PREVENT THE FLOW OF HEAVILY SILT LADEN WATER INTO WATERBODIES OR WETLANDS.

2. DISCHARGE SITE SHOULD BE WELL VEGETATED AND LOCATED AT LEAST 50 FEET FROM ANY WATERBODY. THE TOPOGRAPHY OF THE SITE SHOULD BE SUCH THAT WATER WILL FLOW INTO THE DEWATERING STRUCTURE AND AWAY FROM ANY WORK AREAS. THE AREA DOWNSLOPE FROM THE DEWATERING SITE MUST BE REASONABLY FLAT OR STABILIZED BY VEGETATION OR OTHER MEANS TO ALLOW THE FILTERED WATER TO CONTINUE AS SHEET FLOW.

3. DIRECT THE PUMPED WATER ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL, WEIGHTED TIMBERS, OR A WOVEN GEOTEXTILE STAKED TO THE GROUND SURFACE, SUCH AS MIRAFI 600X, TERRAFIX 400W, OR A COMPANY APPROVED EQUIVALENT. BEYOND THE SPILL PAD FORCE THE DISCHARGE WATER INTO SHEET FLOW USING STRAW BALES AND THE NATURAL TOPOGRAPHY.

4. DISCHARGE RATES SHOULD BE SUCH THAT THE CAPACITY OF THE STRUCTURE WILL NOT BE EXCEEDED.

5. DISCHARGE WATER SHALL BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD USING A COMBINATION OF STRAW BALES AND THE NATURAL TOPOGRAPHY. RECESS STRAW BALES. DRIVE TWO (2) STAKES OR REBAR INTO EACH BALE TO ANCHOR THEM IN PLACE.

6. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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TYPICAL STRAW BALE DEWATERING STRUCTURE

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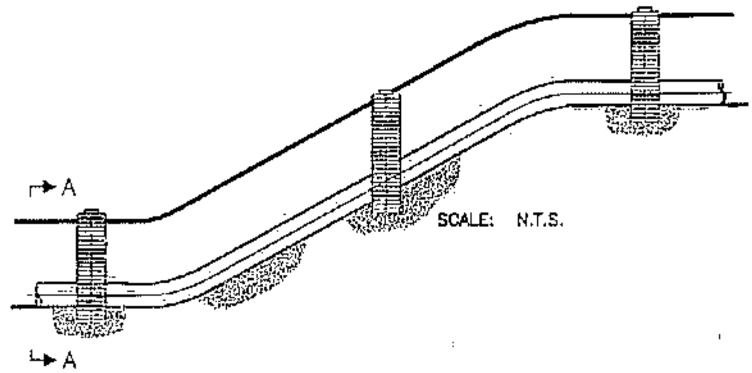
K-00-P-7000-300	ALS	JTG	RG	DETAIL 6



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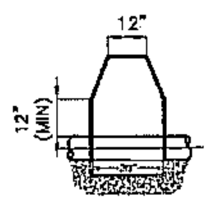

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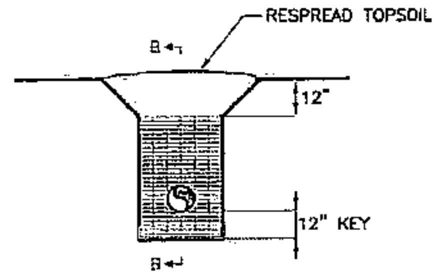

SECTION 'A—A'
SCALE: N.T.S.

NOTES:

1. TRENCH BREAKERS TO BE INSTALLED AS SHOWN ON THE CONSTRUCTION DRAWINGS, WHERE DESCRIBED IN THE PLAN, AND AS DIRECTED BY KEYSTONE.

2. OPEN WEAVE HEMP OR JUTE SACKS SHALL BE FILLED WITH AN AVERAGE 55 LBS. MIXTURE OF:
   1) ONE (1) PART CEMENT AND SIX (6) PARTS SAND OR SUBSOIL, OR
   2) ONE (1) PART CEMENT, THREE (3) PARTS FLYASH, AND FIVE (5) PARTS SAND OR SUBSOIL
   3) SAND

   WITH JUST SUFFICIENT WATER TO PERMIT MIXTURE TO EXUDE AND BOND SACKS TOGETHER. TOPSOIL IS NOT TO BE USED IN SACKS.

3. KEY EACH TRENCH BREAKER A MINIMUM OF ONE (1) FT. INTO BOTTOMS AND SIDES OF TRENCH.

4. FOAM TRENCH BREAKERS MAY BE USED IN LIEU OF SAND SACK TRENCH BREAKERS.

5. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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TYPICAL PERMANENT TRENCH BREAKERS

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1	GENERAL EDITORIAL REVISION	[illegible]
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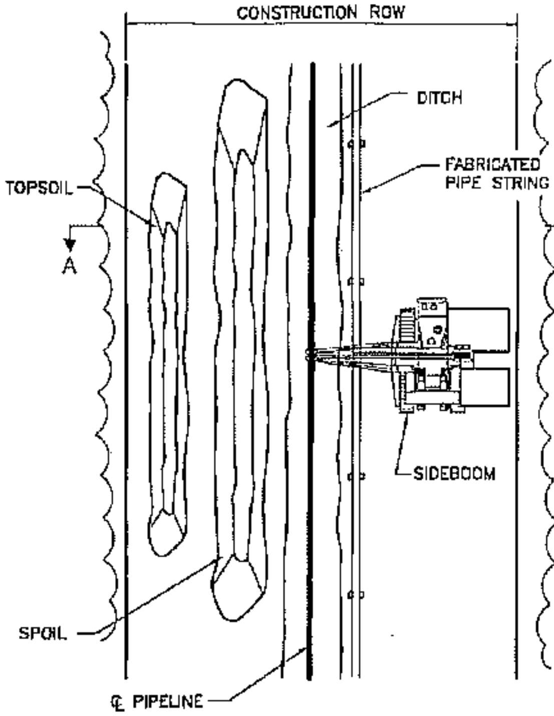
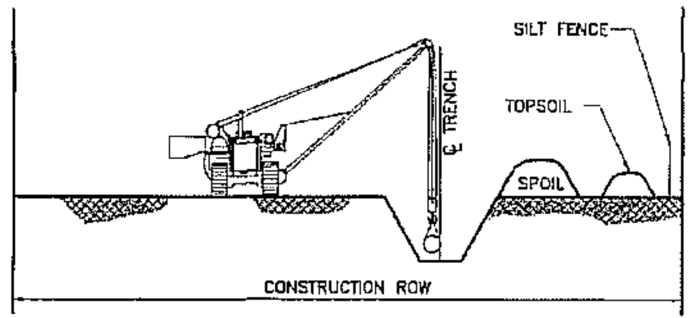
PROJECT: [illegible]

DETAIL 7

LAST PLOT DATE: [illegible]



PLAN VIEW



SECTION "A–A"

CONSTRUCTION PROCEDURES:

1. IF A WETLAND IS BEING CULTIVATED AND BEING FARMED, NO WETLAND CONSTRUCTION PROCEDURES ARE REQUIRED.
2. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
3. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS APPROXIMATELY 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER KEYSTONE'S SPILL PREVENTION PROCEDURES.
4. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY KEYSTONE.
5. CONSTRUCT WHEN DRY, IF POSSIBLE. IF SITE BECOMES WET AT TIME OF TRENCHING, AVOID SOIL COMPACTION BY UTILIZING TIMBER RIP-RAP OR PREFABRICATED EQUIPMENT MATS.
6. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT DOWN SLOPE EDGE OF RIGHT-OF-WAY ALONG WETLAND EDGE IF EVIDENT, OTHERWISE INSTALL BARRIER ON BOTH EDGES.
7. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND REMOVE STUMPS FROM WETLAND FOR DISPOSAL.
8. CONDUCT TRENCH LINE TOPSOIL STRIPPING (IF TOPSOIL IS NOT SATURATED). SALVAGE TOPSOIL TO ACTUAL DEPTH OR A MAXIMUM DEPTH OF 12 INCHES.
9. TRENCH THROUGH WETLANDS.
10. PIPE SECTION TO BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
11. LOWER-IN PIPE. PRIOR TO BACKFILLING TRENCH, IF REQUIRED, TRENCH PLUGS SHALL BE INSTALLED AS REQUIRED. BACKFILL TRENCH.
12. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.
13. IF UTILIZED, REMOVE TIMBER MATS OR PREFABRICATED MATS FROM WETLANDS UPON COMPLETION.

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"DRY" WETLAND CROSSING METHOD

DETAIL 8

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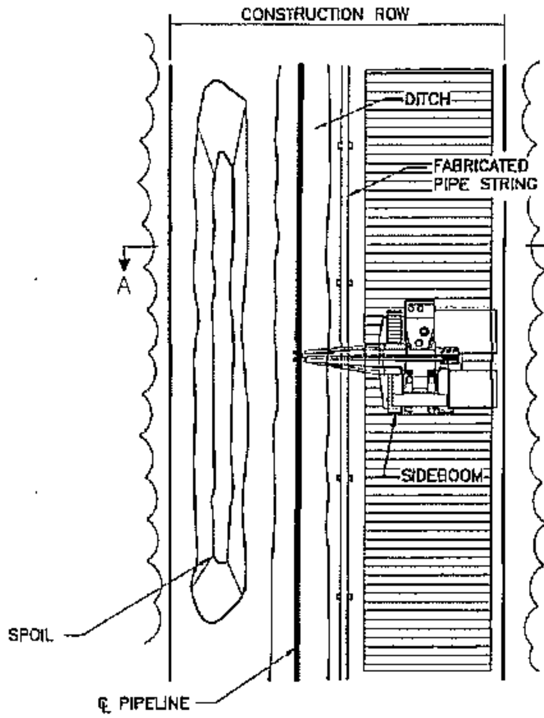
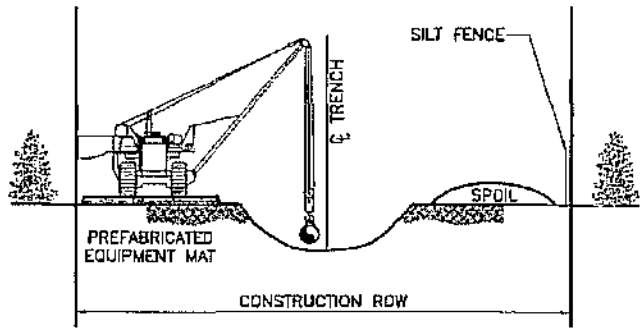


PLAN VIEW



SECTION "A–A"

CONSTRUCTION PROCEDURES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS APPROXIMATLY 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER KEYSTONE'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY KEYSTONE.
4. INSTALL TIMBER MATS/RIP–RAP THROUGH ENTIRE WETLAND AREA. EQUIPMENT NECESSARY FOR RIGHT–OF–WAY CLEARING MAY MAKE ONE (1) PASS THROUGH THE WETLAND BEFORE MATS ARE INSTALLED.
5. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT DOWN SLOPE EDGE OF RIGHT–OF–WAY AND ALONG WETLAND EDGE AS REQUIRED.
6. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND DITCH SPOIL AREAS AND REMOVE FROM WETLAND FOR DISPOSAL.
7. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
8. LEAVE HARD PLUGS AT THE EDGE OF WETLAND UNTIL JUST PRIOR TO TRENCHING.
9. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
10. TRENCH THROUGH WETLANDS.
11. LOWER–IN PIPE, INSTALL TRENCH PLUGS AT WETLAND EDGES AS REQUIRED AND BACKFILL IMMEDIATELY.
12. REMOVE TIMBER MATS OR PREFABRICATED MATS FROM WETLANDS UPON COMPLETION.
13. RESTORE GRADE TO NEAR PRE–CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.

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STANDARD WETLAND CROSSING METHOD

PROJECT: [illegible]

DETAIL 9

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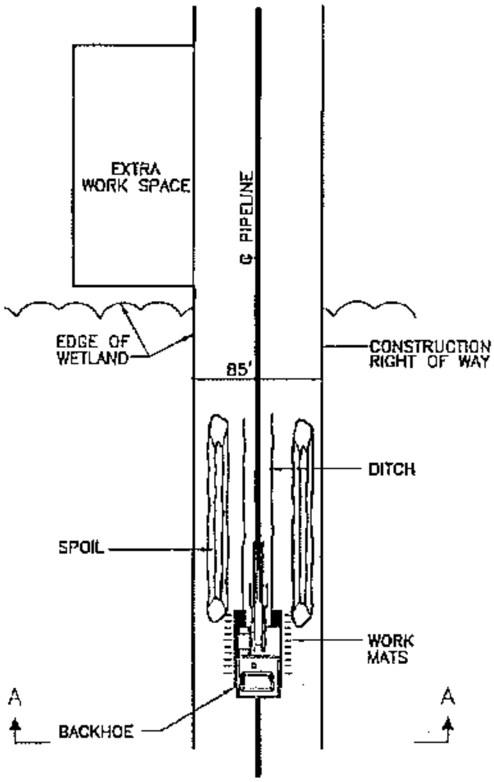
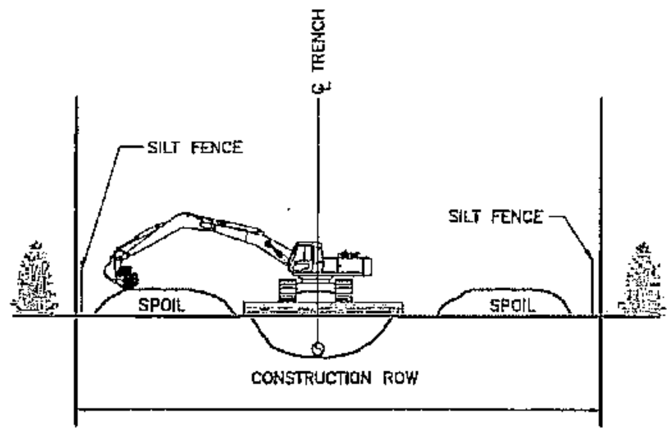


PLAN VIEW



SECTION "A–A"

CONSTRUCTION PROCEDURES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN APPROXIMATELY 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER KEYSTONE'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY AS DIRECTED BY KEYSTONE.
4. RESTRICT ROOT GRUBBING TO ONLY THE AREA OVER THE DITCHLINE.
5. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
6. UTILIZE AMPHIBIOUS EXCAVATORS (PONTOON MOUNTED BACKHOES) OR TRACKED BACKHOES SUPPORTED BY FABRICATED TIMBER MATS OR FLOATS TO EXCAVATE TRENCH. IF FABRICATED TIMBER MATS ARE USED FOR STABILIZATION, THE BACKHOE SHALL GRADUALLY MOVE ACROSS THE WETLAND BY MOVING THE MAT FROM IMMEDIATELY BEHIND TO IMMEDIATELY IN FRONT OF THE BACKHOE'S PATH.
7. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT EDGE OF RIGHT–OF–WAY AND ALONG WETLAND EDGE IF PRACTICAL.
8. FABRICATE PIPE IN STAGING AREA OUTSIDE THE WETLAND IN THE EXTRA WORK SPACE AS INDICATED ON THE CONSTRUCTION DRAWINGS.
9. LEAVE HARD PLUGS AT THE EDGE OF THE WETLAND UNTIL JUST PRIOR TO PIPE PLACEMENT.
10. FLOAT PIPE IN PLACE, LOWER–IN, INSTALL TRENCH PLUGS AT WETLAND EDGES WHERE REQUIRED AND BACKFILL IMMEDIATELY.
11. REMOVE TIMBER MATS OR PREFABRICATED MATS OF NON–NATIVE MATERIAL FROM WETLANDS UPON COMPLETION.
12. RESTORE GRADE TO NEAR PRE–CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.

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PUSH/PULL WETLAND CROSSING METHOD

PROJECT: 50366E

DETAIL 10

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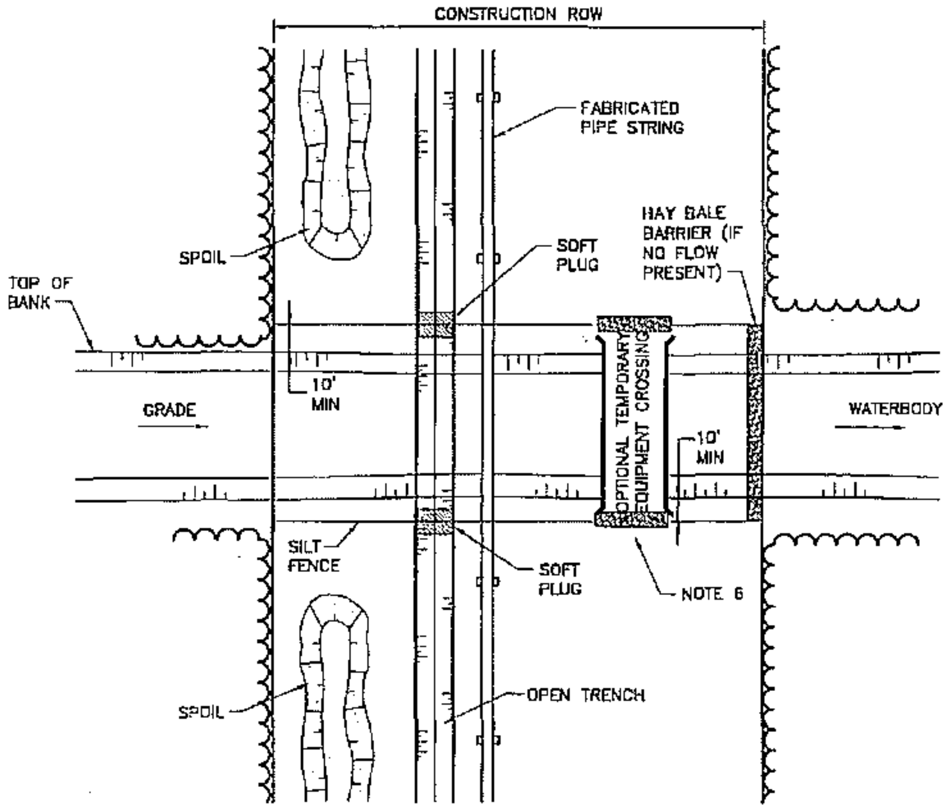

PLAN VIEW

CONSTRUCTION PROCEDURES:

1. METHOD APPLIES TO CROSSINGS WHERE NO FLOWING WATER IS PRESENT AT THE TIME OF CROSSING OR AS OTHERWISE SHOWN ON THE CONSTRUCTION DRAWINGS.
2. CONTRACTOR MAY "MAINLINE THROUGH" THE CROSSING OR UP TO BOTH SIDES OF THE CROSSING; STRING, WELD, COAT AND WEIGHT (IF NECESSARY), USING THE MAINLINE CREW WITH THE PIPE SKIDDED OVER THE CROSSING.
3. NO REFUELING OF MOBILE EQUIPMENT WITHIN APPROXIMATELY 100 FEET OF DRY CHANNEL. REFUEL STATIONARY EQUIPMENT AS PER KEYSTONE'S SPILL PREVENTION PROCEDURES.
4. INSTALLATION OF TEMPORARY EQUIPMENT CROSSING IS OPTIONAL AT THE DISCRETION OF KEYSTONE.
5. IN AGRICULTURAL LAND, STRIP TOPSOIL FROM SPOIL STORAGE AREA. STOCKPILE TOPSOIL AND SPOIL SEPARATELY. TOPSOIL AND SPOIL WILL NOT BE STOCKPILED IN THE CROSSING CHANNEL AND WILL BE PLACED A MINIMUM OF 10 FEET FROM CROSSING BANKS WITHIN THE CONSTRUCTION RIGHT OF WAY.
6. CONSTRUCT SEDIMENT BARRIERS ACROSS THE ENTIRE CONSTRUCTION RIGHT OF WAY FOLLOWING CLEARING AND GRADING AND MAINTAIN UNTIL CONSTRUCTION OF THE CROSSING. EROSION CONTROL MEASURES SHALL BE REINSTALLED IMMEDIATELY FOLLOWING BACKFILLING OF TRENCH AND STABILIZATION OF BANKS. BARRIERS MAY BE TEMPORARILY REMOVED TO ALLOW CONSTRUCTION ACTIVITIES BUT MUST BE REPLACED BY THE END OF EACH WORK DAY.
7. IN-STREAM SPOIL TO BE STORED OUT OF THE STREAM CHANNEL A MINIMUM OF 10 FEET FROM HIGH BANK AND WITHIN THE CONSTRUCTION RIGHT OF WAY.
8. BACKFILL WITH NATIVE MATERIAL.
9. RESTORE CROSSING CHANNEL TO APPROXIMATE PRE-CONSTRUCTION PROFILE AND SUBSTRATE.
10. RESTORE CROSSING BANKS TO APPROXIMATE ORIGINAL CONDITION AND STABILIZE WITH EROSION CONTROL.

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NON-FLOWING WATER BODY CROSSING METHOD

NO.	REVISION	DATE
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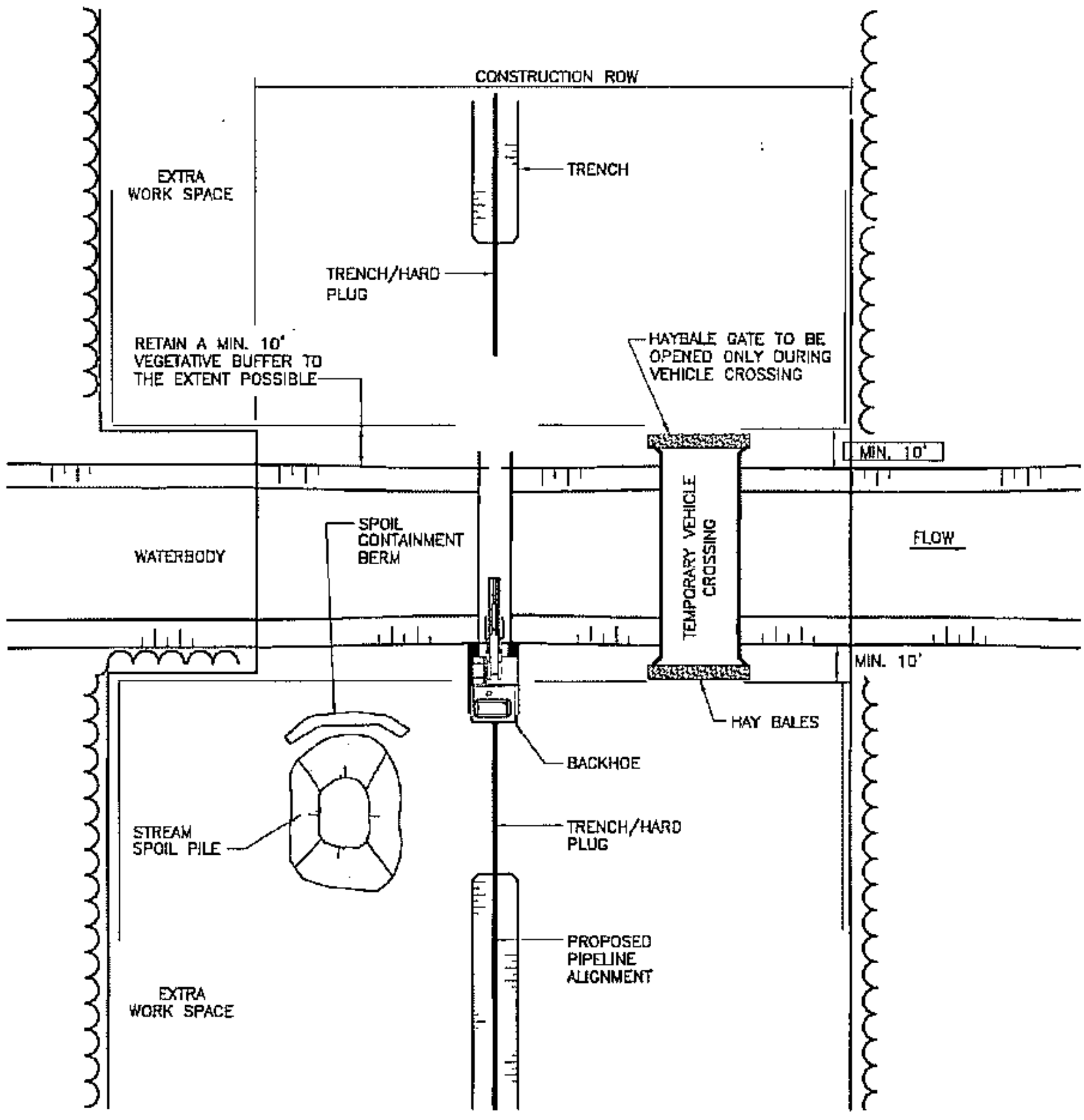
PROJECT: 50386E

DETAIL 11

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY	LAST PLOT DATE:
K-00-P-7000-300	ALS	JTG	RG	Tue, 04 Apr 2008 – 3:05pm

SEE DETAIL 12a FOR CONSTRUCTION PROCEDURE



PLAN VIEW

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KEYSTONE PIPELINE PROJECT

TYPICAL FLOWING WATERBODY CROSSING METHOD

NO.	REVISION	DATE
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PROJECT: 500008

DETAIL 12

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-300	ALB	JTG	RG

LAST PLOT DATE: Tue, 04 Apr 2006 — 3:34pm

CONSTRUCTION PROCEDURES:

1. RIGHT-OF-WAY BOUNDARIES AND WORK SPACE LIMITS SHALL BE CLEARLY DELINEATED. STAGING FOR MAKEUP SHALL BE LOCATED A MINIMUM OF 10 FEET FROM WATERBODY.

2. CLEARING LIMITS WILL BE CLEARLY DELINEATED AND A 10 FOOT VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREA AND THE WATERBODY SHALL BE MAINTAINED TO THE EXTENT POSSIBLE. ALL CLEARING SHALL BE MINIMIZED TO THE EXTENT POSSIBLE AND TO ONLY THAT NECESSARY FOR CONSTRUCTION. WOODY VEGETATION SHALL BE CUT AT GROUND LEVEL AND THE STUMPS/ROOTS LEFT IN PLACE TO THE EXTENT POSSIBLE.

3. TOPSOIL SHALL BE STRIPPED FROM THE DITCH LINE IN ALL WETLANDS RIPARIAN.

4. CONTRACTOR SHALL INSTALL SIGNS APPROXIMATELY 100 FEET MINIMUM FROM EACH WATERBODY AND WETLAND TO IDENTIFY THE HAZARDOUS MATERIALS EXCLUSION AREA.

5. EROSION AND SEDIMENT CONTROL

   A. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS WATERBODY OR WETLAND.

   B. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY OR INDIRECTLY INTO THE WATERBODY. ALL EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO SUIT ACTUAL SITE CONDITIONS. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION.

   C. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA, INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED CONSTRUCTION RIGHT OF WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.

   D. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE WATERBODY CROSSING UNTIL THE WATER CROSSING IS INSTALLED AND BACKFILLED.

   E. TRENCH BREAKERS ARE TO BE INSTALLED AT THE SAME SPACING AND IMMEDIATELY UPSLOPE OF PERMANENT SLOPE BREAKERS, OR AS DIRECTED BY THE COMPANY.

6. CONTRACTOR SHALL MAINTAIN HARD PLUGS IN THE DITCH AT THE WATERBODY UNTIL JUST PRIOR TO PIPE INSTALLATION. CONTRACTOR SHALL EXCAVATE TRENCH AND INSTALL PIPE AS EXPEDIENTLY AS PRACTICAL TO REDUCE THE DURATION OF WORK ACTIVITIES IN THE WATERBODY BED.

7. CONTRACTOR SHALL PLACE TRENCH SPOIL ONLY IN CERTIFICATED WORK SPACE AND A MINIMUM OF 10 FEET FROM THE WATERBODY BANKS TO PREVENT ENTRY OF SPOIL INTO THE WATERBODY. SPOIL SHALL BE CONTAINED AS NECESSARY USING EITHER A STRAW BALE BARRIER OR AN EARTH/ROCK BERM.

8. CONTRACTOR SHALL RESTORE THE WATERBODY AND BANKS TO APPROXIMATE PRECONSTRUCTION CONTOURS, UNLESS OTHERWISE APPROVED BY THE COMPANY. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED. ANY MATERIALS PLACED IN THE WATERBODY TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATERBODY AND WETLAND BOUNDARIES UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.

9. VEHICLE CROSSING CAN BE CONSTRUCTED USING EITHER A FLUME CROSSING OR A TEMPORARY BRIDGE. VEHICLE CROSSING ONLY REQUIRED IF STREAM SUPPORTS A STATE DESIGNATED FISHERY.

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TYPICAL FLOWING WATERBODY CROSSING METHOD

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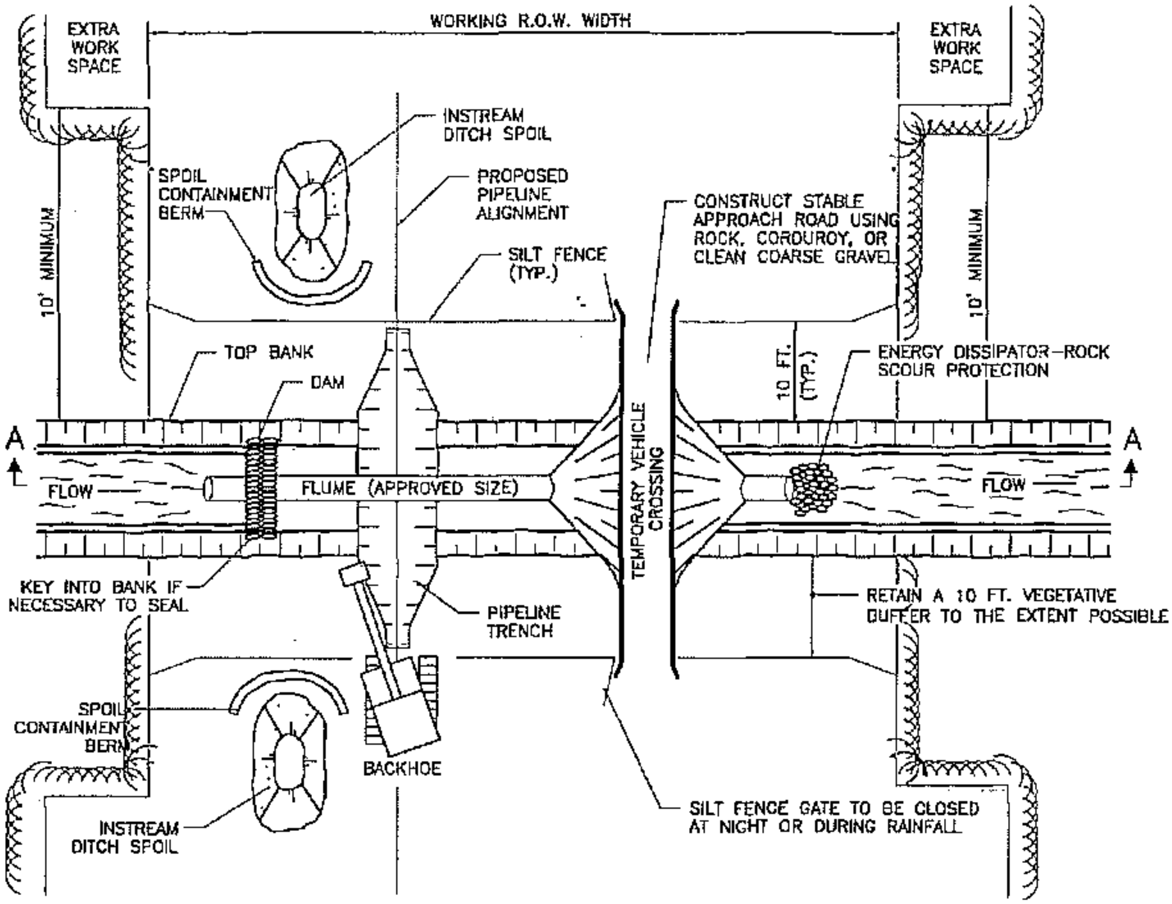
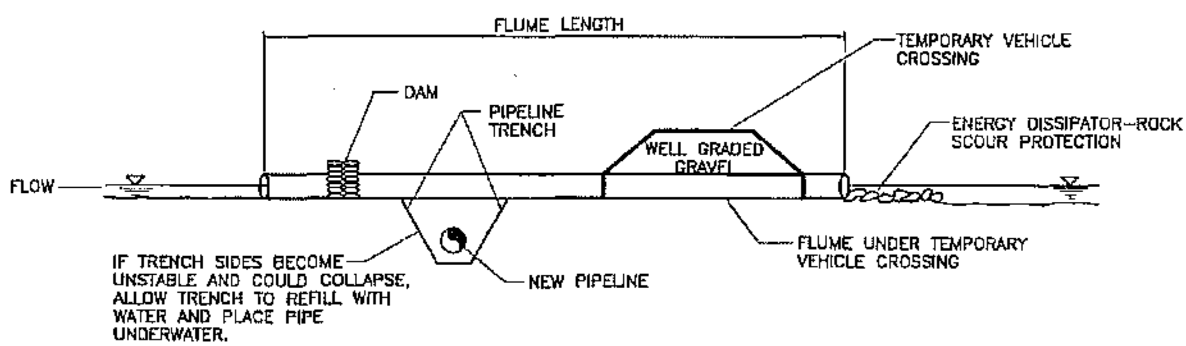
PROJECT: [illegible]

DETAIL 12a

LAST PLOT DATE: [illegible]



PLAN VIEW



SECTION 'A-A'

NOTES:
1. PIPELINE PLACEMENT WITHIN RIGHT-OF-WAY CONCEPTUAL ONLY.
2. SEE DETAIL 13a FOR CONSTRUCTION PROCEDURES.

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TYPICAL DRY FLUME CROSSING METHOD

NO.	REVISION	DATE
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PROJECT: 50388E

DETAIL 13

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
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LAST PLOT DATE:

CONSTRUCTION PROCEDURES:

1. MARK OUT AND MAINTAIN LIMITS OF AUTHORIZED WORK AREAS WITH FENCING OR FLAGGING TAPE TO AVOID UNNECESSARY DISTURBANCE OF VEGETATION. ENSURE EQUIPMENT OPERATORS WORKING ON THE CROSSING HAVE BEEN BRIEFED ABOUT THIS PLAN AND THE MEASURES NEEDED TO PROTECT WATER QUALITY.

2. ALL NECESSARY EQUIPMENT AND MATERIALS TO BUILD THE FLUME MUST BE ON SITE OR READILY AVAILABLE PRIOR TO COMMENCING IN-WATER WORK.

3. TO THE EXTENT POSSIBLE, MAINTAIN A MINIMUM 10 FT. VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREAS AND THE WATERCOURSE. INSTALL AND MAINTAIN A SILT FENCE OR STRAW BALE BARRIER UPSLOPE OF THE BUFFER STRIP ON EACH SIDE OF THE WATERCOURSE.

4. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED OR ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS STREAM.
   a. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY INTO THE STREAM.
   b. EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO ACTUAL SITE CONDITIONS.
   c. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION. UTILIZE STRAW BALE BARRIERS ONLY IN LIEU OF A SILT FENCE WHERE FREQUENT ACCESS IS REQUIRED.
   d. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG.
   e. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED PORTIONS OF THE RIGHT-OF-WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.
   f. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE RIVER CROSSING UNTIL THE RIVER CROSSING IS INSTALLED AND BACKFILLED.

5. PIPE SHALL BE STRUNG AND WELDED FOR READY INSTALLATION PRIOR TO WATERCOURSE TRENCHING.

6. FLUME CAPACITY DURING DRY CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE 1.5 TIMES THE FLOW MEASURED AT THE TIME OF CONSTRUCTION PROVIDED THAT THE FLUMES WILL BE IN PLACE NOT MORE THAN 96 HOURS AND NO PRECIPITATION IS FORECAST. FLUME CAPACITY FOR VEHICLE ACCESS SHALL BE SUFFICIENT TO PASS THE 2 YEAR DESIGN FLOW OR THE FLOW REASONABLY EXPECTED TO OCCUR DURING THE INSTALLATION. EXCESS FLUMES REQUIRED FOR LONGER TERM ACCESS SHALL BE CAPPED DURING DRY CROSSING PROCEDURES.

7. ENSURE THAT THE DAMS AND VEHICLE-CROSSING ARE LOCATED FAR ENOUGH APART TO ALLOW FOR A WIDE EXCAVATION. FLUMES ARE TO BE SET WITH 10 PERCENT OF THEIR DIAMETER BELOW STREAMBED LEVEL WHERE SOIL CONDITIONS PERMIT (OTHERWISE INSTALLED AT STREAM GRADE AND SLOPE).

8. PLACE IMPERVIOUS DAMS AT EACH END OF THE FLUME, UPSTREAM FIRST, THEN DOWNSTREAM. ACCEPTABLE ALTERNATIVES INCLUDE GRAVEL WITH RIP-RAP PROTECTION, SAND BAGS, STEEL PLATE AND ROCKFILL. DURING INSTALLATION, INSTALL AN IMPERVIOUS MEMBRANE, IF NECESSARY, TO LIMIT LEAKAGE. DAMS MAY NEED KEYING INTO THE BANK AND STREAMBED.

9. EXCAVATE TRENCH THROUGH PLUGS AND UNDER FLUME FROM BOTH SIDES. WORK IS TO BE COMPLETED AS QUICKLY AS POSSIBLE.
   a. LOWER IN PIPE BY PASSING UNDER FLUME AND BACKFILL IMMEDIATELY WITH SPOIL MATERIAL.
   b. IT IS NOT NECESSARY TO DEWATER THE IN-STREAM TRENCH, HOWEVER, DISPLACED WATER SHALL BE PUMPED TO A STABLE UPLAND AREA TO AVOID OVERTOPPING OF DAMS DURING PIPE PLACEMENT.
   c. IF THE SPOIL MATERIAL IS NOT SUITABLE, USE IMPORTED CLEAN GRANULAR MATERIAL.
   d. IF BLASTING IS REQUIRED, USE CONTROLLED BLASTING TECHNIQUES TO PREVENT DAMAGE TO THE FLOW CONVEYANCE SYSTEM. ALTERNATIVELY, BLASTING MAY BE ACCOMPLISHED PRIOR TO FLUME INSTALLATION BY DRILLING THROUGH THE OVERBURDEN.

10. EXCAVATED MATERIAL MUST NOT BE STOCKPILED WITHIN 10 FT. OF THE WATERCOURSE. THIS MATERIAL SHALL BE CONTAINED TO PREVENT SATURATED SOIL FROM FLOWING BACK INTO THE WATERCOURSE.

11. DEWATERING OF THE ONLAND TRENCH SHOULD OCCUR IN A STABLE VEGETATED AREA A MINIMUM OF 50 FT. FROM ANY WATERBODY. THE PUMP DISCHARGE SHOULD BE DIRECTED ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL OR TIMBERS TO PREVENT LOCALIZED EROSION. THE DISCHARGE WATER SHOULD ALSO BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD BY USING STRAW BALES AND THE NATURAL TOPOGRAPHY.

12. FLUMES SHOULD BE REMOVED AS SOON AS POSSIBLE, WHEN NO LONGER REQUIRED FOR PIPE LAYING OR FOR ROAD ACCESS, IN THE FOLLOWING MANNER:
   a. REMOVE THE VEHICLE CROSSING RAMP. BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH THE FLOW CONDITIONS (E.G., EROSION CONTROL BLANKETS, CRIBBING, ROCK RIP-RAP, ETC.) TO THE MAXIMUM EXTENT POSSIBLE BEFORE REMOVING THE DAMS.
   b. REMOVE DOWNSTREAM DAM.
   c. REMOVE UPSTREAM DAM.
   d. REMOVE FLUME.
   e. COMPLETE BANK TRIMMING AND EROSION PROTECTION. IF SANDBAGS ARE USED FOR THE DAMS, PLACE AND REMOVE BY HAND TO AVOID EQUIPMENT BREAKING BAGS.

13. RESTORE THE STREAM BED AND BANKS TO APPROXIMATE PRE-CONSTRUCTION CONTOURS, BUT NOT TO EXCEED 2 HORIZONTAL TO 1 VERTICAL.
   a. INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED ON A SITE SPECIFIC BASIS. IN THE ABSENCE OF SITE SPECIFIC INFORMATION, A FLEXIBLE CHANNEL LINER SUCH AS NAG C125 OR C350 WHICH IS CAPABLE OF WITHSTANDING ANTICIPATED FLOW SHALL BE INSTALLED. ALTERNATIVELY, ROCK RIP-RAP SHALL BE INSTALLED.
   b. ANY MATERIALS PLACED IN THE STREAM TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING.
   c. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATER COURSE UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.

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KEYSTONE PIPELINE PROJECT

TYPICAL DRY FLUME CROSSING METHOD

NO.	REVISION	DATE
1	GENERAL EDITORIAL REVISION	APR 04, 2008
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DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY	PROJECT	
K-00-P-7000-300	ALS	JTG	RG	50380E	DETAIL 13a

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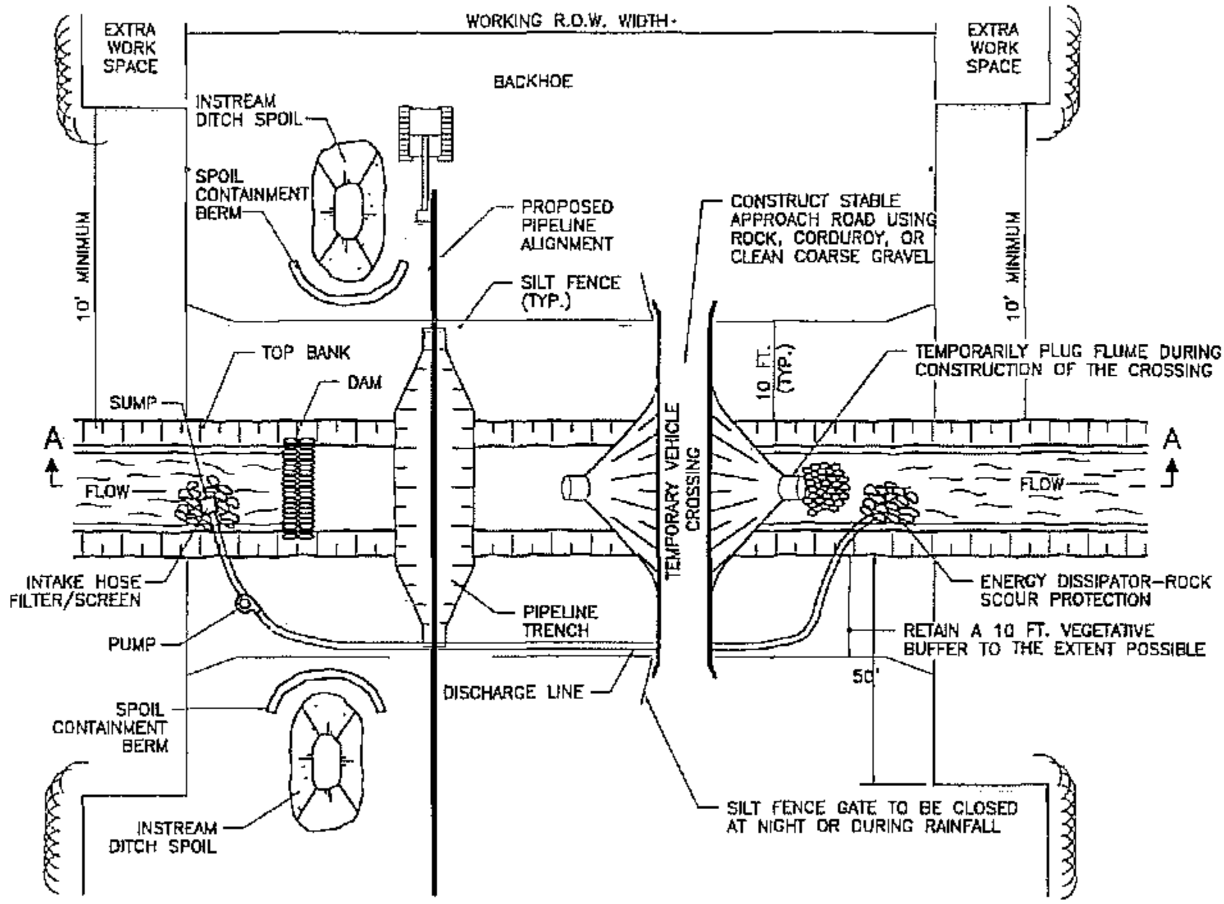
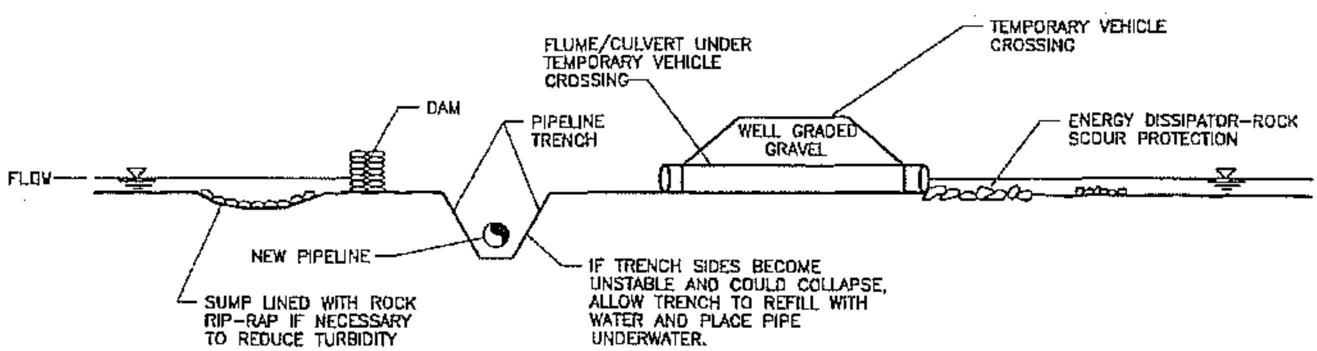


PLAN VIEW



SECTION 'A–A'

NOTES:
1. PIPELINE PLACEMENT WITHIN RIGHT–OF–WAY CONCEPTUAL ONLY.
2. SEE DETAIL 14a FOR CONSTRUCTION PROCEDURE

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TYPICAL DAM AND PUMP CROSSING

DETAIL 14

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
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CONSTRUCTION PROCEDURES:

1. WHERE NECESSARY, OBTAIN PRIOR APPROVAL BEFORE USING THE DAM AND PUMP METHOD.
2. IF THERE IS ANY FLOW IN THE WATERCOURSE, INSTALL PUMPS TO MAINTAIN STREAMFLOW AROUND THE BLOCKED OFF SECTIONS OF CHANNEL. THE PUMP IS TO HAVE 1.5 TIMES THE PUMPING CAPACITY OF ANTICIPATED FLOW. A SECOND STANDBY PUMP OF EQUAL CAPACITY IS TO BE READILY AVAILABLE AT ALL TIMES. AN ENERGY DISSIPATOR IS TO BE BUILT TO ACCEPT PUMP DISCHARGE WITHOUT STREAMBED OR STREAMBANK EROSION. IF THE CROSSING IS PROLONGED BEYOND ONE DAY THE OPERATION NEEDS TO BE MONITORED OVERNIGHT.
3. SCHEDULE INSTREAM ACTIVITY FOR LOW FLOW PERIODS IF POSSIBLE
4. MARK OUT AND MAINTAIN LIMITS OF AUTHORIZED WORK AREAS WITH FENCING OR FLAGGING TAPE TO AVOID UNNECESSARY DISTURBANCE OF VEGETATION. ENSURE EQUIPMENT OPERATORS WORKING ON THE CROSSING HAVE BEEN BRIEFED ABOUT THIS PLAN AND THE MEASURES NEEDED TO PROTECT WATER QUALITY. INSTALL PRE-WORK SEDIMENT CONTROL MEASURES AS SPECIFIED IN THE PLAN. ALL NECESSARY EQUIPMENT AND MATERIALS TO BUILD THE DAMS AND TO PUMP WATER MUST BE ON SITE OR READILY AVAILABLE PRIOR TO COMMENCING IN-WATER CONSTRUCTION. PIPE SHOULD BE STRUNG, WELDED AND COATED AND READY FOR INSTALLATION PRIOR TO WATERCOURSE TRENCHING.
5. CONTRACTOR SHALL SUPPLY, INSTALL AND MAINTAIN SEDIMENT CONTROL STRUCTURES, AS DEPICTED AND ALONG DOWN GRADIENT SIDES OF WORK AREAS AND STAGING AREAS SUCH THAT NO HEAVILY SILT LADEN WATER ENTERS STREAM.
   a. NO HEAVILY SILT LADEN WATER SHALL BE DISCHARGED DIRECTLY INTO THE STREAM.
   b. EROSION AND SEDIMENT CONTROL STRUCTURE LOCATIONS AS DEPICTED ARE APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED BY THE COMPANY INSPECTOR TO ACTUAL SITE CONDITIONS.
   c. SILT FENCE OR STRAW BALE INSTALLATIONS SHALL INCLUDE REMOVABLE SECTIONS TO FACILITATE ACCESS DURING CONSTRUCTION. UTILIZE STRAW BALE BARRIERS ONLY IN LIEU OF A SILT FENCE WHERE FREQUENT ACCESS IS REQUIRED.
   d. SEDIMENT LADEN WATER FROM TRENCH DEWATERING SHALL BE DISCHARGED TO A WELL VEGETATED UPLAND AREA, INTO A STRAW BALE DEWATERING STRUCTURE OR GEOTEXTILE FILTER BAG.
   e. SEDIMENT CONTROL STRUCTURES MUST BE IN PLACE AT ALL TIMES ACROSS THE DISTURBED PORTIONS OF THE RIGHT-OF-WAY EXCEPT DURING EXCAVATION/INSTALLATION OF THE CROSSING PIPE.
   f. SOFT DITCH PLUGS MUST REMAIN IN PLACE AT CONVENIENT LOCATIONS TO SEPARATE MAINLINE DITCH FROM THE RIVER CROSSING UNTIL THE RIVER CROSSING IS INSTALLED AND BACKFILLED.
6. TO THE EXTENT POSSIBLE, MAINTAIN A MINIMUM 10 FEET VEGETATIVE BUFFER STRIP BETWEEN DISTURBED AREAS AND THE WATERCOURSE. INSTALL AND MAINTAIN A SILT FENCE UPSLOPE OF THE BUFFER STRIP ON EACH SIDE OF THE WATERCOURSE. THE SILT FENCE SHOULD INCORPORATE REMOVABLE "GATES" AS REQUIRED TO ALLOW ACCESS WHILE MAINTAINING EASE OF REPLACEMENT FOR OVERNIGHT OR DURING PERIODS OF RAINFALL.
7. CONSTRUCT A TEMPORARY SUMP UPSTREAM OF THE DAM AND LINE WITH ROCKFILL IF A NATURAL POOL DOES NOT EXIST. INSTALL THE PUMP OR PUMP INTAKE IN THE POOL OR SUMP. DISCHARGE WATER ONTO AN ENERGY DISSIPATOR DOWNSTREAM OF THE WORK AREA.
8. EXCAVATED MATERIAL MUST NOT BE STOCKPILED WITHIN 10 FT. OF THE WATERCOURSE. THIS MATERIAL MUST BE CONTAINED WITHIN BERM CONTAINMENT, WITH SECONDARY SILT FENCE PROTECTION TO PREVENT SATURATED SOIL FROM FLOWING BACK INTO THE WATERCOURSE.
9. CHEMICALS, FUELS, LUBRICATING OILS SHALL NOT BE STORED AND EQUIPMENT REFUELED WITHIN 100 FT. OF THE WATERBODY. PUMPS ARE TO BE REFUELED AS PER THE SPCC PLANS.
10. STAGING AREAS ARE TO BE LOCATED AT LEAST 10 FT. FROM THE WATER'S EDGE (WHERE TOPOGRAPHIC CONDITIONS PERMIT) AND SHALL BE THE MINIMUM SIZE NEEDED.
11. DAMS ARE TO BE MADE OF STEEL PLATE, INFLATABLE PLASTIC DAM, SAND BAGS, COBBLES, WELL GRADED COARSE GRAVEL FILL, OR ROCK FILL. DAMS MAY NEED KEYING INTO THE BANKS AND STREAMBED. ENSURE THAT THE DAM AND VEHICLE CROSSING ARE LOCATED FAR ENOUGH APART TO ALLOW FOR A WIDE EXCAVATION. CAP FLUMES USED UNDER VEHICLE CROSSING DURING DRY CROSSING.
12. DEWATER AREA BETWEEN DAMS IF POSSIBLE. DEWATERING SHOULD OCCUR IN A STABLE VEGETATIVE AREA A MINIMUM OF 50 FT. FROM ANY WATERBODY. THE PUMP DISCHARGE SHOULD BE DISCHARGED ONTO A STABLE SPILL PAD CONSTRUCTED OF ROCKFILL, SANDBAGS, OR TIMBERS TO PREVENT LOCALIZED EROSION. THE DISCHARGE WATER SHOULD ALSO BE FORCED INTO SHEET FLOW IMMEDIATELY BEYOND THE SPILL PAD BY USING STRAW BALES AND THE NATURAL TOPOGRAPHY DISCHARGED WATER SHALL NOT BE ALLOWED TO FLOW INTO ANY WATERCOURSE OR WETLAND. IF IT IS NOT POSSIBLE TO DEWATER THE EXCAVATION DUE TO SOILS WITH A HIGH HYDRAULIC CONDUCTIVITY, THE EXCAVATION AND PIPE PLACEMENT IS TO BE CARRIED OUT IN THE STANDING WATER. PUMP ANY DISPLACED WATER AS DESCRIBED ABOVE TO PREVENT OVERTOPPING OF DAMS.
13. EXCAVATE TRENCH THROUGH PLUGS AND STREAMBED FROM BOTH SIDES, RE-POSITIONING DISCHARGE HOSE AS NECESSARY. LOWER THE PIPE IN THE TRENCH AND BACKFILL IMMEDIATELY. DURING THIS OPERATION WORK IS TO BE COMPLETED AS QUICKLY AS POSSIBLE.
14. CONTRACTOR SHALL RESTORE THE STREAM BED AND BANKS TO APPROXIMATE PRE-CONSTRUCTION CONTOURS, BUT NOT TO EXCEED 2 HORIZONTAL TO 1 VERTICAL.
   a. CONTRACTOR SHALL INSTALL PERMANENT EROSION AND SEDIMENT CONTROL STRUCTURES AS INDICATED ON A SITE SPECIFIC BASIS. IN THE ABSENCE OF SITE SPECIFIC INFORMATION, A FLEXIBLE CHANNEL LINER SUCH AS NAG C125 OR C350 WHICH IS CAPABLE OF WITHSTANDING ANTICIPATED FLOW SHALL BE INSTALLED. ALTERNATIVELY, ROCK RIP-RAP SHALL BE INSTALLED.
   b. ANY MATERIALS PLACED IN THE STREAM TO FACILITATE CONSTRUCTION SHALL BE REMOVED DURING RESTORATION. BANKS SHALL BE STABILIZED AND TEMPORARY SEDIMENT BARRIERS INSTALLED AS SOON AS POSSIBLE AFTER CROSSING, BUT WITHIN 24 HOURS OF COMPLETING THE CROSSING.
   c. MAINTAIN A SILT FENCE OR STRAW BALE BARRIER ALONG THE WATER COURSE UNTIL VEGETATION IS ESTABLISHED IN ADJACENT DISTURBED AREAS.
15. WHEN THE STREAMBED HAS BEEN RESTORED, THE CREEK BANKS ARE TO BE CONTOURED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH FLOW VELOCITY BETWEEN DAMS (E.G., EROSION CONTROL BLANKETS, CRIBBING, ROCK RIP-RAP, ETC.). THE DAMS ARE TO BE REMOVED DOWNSTREAM FIRST. KEEP PUMP RUNNING UNTIL NORMAL FLOW IS RESUMED. COMPLETE BANK TRIMMING AND EROSION PROTECTION. IF SANDBAGS ARE USED FOR THE DAMS, PLACE AND REMOVE BY HAND TO AVOID EQUIPMENT BREAKING BAGS.

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TYPICAL DAM AND PUMP CROSSING

PROJECT: 503386

DETAIL 14a

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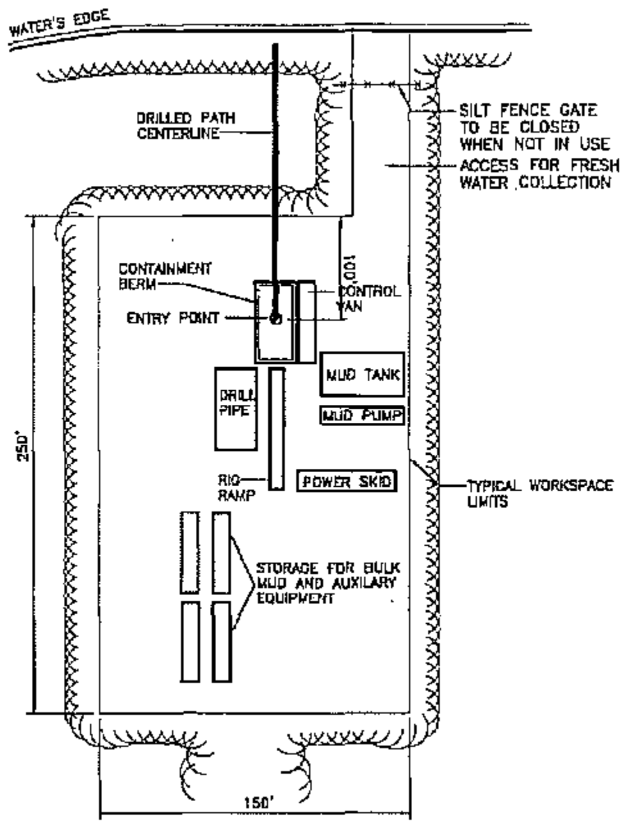
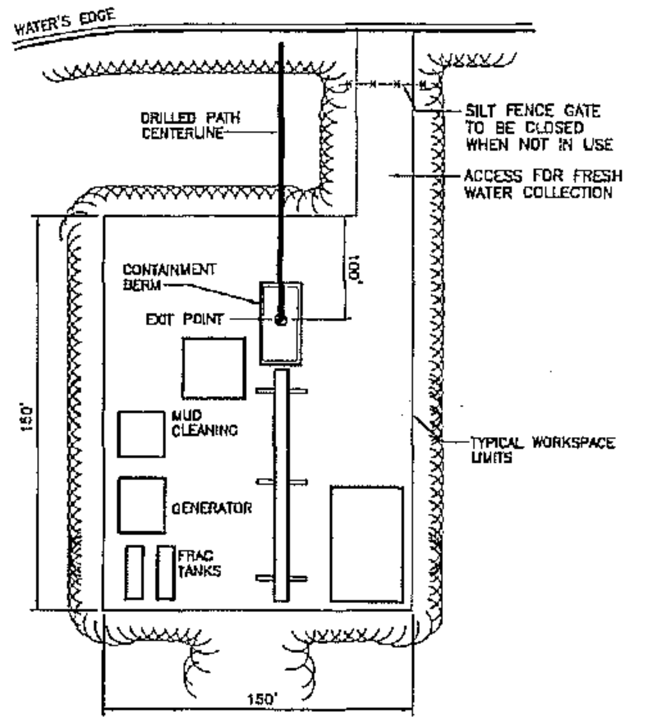
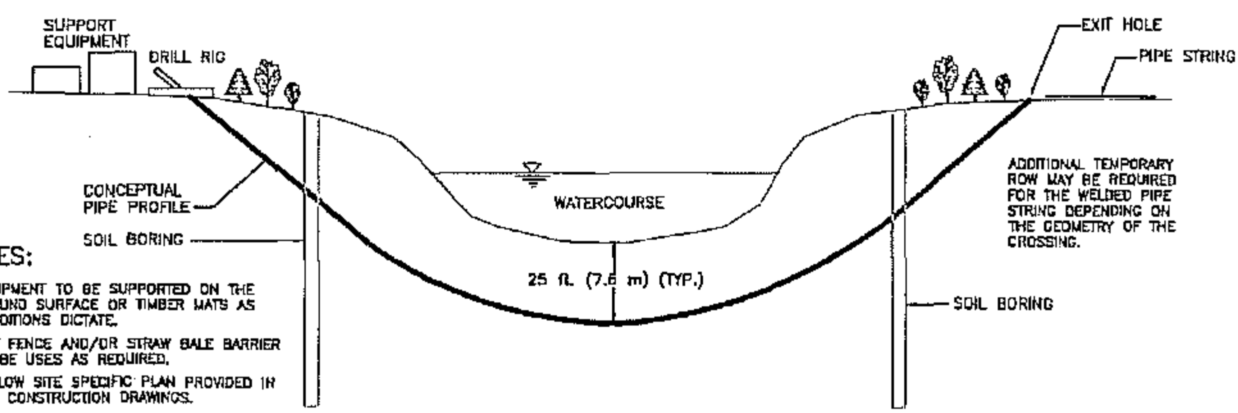


SITE PLAN
ENTER SIDE



SITE PLAN
EXIT SIDE



NOTES:

1. EQUIPMENT TO BE SUPPORTED ON THE GROUND SURFACE OR TIMBER MATS AS CONDITIONS DICTATE.
2. SILT FENCE AND/OR STRAW BALE BARRIER TO BE USES AS REQUIRED.
3. FOLLOW SITE SPECIFIC PLAN PROVIDED IN THE CONSTRUCTION DRAWINGS.
4. CONFIGURATIONS SHOWN ARE TYPICAL AND SHALL BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS

PROFILE

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TYPICAL HORIZONTAL DRILL (HDD) SITE PLAN & PROFILE

PROJECT: 50388E

DETAIL 15

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
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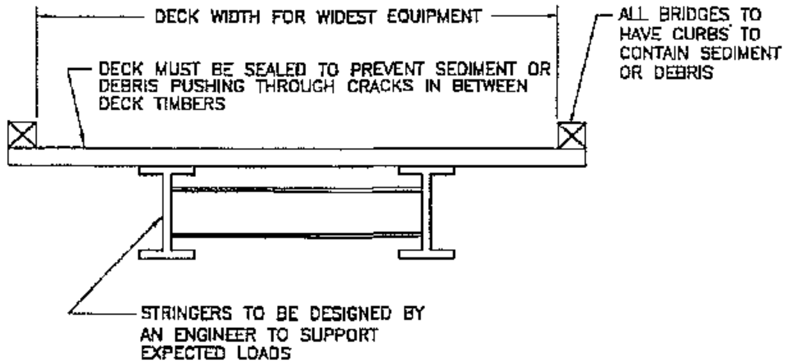
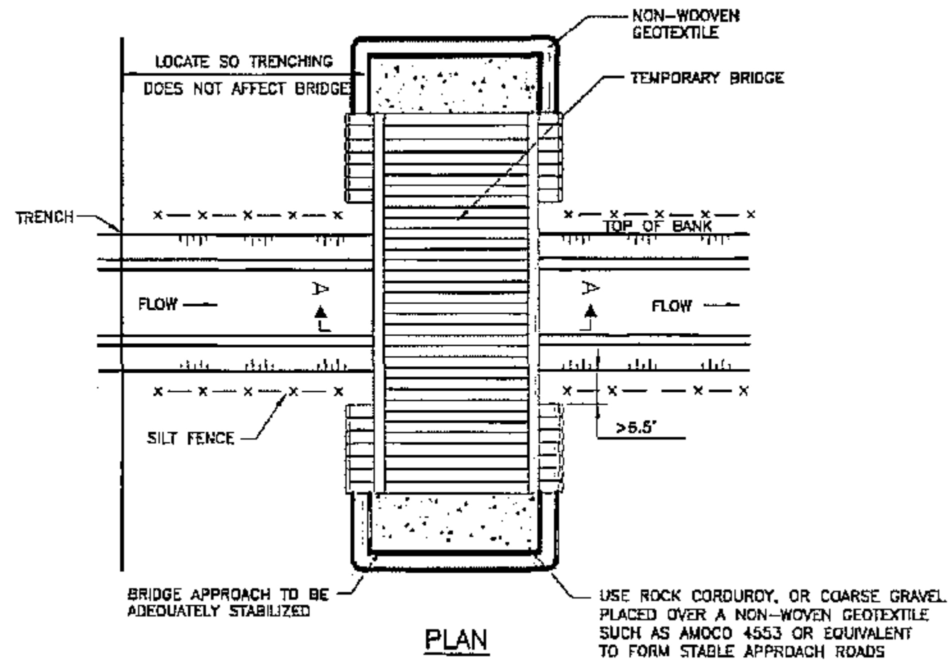
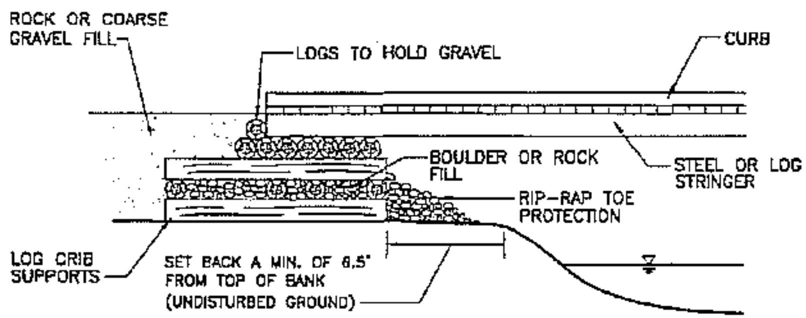
LAST PLOT DATE: [illegible]



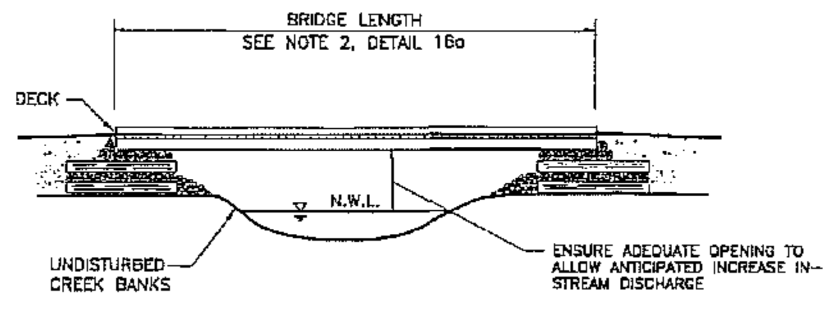
SECTION A–A



PLAN



TYPICAL TEMPORARY CRIB ABUTMENT



BRIDGE PROFILE

NOTES:

1. SEE DETAIL 16a FOR CONSTRUCTION PROCEDURES

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TYPICAL TEMPORARY BRIDGE CROSSING

PROJECT: 60318E

DETAIL 16

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-300	ALS	JTG	RG

LAST PLOT DATE: Tue, 04 Apr 2006 – 3:31pm

CONSTRUCTION PROCEDURES:

IN GENERAL TERMS, THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION PROCEDURES THAT ARE RECOMMENDED TO BE FOLLOWED FOR TEMPORARY BRIDGE CROSSINGS:

1. A PORTABLE BRIDGE, FLEXI-FLOAT, OR FLUMED VEHICLE CROSSING MAY BE SUBSTITUTED FOR THE TEMPORARY BRIDGE. IT IS IMPORTANT THAT THE SIZE OF THE TOTAL OPENING BE SELECTED SO THE STRUCTURE CAN SAFELY PASS FLOOD FLOWS THAT CAN REASONABLY BE EXPECTED TO OCCUR DURING THE LIFE OF THE CROSSING.

2. DETERMINE BRIDGE LENGTH REQUIRED AND FOLLOW EITHER METHOD A) OR B) FOR DETERMINING THE OPENING SIZE. IF A) IS FOLLOWED, A MINIMUM 6.5 ft. SETBACK FROM TOP OF BANK MUST BE PRESERVED AS A "NO DISTURBANCE AREA." IF ABUTMENTS OR PIERS IN THE STREAMBED ARE REQUIRED, METHOD B) IS TO BE FOLLOWED.

3. INSTALL THE BRIDGE IN A MANNER THAT WILL MINIMIZE SEDIMENT ENTERING THE WATER. STRINGERS MUST BE DESIGNED TO SUPPORT THE LOADS EXPECTED ON THE BRIDGE. CURBS MUST BE INSTALLED ALONG THE EDGE OF THE DECK TO CONTAIN SEDIMENT AND DEBRIS ON THE BRIDGE. FASTENERS CONNECTING COMPONENTS MUST BE STRONG ENOUGH TO HOLD THEM IN POSITION DURING THE LIFE OF THE BRIDGE. CRIBS ARE TO BE FILLED WITH ROCK OR COBBLE. RIP-RAP EROSION PROTECTION IS TO BE PLACED AROUND THE CRIBS AND ON ANY FILL SLOPES PROJECTING INTO THE WATERBODY.

4. ROAD APPROACHES LEADING TO THE BRIDGE MUST BE RAISED AND STABLE SO EQUIPMENT LOADS ARE SUPPORTED A SUFFICIENT DISTANCE BACK FROM THE WATER TO REDUCE SEDIMENT AND DEBRIS ENTERING THE WATERBODY FROM EQUIPMENT TRACKS. THIS MAY REQUIRE USING MATERIALS SUCH AS GRAVEL, ROCK OR CORDUROY. DO NOT USE SOIL TO CONSTRUCT OR STABILIZE EQUIPMENT BRIDGES. IF CUTS ARE NEEDED TO OBTAIN A SATISFACTORY GRADE, THEY ARE TO BE DUG WITH SIDE DITCHES AND STABLE SLOPES. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO KEEP SEDIMENT ON LAND (E.G., SILT FENCING, FILTER CLOTH, RIP-RAP, SEED AND MULCH, ETC.)

5. MAINTAIN A SILT FENCE ON EACH SIDE OF THE WATERBODY EXTENDING A MINIMUM OF 10 ft. BEYOND THE WIDTH OF DISTURBANCE UNTIL VEGETATION HAS BEEN ESTABLISHED IN UPSLOPE AREAS.

6. PERIODICALLY CHECK BRIDGE INSTALLATION AND REMOVE ANY BUILD-UP OF SEDIMENT OR DEBRIS ON THE BRIDGE. DISPOSE OF THIS MATERIAL IN A LOW LYING AREA AT LEAST 100 ft. FROM THE WATERBODY.

7. REMOVE TEMPORARY CROSSINGS AS SOON AS POSSIBLE AFTER FINAL CLEAN-UP. MATERIALS PLACED ALONG THE WATERBODY SHOULD BE COMPLETELY REMOVED DURING FINAL CLEAN-UP. REMOVAL SHOULD NOT NOT OCCUR OUTSIDE THE CONSTRUCTION WINDOWS.
   SURPLUS GRAVEL IS TO BE SPREAD ON THE RIGHT-OF WAY AS GRAVEL SHEETING, IF GRADATION IS SUITABLE, OR MOVED AT LEAST 100 ft. FROM TOP OF BANK FOR DISPOSAL. BRIDGE MATERIALS ARE TO BE REMOVED FROM THE CROSSING AREA. THE WATERBODY BED AND BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL COMPATIBLE WITH THE EXPECTED FLOW CONDITIONS.

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TYPICAL TEMPORARY BRIDGE CROSSING

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DETAIL 16a

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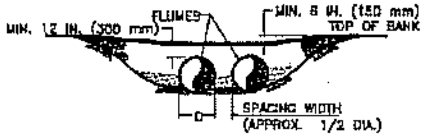
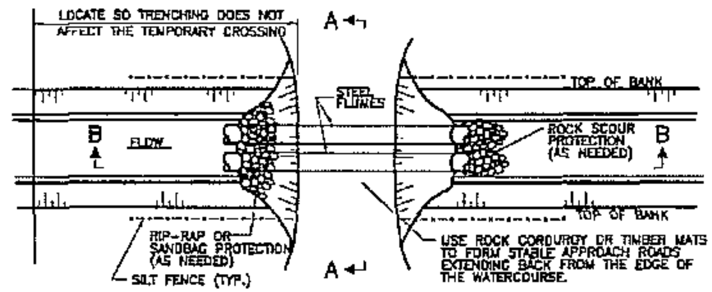
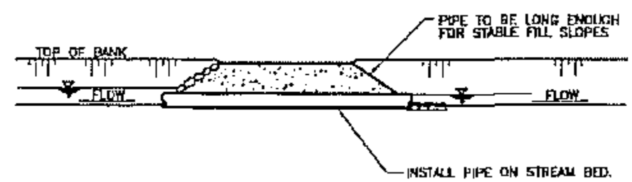


SECTION 'A–A'



PLAN VIEW



SECTION 'B–B'

CONSTRUCTION PROCEDURES:

THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES TO BE FOLLOWED AT ALL TEMPORARY FLUME VEHICLE CROSSINGS.

1. A PORTABLE FLEXI-FLOAT, OR TEMPORARY BRIDGE MAY BE SUBSTITUTED FOR THE TEMPORARY FLUME CROSSING.

2. THE LENGTH OF THE FLUME SHALL BE SUFFICIENT TO SPAN THE ENTIRE AREA REQUIRED FOR VEHICULAR ACCESS, EXTENDING 4 FT. BEYOND TOE OF FILL MATERIAL, SO TRENCHING WILL NOT AFFECT THE ROAD CROSSING. A LONGER PIPE IS TO BE USED, IF NEEDED, TO MAINTAIN STABLE SIDE SLOPES. FLUME CAPACITY TO BE BASED ON THE 2–YEAR DESIGN FLOW OR MAXIMUM FLOW ANTICIPATED TO OCCUR DURING INSTALLATION, AS SPECIFIED IN CONSTRUCTION DOCUMENTS.

3. WHERE PRACTICAL, BACKFILL AROUND THE PIPES AT THE ROAD WITH CLEAN, COARSE ROCK FILL MATERIAL. IF SCOUR IS POSSIBLE, RIP–RAP IS TO BE PLACED ON THE STREAM BED DOWN–STREAM OF THE PIPE OUTLET EXTENDING A MINIMUM OF TWO PIPE DIAMETERS. ALTERNATIVELY, TIMBER EQUIPMENT MATS, SAND BAGS OR TIMBER CORDUROY MAY BE USED TO FORM THE TRAVEL SURFACE.

4. TO REDUCE MUD ENTERING THE WATER FROM EQUIPMENT TRACKS, THE APPROACH ROAD LEADING TO THE CULVERT CROSSING MUST BE RAISED AND STABLE SO EQUIPMENT LOADS ARE SUPPORTED A SUFFICIENT DISTANCE BACK FROM THE WATER. IF CUTS ARE NEEDED TO OBTAIN A SATISFACTORY GRADE, THEY ARE TO BE DUG WITH SIDE DITCHES AND STABLE SLOPES. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO LIMIT THE POTENTIAL FOR SEDIMENT TO ENTER THE WATERBED (E.G., CHECK DAMS, SILT FENCE, RIP–RAP, SEED AND MULCH, SEDIMENT TRAPS, ETC.).

5. PERIODICALLY CHECK THE TEMPORARY CROSSING INSTALLATION AND REMOVE ANY BUILD–UP OF SEDIMENT OR DEBRIS ON THE BRIDGE. DISPOSE OF THIS MATERIAL AT LEAST 100 FT. FROM THE WATERCOURSE AND ABOVE THE HIGH WATER LEVEL.

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TYPICAL FLUME BRIDGE CROSSING

PROJECT: [illegible]

DETAIL 17

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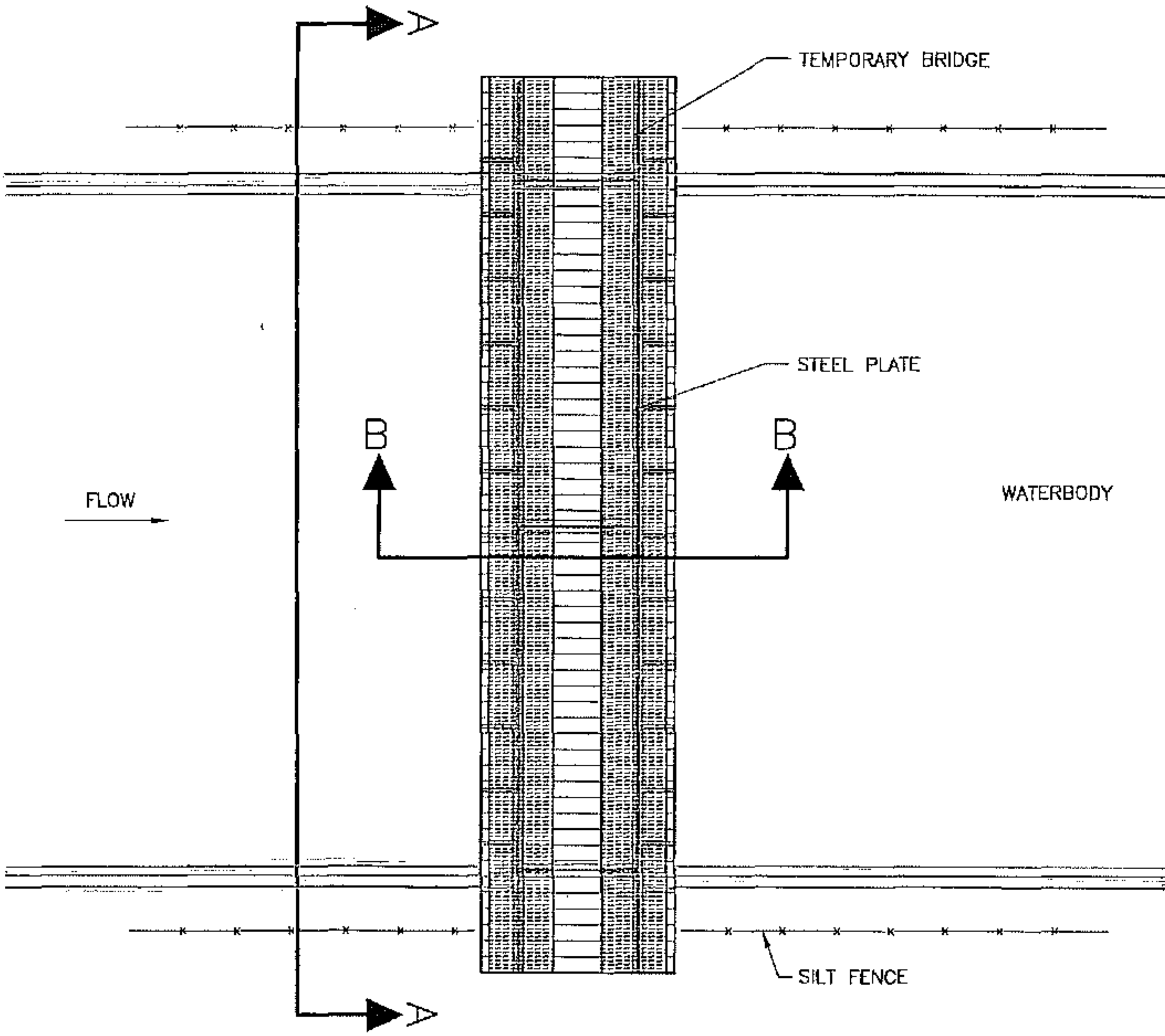

NOTES:

1. SEE DETAIL 18a FOR CONSTRUCTION PROCEDURES

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TYPICAL RAILCAR BRIDGE CROSSING

DETAIL 18

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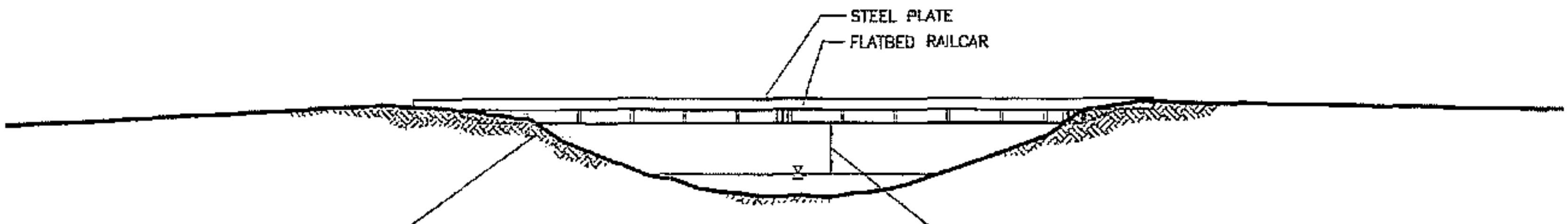


CROSS SECTION A–A

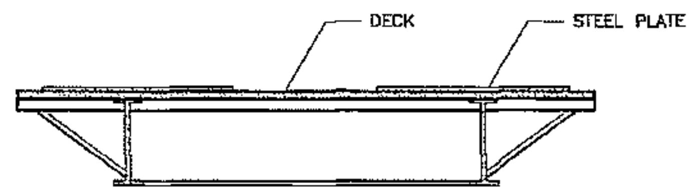
CONSTRUCTION PROCEDURES:

1. THIS TYPICAL DRAWING PROVIDES FOR A RAILCAR BRIDGE EQUIPMENT CROSSING.

2. BRIDGE SHOULD BE A MINIMUM OF 12 FEET LONGER THAN BANK TO BANK WIDTH.

3. BEST MANAGEMENT PRACTICES UTILIZING EROSION CONTROL DEVICES, SUCH AS HAY BALES AND SILT FENCE ARE REQUIRED TO PREVENT SEDIMENTATION OF THE STREAM. EROSION PROTECTION SHALL BE PLACED ON THE STREAM BANKS.

4. DURING FINAL CLEAN–UP, REMOVE TEMPORARY EQUIPMENT CROSSINGS AS SOON AS POSSIBLE. INSTALLED MATERIALS, SUCH AS HAY BALES AND SILT FENCE MUST BE REMOVED AND DISPOSED IN ACCORDANCE WITH STATE AND LOCAL REGULATIONS AND REQUIREMENTS. THE STREAM BED, BANKS AND AREAS AFFECTED BY CONSTRUCTION OF THE TEMPORARY EQUIPMENT CROSSING SHOULD BE RESTORED TO A STABLE CONDITION. IF REQUIRED TO PREVENT TRANSPORT OF SEDIMENTATION TO THE STREAM, SILT FENCE SHOULD BE INSTALLED AT THE TOP OF THE BANKS.



CROSS SECTION B–B

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TYPICAL RAILCAR BRIDGE CROSSING

PROJECT: [illegible]

DETAIL 18a

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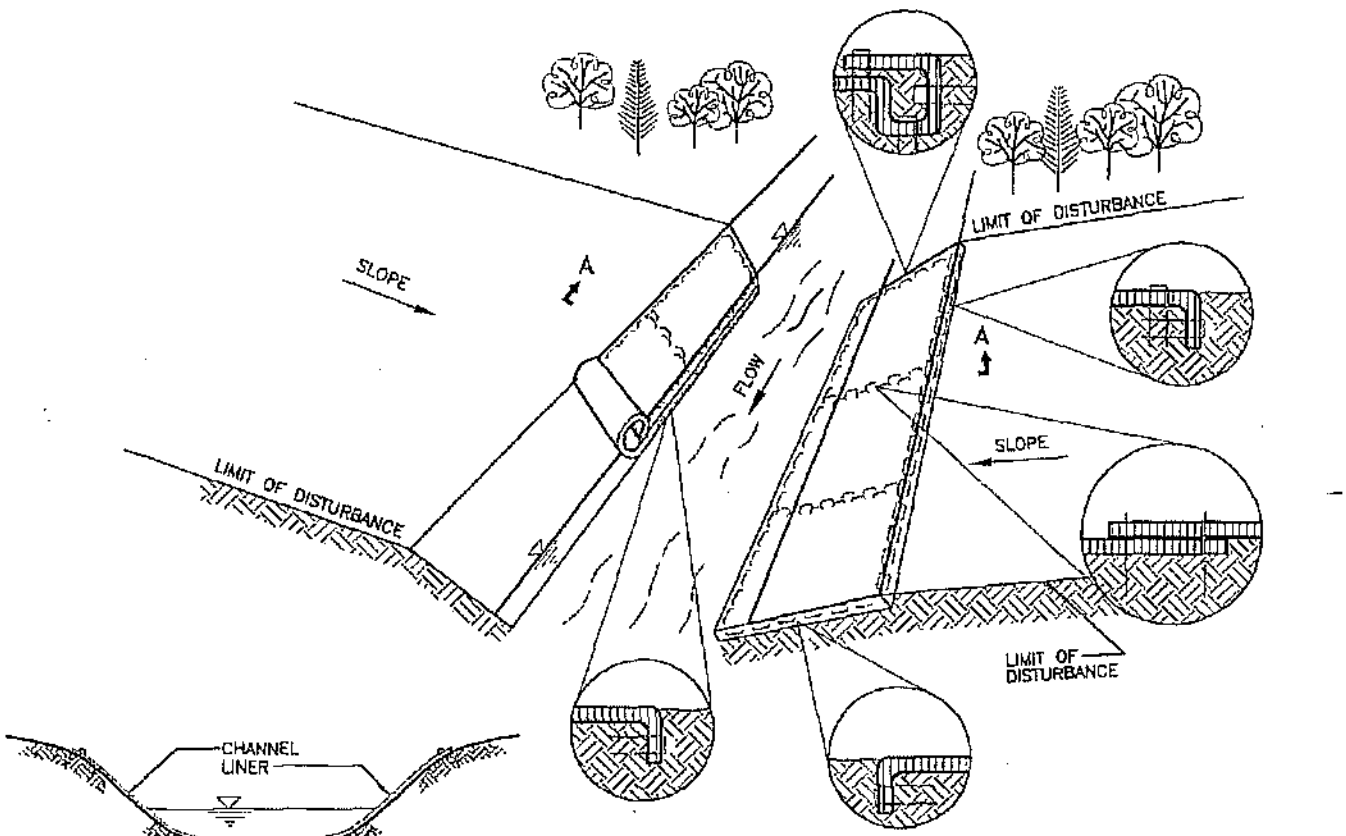
K-00-P-7000-300	ALS	JTG	RG	[illegible]



SECTION

SECTION A–A

NOTES:

1. INSTALL AND ANCHOR LINERS FOLLOWING MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SOIL BEFORE INSTALLING CHANNEL LINER, INLCUDING THE APPLICATION OF FERTILIZER AND SEED. CHANNEL LINERS SHOULD EXTEND COMPLETELY ACROSS DISTURBED BANK AREAS TO PROTECT ERODIBLE SURFACES.
3. BEGIN AT THE END OF THE CHANNEL BY ANCHORING THE LINER IN A TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
4. ROLL LINER IN DIRECTION OF WATER FLOW.
5. INSTALL LINERS END–OVER–END (SHINGLE STYLE) WITH OVERLAP USEING A DOUBLE ROW OF STAGGERED STAPLES 4 In. (100 mm) APART TO SECURE LINER.
6. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 ft. (9 TO 12 m) INTERVALS. USE A ROW OF STAPLES 4 In. (100 mm) BELOW THE FIRST ROW IN A STAGGERED PATTERN.
7. INSTALL CHANNEL LINER TO THE TOP OF THE DEFINED CHANNEL SECTION. TWO OR MORE ROWS OF BLANKETS MAY BE NECESSARY. THESE LINERS MUST BE OVERLAPPED 4 In. (100 mm) AND STAPLED.
8. THE CHANNEL LINER SHOULD EXTEND TO THE BASE OF THE CHANNEL AND STAPLED. FOR CHANNELS WITH VERY LITTLE OR NO FLOW, EXTEND A MIN. OF 1 ft. (300 mm) BELOW THE LOW WATER LEVEL AND STAPLE IN PLACE.
9. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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FLEXIBLE CHANNEL LINER INSTALLATION

PROJECT: 50308E

DETAIL 19

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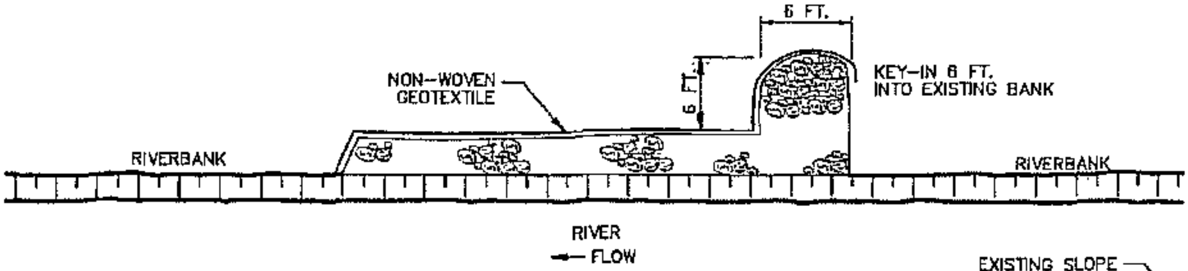
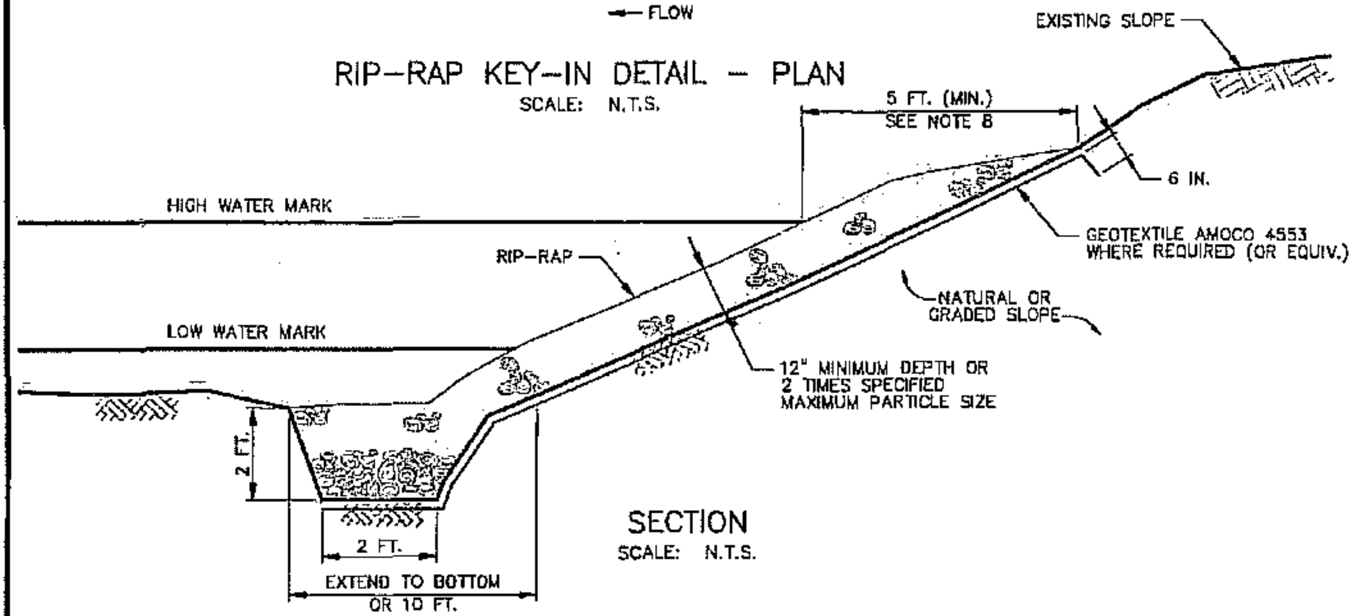


RIP-RAP KEY-IN DETAIL - PLAN
SCALE: N.T.S.



SECTION
SCALE: N.T.S.

NOTES:

1. REMOVE ALL STUMPS, ORGANIC MATERIAL, AND PREPARE BANKS TO A STABLE CONFIGURATION TO A MAXIMUM SLOPE OF 2 HORIZONTAL TO 1 VERTICAL.
2. CONSTRUCT TOE TRENCH TO KEY IN BOTTOM OF RIP-RAP PROTECTION.
3. INSTALL FILTER CLOTH (GEOTEXTILE), SUCH AS AMOCO 4553 OR EQUIVALENT, UNDER ROCK WHERE SPECIFIED OR AS DIRECTED BY THE COMPANY. ADJOINING EDGES OF CLOTH SHALL OVERLAP A MINIMUM OF 12"
4. ROCK UTILIZED FOR RIP-RAP SHALL CONSIST OF SOUND, DURABLE ROCK, AND RESISTANT TO WEATHERING. INDIVIDUAL PIECES SHOULD BE ANGULAR, BLOCK SHAPED, AND HAVE A MINIMUM SPECIFIC GRAVITY OF 2.2.
5. INSTALL RIP-RAP TO A THICKNESS OF APPROXIMATELY 2 TIMES THE MAXIMUM EQUIVALENT DIAMETER OF THE RIP-RAP. EACH LOAD SHOULD BE WELL GRADED. A WELL GRADED MIXTURE IS COMPOSED 60% (MINIMUM) OF LARGER SIZES WITH 40% OF SMALLER SIZES TO FILL THE VOIDS.
6. SIZE OF RIP-RAP IS DEPENDENT UPON THE PREDICTED FLOW CONDITIONS.
7. KEY IN THE EDGES OF THE RIP-RAP AND FILTER CLOTH TO NATURAL GROUND CONTOURS SO THAT UNDERMINING DOES NOT OCCUR.
8. RIP-RAP IS TO BE INSTALLED TO 2 FT. ABOVE THE NORMAL HIGH WATER MARK OR 5 FT. ALONG THE SLOPE, WHICHEVER IS LESS.
9. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE TO SUIT ACTUAL SITE CONDITIONS.

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TYPICAL ROCK
RIP-RAP

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PROJECT: [illegible]

DETAIL 20

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY	LAST PLOT DATE:
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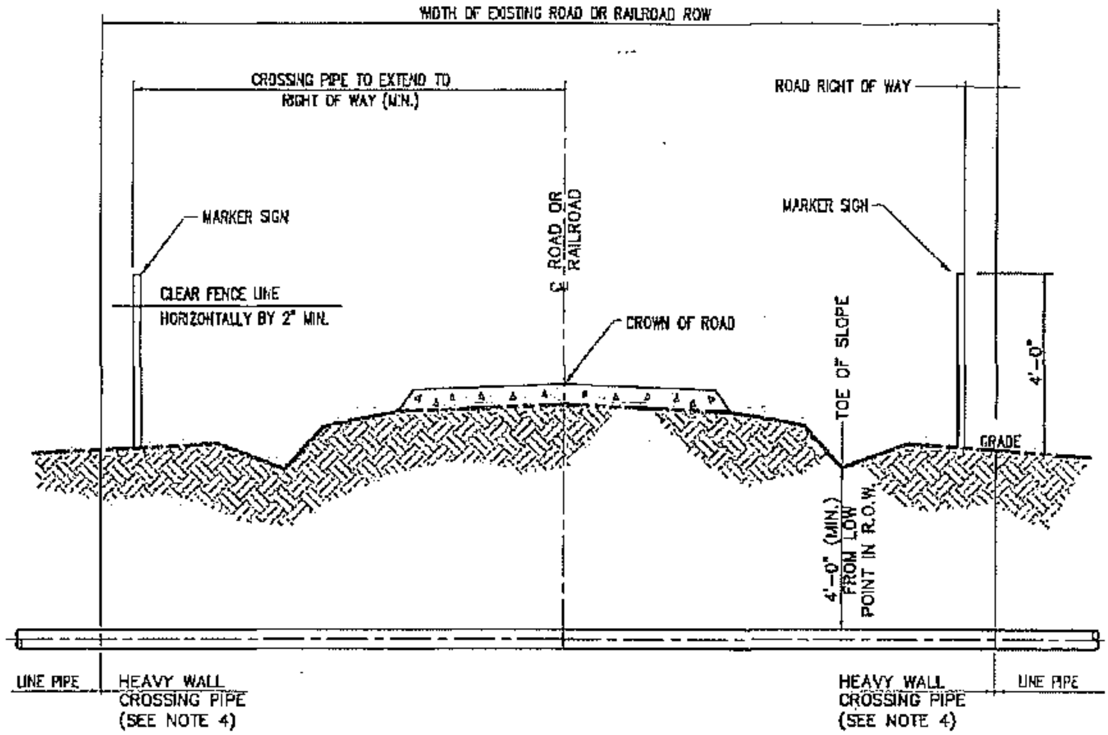
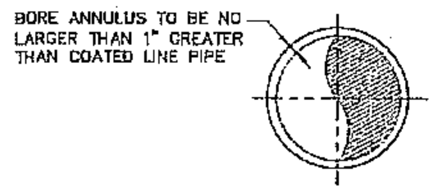


TYPICAL UNCASED ROAD CROSSING BORED



NOTES:

1. CROSSINGS SHALL BE IN ACCORDANCE WITH APPLICABLE PERMIT.
2. ROAD CROSSING PIPE SHALL EXTEND AT MINIMUM TO RIGHT OF WAY LINE UNLESS OTHERWISE SPECIFIED.
3. THE TYPE AND MINIMUM REQUIRED LENGTH OF PIPE FOR CROSSINGS OF ROADS SHALL BE AS SPECIFIED ON ALIGNMENT SHEETS.
4. PIPE FOR BORED CROSSINGS TO INCLUDE ABRASION-RESISTANT (ARB) COATING.
5. PIPELINE MARKER & TEST STATIONS TO BE INSTALLED ON ROW LINE NEXT TO FENCE IF POSSIBLE.
6. THE CROSSING PIPE SHALL BE STRAIGHT WITH NO VERTICAL OR HORIZONTAL BENDS WITHIN ROAD RIGHT OF WAY.

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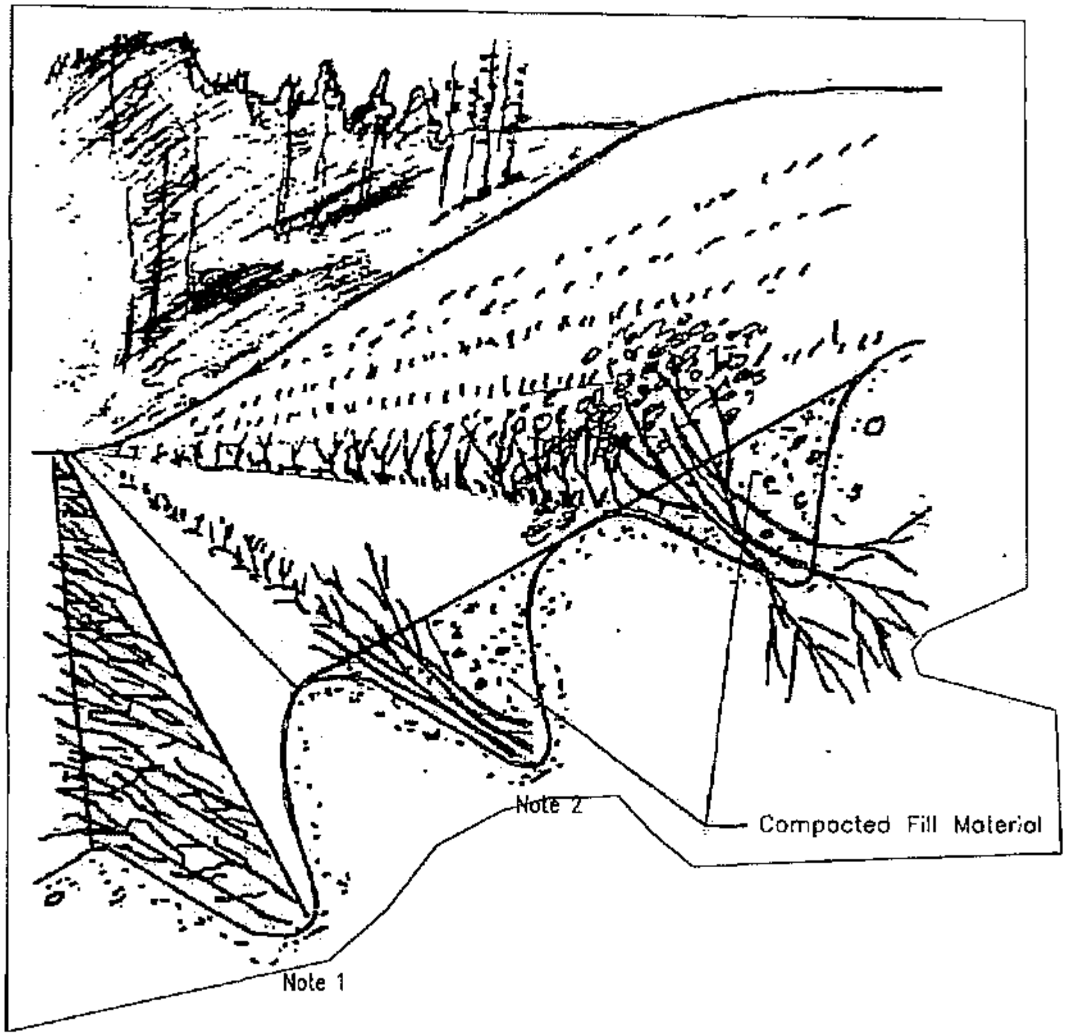
TYPICAL UNCASED ROAD CROSSING BORE DETAIL

PROJECT: 50358E

DETAIL 21

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-301	AH	JTG	RG

LAST PLOT DATE: Tue, 04 Apr 2006 — 3:01pm



NOTES:

1. CUT TRENCH ACROSS SLOPE. FILL WITH DORMANT WOODY PLANT MATERIAL.
2. FILL IS PLACED ON TOP OF BRANCH LAYER AND COMPACTED.
3. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT SITE CONDITIONS.

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NO.	REVISION	DATE
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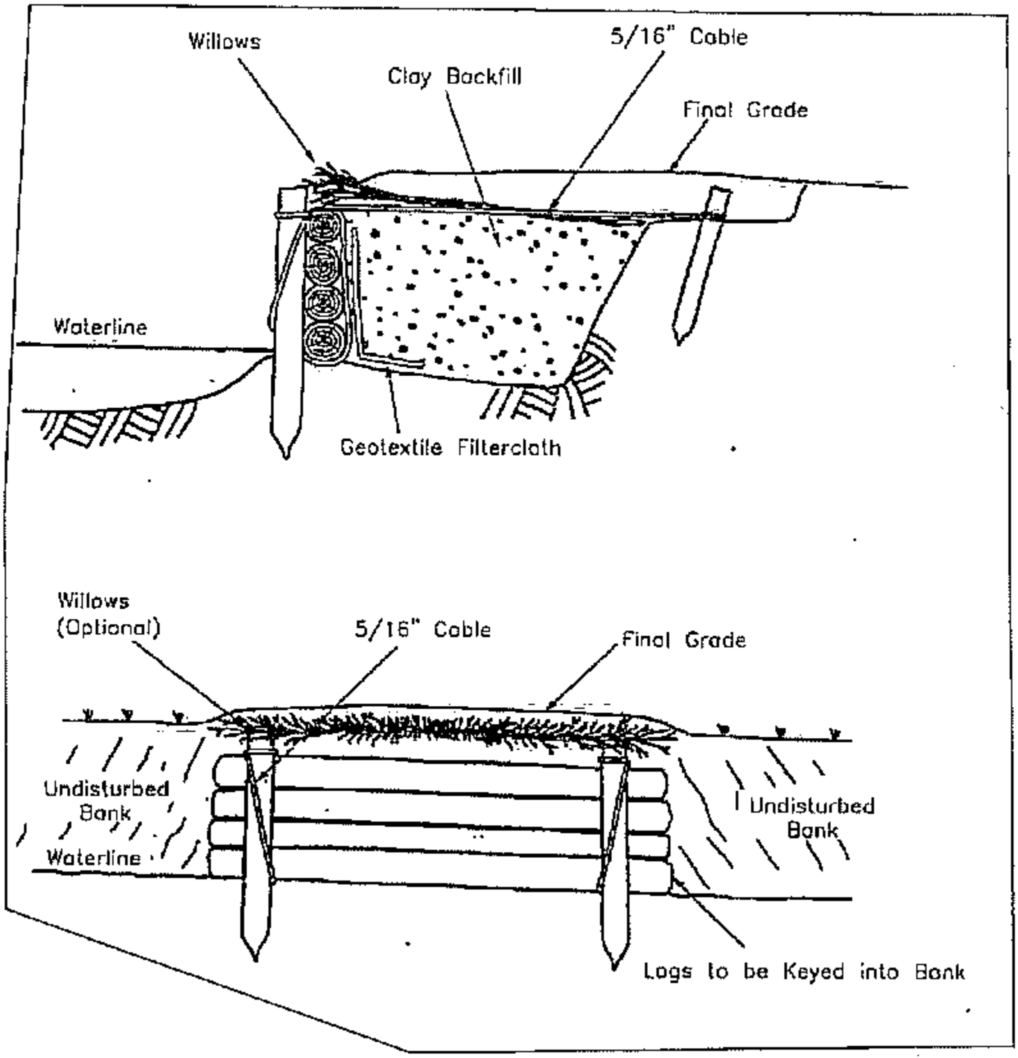
STREAMBANK RECLAMATION-BRUSH LAYER IN CROSS CUT SLOPE

PROJECT: 50380E

DETAIL 22

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-301	NY	GC	LAG

LAST PLOT DATE: [illegible]



NOTES:

1. LOG WALLS TO BE CONSTRUCTED USING CONIFEROUS MATERIAL.
2. NATURE BACKFILL OR LOOSE GRADE MATERIAL SHOULD BE USED AS FILL MATERIAL.
3. ANCHOR PILINGS OR DEADMAN ANCHORS TO BE USED TO SECURE CABLE IN BANK.
4. NON-WOVEN FILTER CLOTH (NYLEX C34 OR EQUIVALENT) TO BE USED TO LINE LOG WALL.
5. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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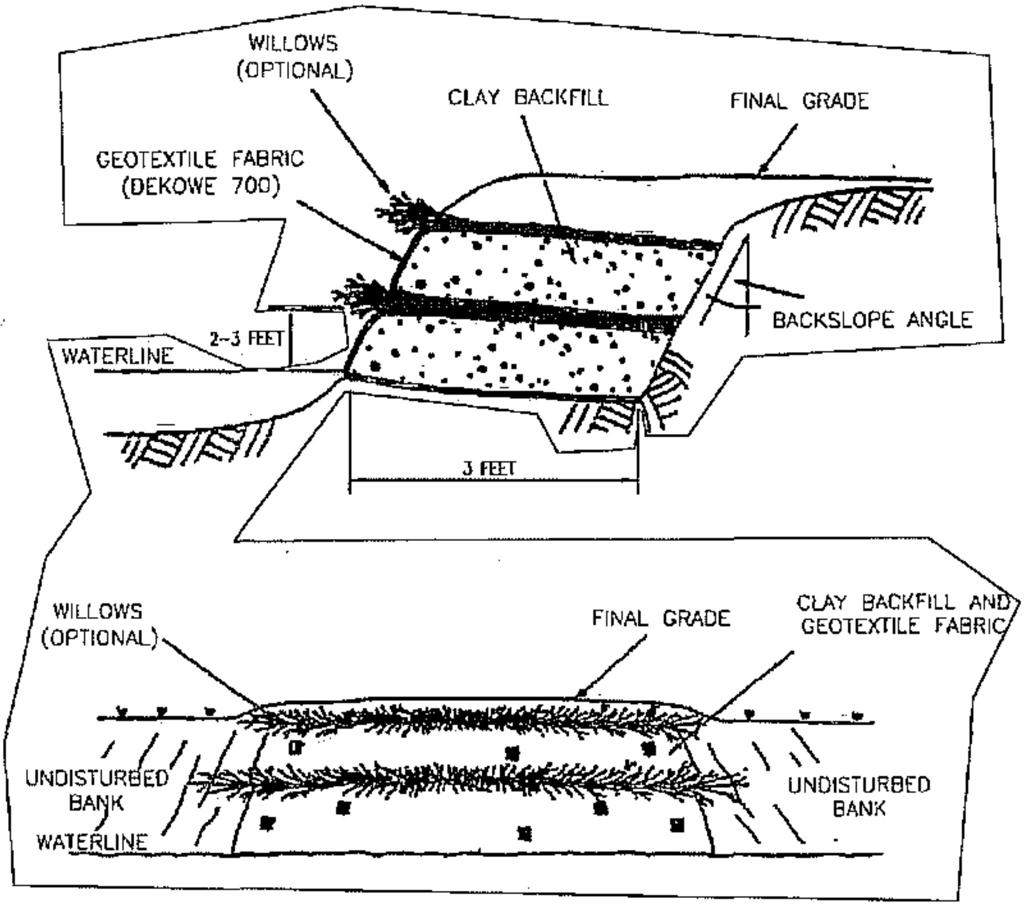
STREAMBANK RECLAMATION-LOGWALL

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-301	NY	GC	LAG

PROJECT:

DETAIL 23

LAST PLOT DATE:



NOTES:

1. NATURE BACKFILL OR LOOSE GRADE MATERIAL SHOULD BE USED TO MINIMIZE AIR SPACES. THIS ALLOWS PROPER SOIL FABRIC CONTACT, WHICH MINIMIZES STEELING AND SCOURING DURING RUNOFF AND ENSURES SURVIVAL OF THE WILLOW CUTTINGS.
2. PLYWOOD FORMS (8X2 FEET) MAY BE REQUIRED TO HELP RECONSTRUCT STEEP OR VERTICAL BANKS.
3. GRID LAYERS SHOULD NOT EXCEED 3 FEET IN HEIGHT WITH A MINIMUM OF 3 FEET SET IN BANK.
4. WILLOWS SHOULD BE HARVESTED AS CLOSE TO INSTALLATION AS POSSIBLE, PREFERABLY THE PREVIOUS DAY BUT NO MORE THAN 2 DAYS EARLY.
5. WILLOWS SHOULD BE 0.5 TO 1 INCH IN DIAMETER AND 2 TO 3 FEET LONG WITH NO MORE THAN 10 INCHES LEFT EXPOSED.
6. PLANTING RATE SHOULD BE APPROXIMATELY 1 STEM PER 6 INCHES.
7. INSTALLATION TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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STREAMBANK RECLAMATION-VEGETATED GEOTEXTILE INSTALLATION

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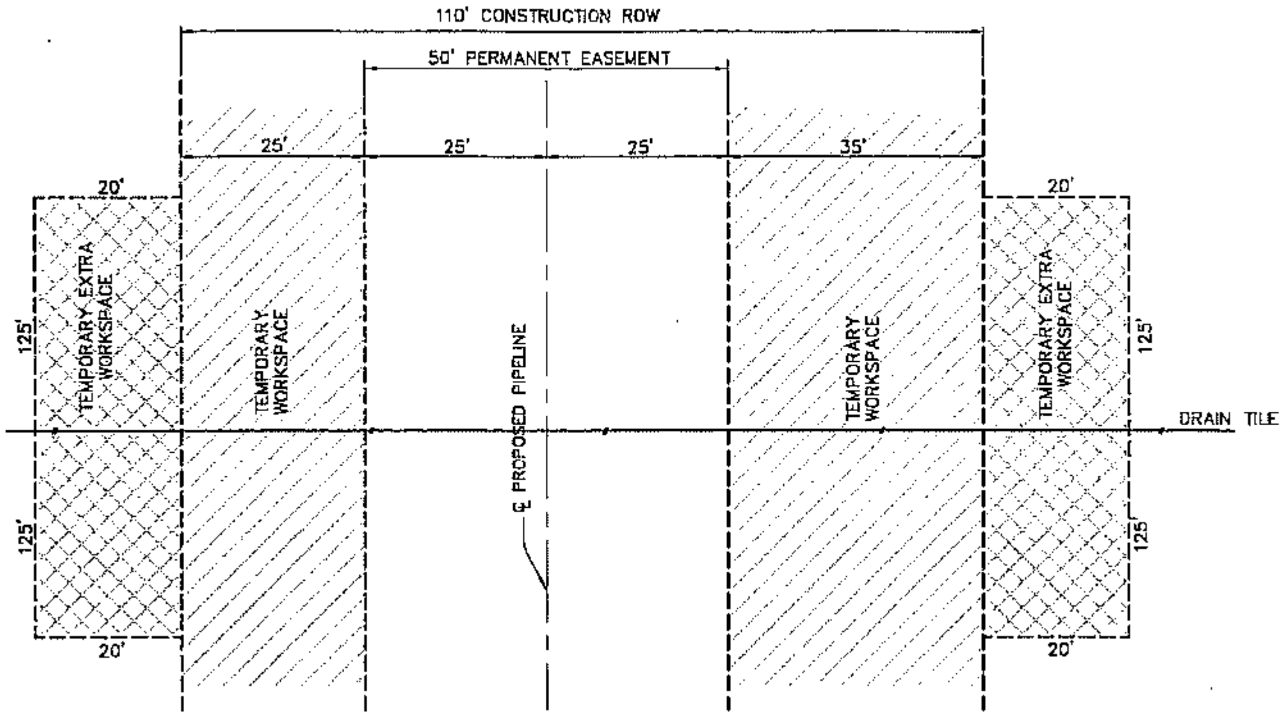
K-00-P-7000-301	NY	GC	LAG

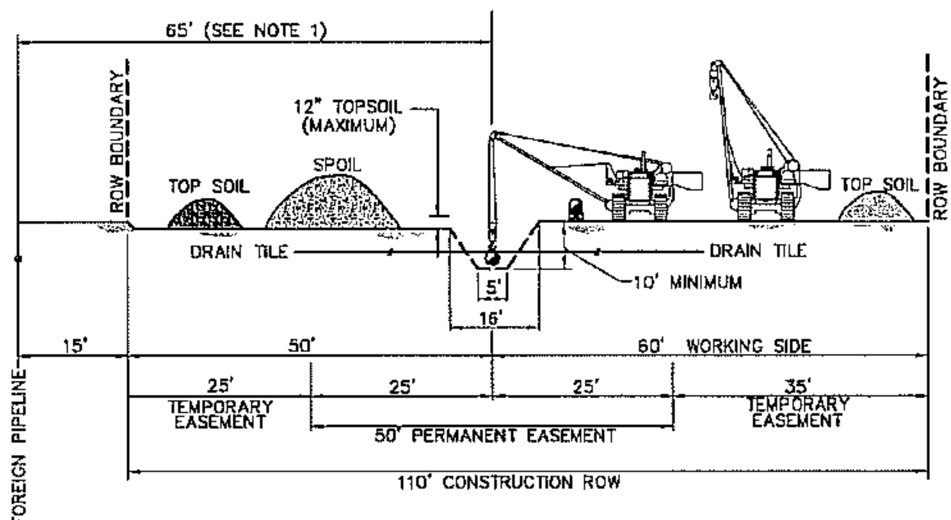
PROJECT: [illegible]

DETAIL 24

LAST PLOT DATE: [illegible]



PLAN



ELEVATION
N.T.S.

NOTES:

1. THE OFFSET FROM A FOREIGN PIPELINE, WHERE APPLICABLE, WILL BE 40' FOR MOST LOCATION. BUT MAY BE INCREASED OR DECREASED DEPENDING ON THE SITE SPECIFIC CONSTRUCTION REQUIREMENTS.
2. THE MINIMUM CLEARANCE BETWEEN THE TOP OF PIPE AND THE BOTTOM OF DRAIN TILE WILL BE 12 INCHES.
3. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY KEYSTONE AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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KEYSTONE PIPELINE PROJECT

TYPICAL ROW LAYOUT/SOIL HANDLING 110' CONST. R.O.W. 50' ESMT. DRAIN TILE CROSSING

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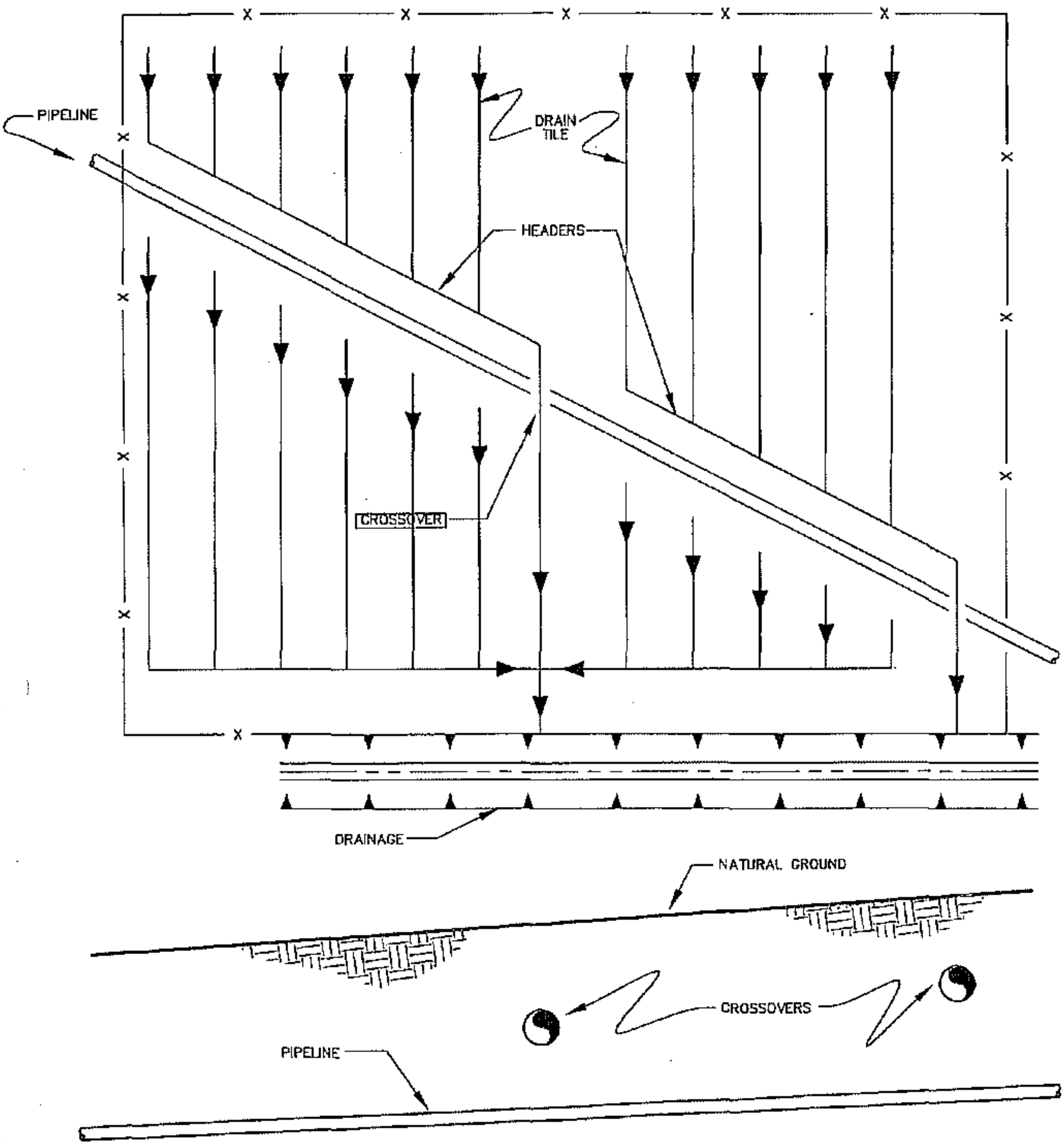
PROJECT: 50388E

DETAIL 25

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-305	ALS	BLS	RG

LAST PLOT DATE:

HEADER / MAIN CROSSOVERS OF PIPELINE



PROFILE

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HEADER / MAIN CROSSOVERS OF PIPELINE

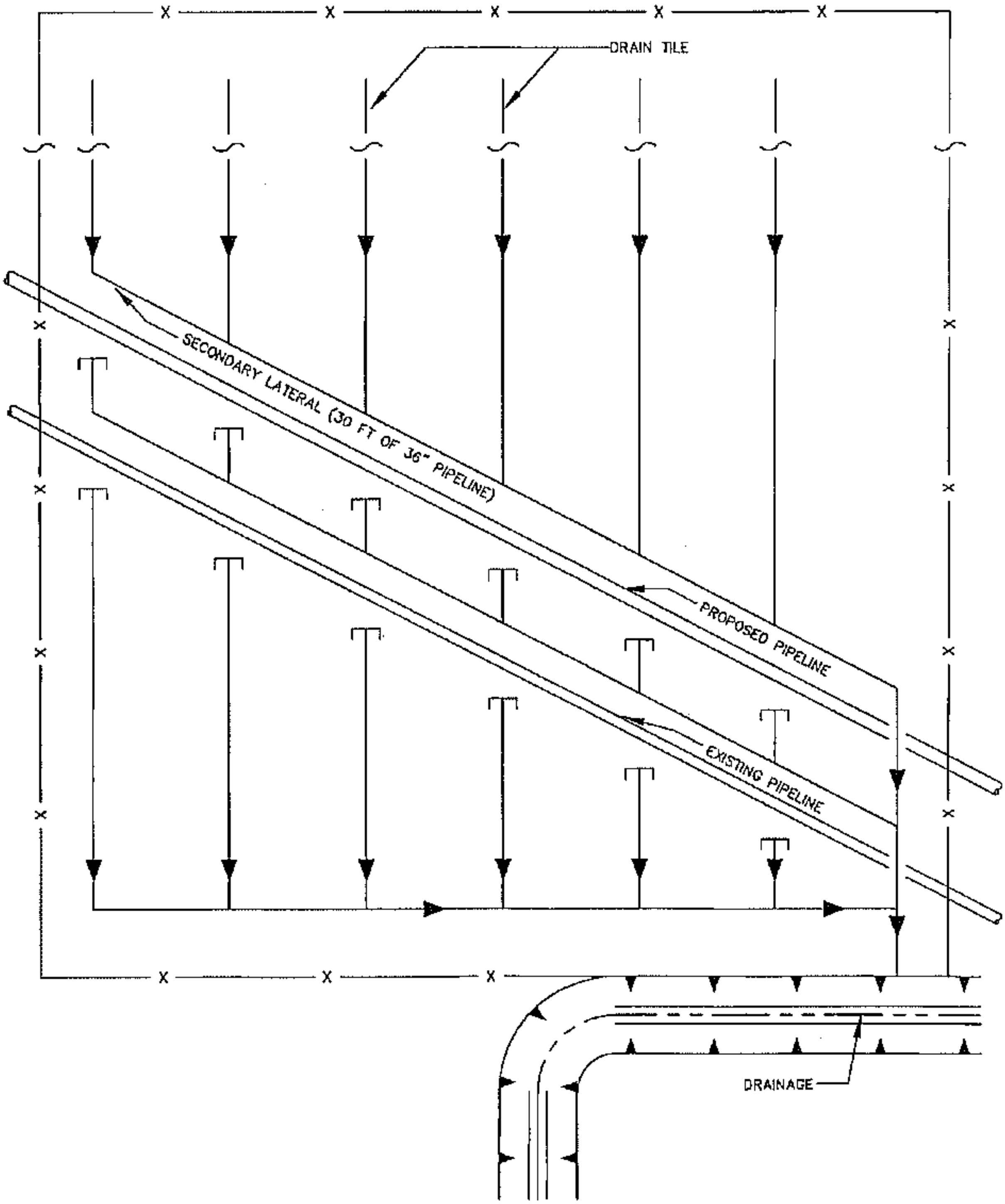
PROJECT: [illegible]

DETAIL 26

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-304	ALS	JTG	RG

LAST PLOT DATE: [illegible]

RELOCATE / REPLACE DRAINAGE HEADER / MAIN



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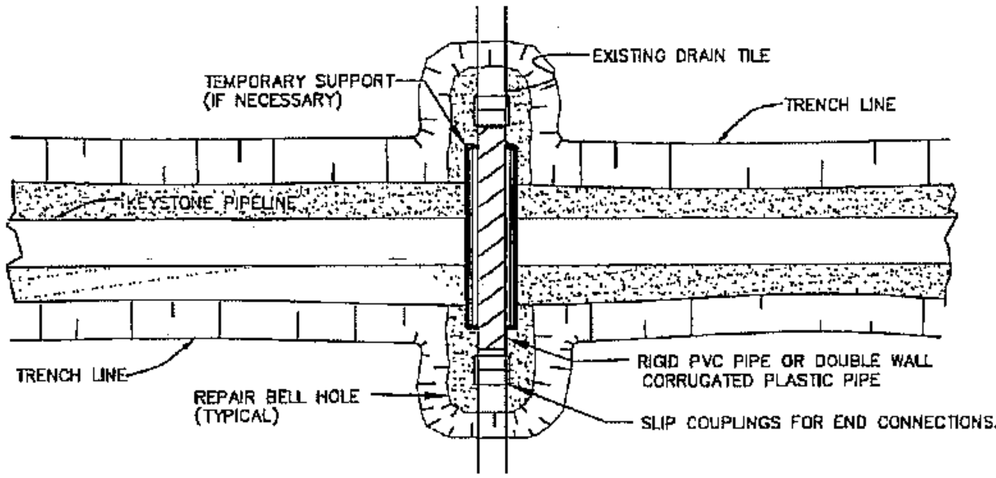
HEADER / MAIN
CROSSOVERS OF PIPELINE

PROJECT:

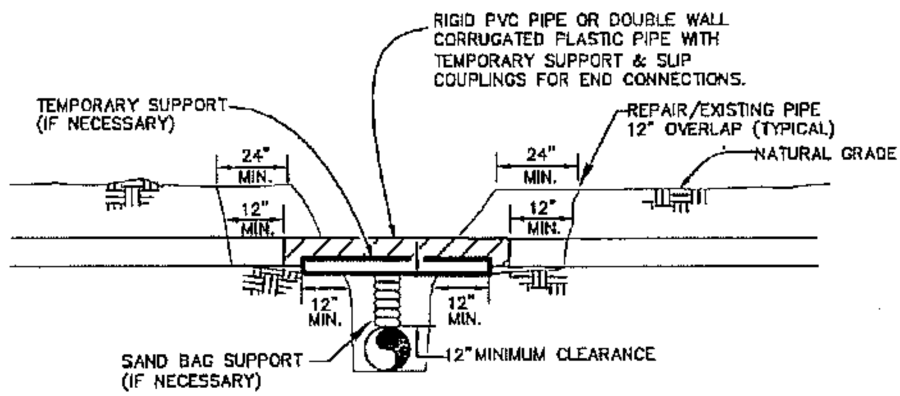
DETAIL 27

DRAWING NUMBER	DRAWN BY	CHECKED BY	APPROVED BY
K-00-P-7000-304	ALS	JTG	RG

LAST PLOT DATE:



PLAN



CROSS SECTION

NOTES:

1. IMMEDIATELY REPAIR TILE IF WATER IS FLOWING THROUGH TILE AT TIME OF TRENCHING.
2. SCREEN ALL EXPOSED ENDS OF TILE LINES.

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KEYSTONE PIPELINE PROJECT

DRAINAGE AND IRRIGATION TEMPORARY DRAIN TILE REPAIR

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PROJECT: [illegible]

DETAIL 28

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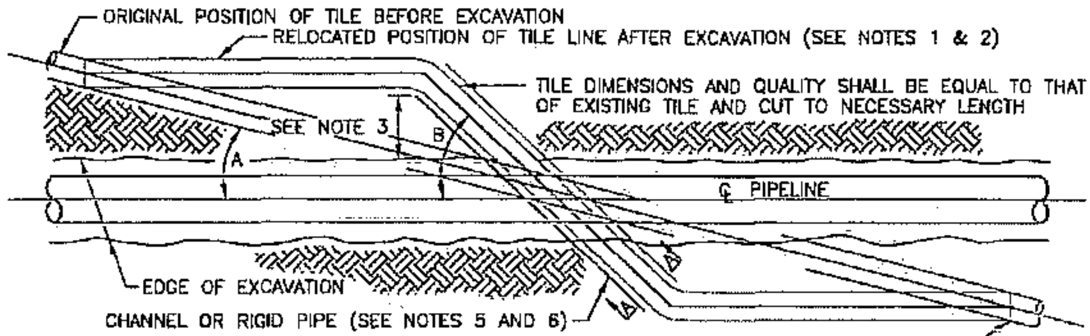
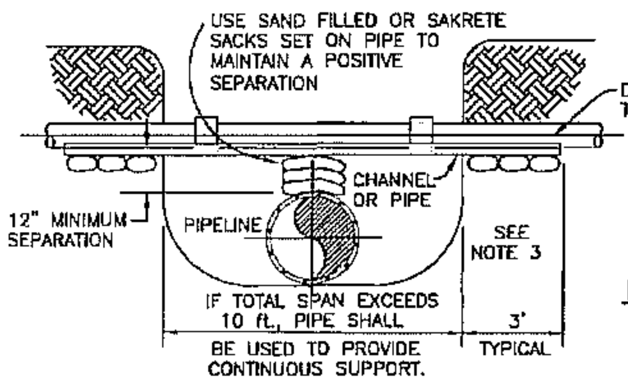
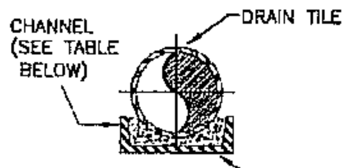


PLAN VIEW

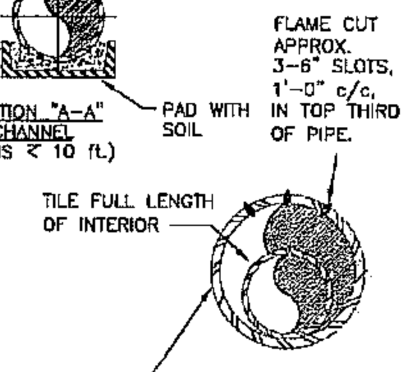




SECTION "A-A" CHANNEL

(SPANS ≯ 10 ft.)

END VIEWS



SECTION "A–A" RIGID PIPE

(SPANS > 10 ft.)

MINIMUM SUPPORT TABLE			
TILE SIZE	CHANNEL SIZE	PIPE SIZE	
3"	4" @ 5.4 #/ft.	4"	STD. WT
4"–5"	5" @ 6.7 #/ft.	6"	STD. WT
6"–9"	7" @ 9.8 #/ft.	8"–10"	STD. WT
10"	10" @ 15.3 #/ft.	12"	STD. WT

NOTES

1. TILE REPAIR SHALL MAINTAIN ORIGINAL ALIGNMENT AND GRADIENT WHEN ANGLE "A", BETWEEN PIPELINE AND ORIGINAL TILE, IS MORE THAN 20° UNLESS OTHERWISE DIRECTED BY KEYSTONE REPRESENTATIVE.
2. WHEN ANGLE A IS LESS THAN 20°, UNLESS OTHERWISE DIRECTED BY COMPANY, ANGLE "B" SHALL BE 45° FOR USUAL WIDTHS OF TRENCH. FOR EXTRA WIDTHS IT MAY BE GREATER AS DIRECTED BY KEYSTONE REPRESENTATIVE.
3. 3'–0" MINIMUM LENGTH OF CHANNEL OR RIGID PIPE SHALL BE SUPPORTED BY UNDISTURBED SOIL, OR IF CROSSING IS NOT AT RIGHT ANGLES TO GAS PIPELINE, EQUIVALENT LENGTH PERPENDICULAR TO TRENCH. SHIM WITH SAKRETE, SAND BAGS OR CONCRETE BLOCKS TO UNDISTURBED SOIL FOR SUPPORT AND DRAINAGE GRADIENT MAINTENANCE (TYPICAL BOTH SIDES).
4. DRAINAGE TILE SHALL BE REPLACED SO THAT ITS FORMER GRADIENT AND ALIGNMENT ARE RESTORED.
5. DIAMETER OF RIGID PIPE SHALL BE OF ADEQUATE SIZE TO ALLOW FOR THE INSTALLATION OF THE TILE FOR THE FULL LENGTH OF THE RIGID PIPE.
6. OTHER METHODS OF SUPPORTING DRAIN TILE MAY BE USED IF THE ALTERNATE PROPOSED IS EQUIVALENT IN STRENGTH TO THE CHANNEL/PIPE SECTIONS SHOWN AND IF APPROVED BY THE KEYSTONE REPRESENTATIVE IN ADVANCE. SITE SPECIFIC ALTERNATE SUPPORT SYSTEM TO BE DEVELOPED BY KEYSTONE REPRESENTATIVE AND FURNISHED TO CONTRACTOR FOR SPANS IN EXCESS OF 20 FEET, TILE GREATER THAN 10" DIAMETER, AND FOR "HEADER" SYSTEMS.
7. ALL MATERIAL TO BE FURNISHED BY CONTRACTOR.
8. PRIOR TO REPAIRING TILE, CONTRACTOR SHALL PROBE INTO THE EXISTING TILE TO THE FULL WIDTH OF THE RIGHT OF WAY TO DETERMINE IF ADDITIONAL DAMAGE HAS OCCURRED. ALL DAMAGED/DISTURBED TILE SHALL BE REPAIRED AS NEAR AS PRACTICABLE TO ITS ORIGINAL OR BETTER CONDITION.
9. "NIGHT CAP" OPEN ENDS OF PIPE AND/OR DRAIN TILES IF REPAIRS ARE NOT COMPLETED BY END OF WORK DAY.

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KEYSTONE PIPELINE PROJECT

DRAINAGE AND IRRIGATION PERMANENT DRAIN TILE REPAIR

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DETAIL 29

LAST PLOT DATE: Tue, 04 Apr 2006 – 3:50pm

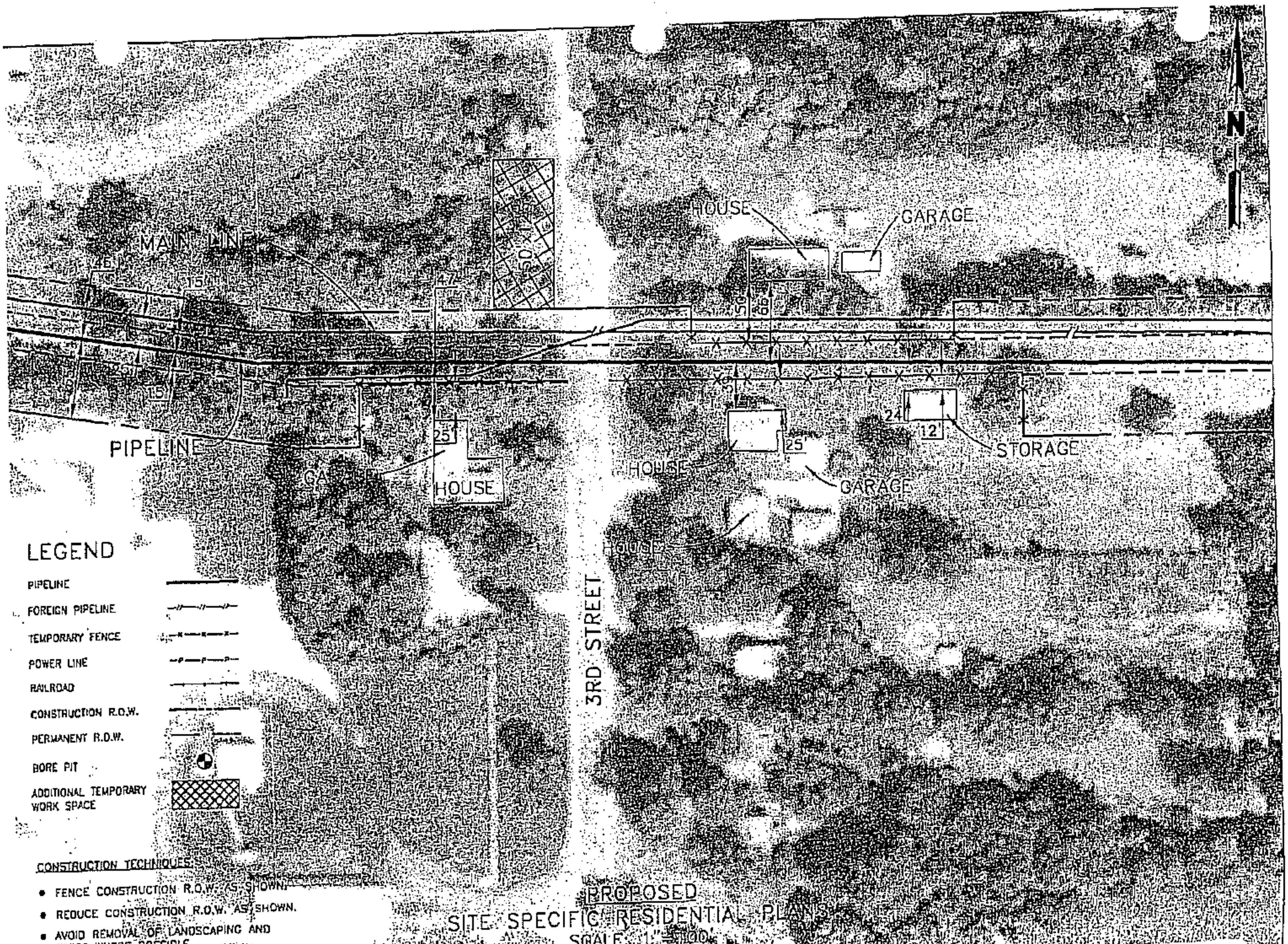
N
MAIN LINE
PIPELINE
HOUSE
GARAGE
HOUSE
GARAGE
HOUSE
STORAGE
GARAGE
HOUSE
3RD STREET
LEGEND
PIPELINE
FOREIGN PIPELINE
TEMPORARY FENCE
POWER LINE
RAILROAD
CONSTRUCTION R.O.W.
PERMANENT R.O.W.
BORE PIT
ADDITIONAL TEMPORARY WORK SPACE
CONSTRUCTION TECHNIQUES:
• FENCE CONSTRUCTION R.O.W. AS SHOWN.
• REDUCE CONSTRUCTION R.O.W. AS SHOWN.
• AVOID REMOVAL OF LANDSCAPING AND TREES WHERE POSSIBLE.
• USE DRAG SECTION OR STOVE PIPE CONSTRUCTION TECHNIQUE.
PROPOSED
SITE SPECIFIC RESIDENTIAL PLANS
SCALE: 1" = 100'

FIGURE 1

Appendix F
Waterbody Crossing Table

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
KEYSTONE MAINLINE					
NORTH DAKOTA					
Cavalier	0.6	Unnamed	Intermittent Stream/River		
Cavalier	1.7	Unnamed	Intermittent Stream/River		
Cavalier	2.6	Unnamed	Intermittent Stream/River		
Cavalier	3.6	Unnamed	Intermittent Stream/River		
Cavalier	5.1	Unnamed	Intermittent Stream/River		
Pembina	7.1	Pembina River	Perennial Stream/River	Fish and Other Aquatic Biota; Recreation, Class 1A	Fully Supporting but Threatened
Pembina	10.5	Unnamed	Intermittent Stream/River		
Pembina	10.8	Unnamed	Intermittent Stream/River		
Pembina	13.1	Unnamed	Intermittent Stream/River		
Pembina	16.1	Unnamed	Intermittent Stream/River		
Pembina	16.6	Unnamed	Intermittent Stream/River		
Pembina	16.7	Unnamed	Intermittent Stream/River		
Pembina	17.0	Unnamed	Intermittent Stream/River		
Pembina	17.4	Unnamed	Intermittent Stream/River		
Pembina	17.8	Unnamed	Intermittent Stream/River		
Pembina	18.4	Tongue R.	Perennial Stream/River	Fish and Other Aquatic Biota, Class II	Fully Supporting but Threatened
Pembina	20.4	Unnamed	Intermittent Stream/River		
Pembina	20.6	Unnamed	Intermittent Stream/River		
Pembina	21.5	Unnamed	Intermittent Stream/River		
Pembina	22.8	Unnamed	Intermittent Stream/River		
Pembina	23.7	Unnamed	Intermittent Stream/River		
Pembina	24.7	Unnamed	Intermittent Stream/River		
Pembina	26.1	Unnamed	Intermittent Stream/River		
Pembina	26.7	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Pembina	27.9	Unnamed	Intermittent Stream/River		
Pembina	29.4	North Branch Parker River	Intermittent Stream/River	Fish and Other Aquatic Biota, Class III	Fully Supporting but Threatened
Pembina	31.0	Unnamed	Intermittent Stream/River		
Pembina	31.8	Unnamed	Intermittent Stream/River		
Walsh	33.2	Unnamed	Intermittent Stream/River		
Walsh	33.3	Unnamed	Intermittent Stream/River		
Walsh	34.2	Unnamed	Intermittent Stream/River		
Walsh	35.3	Unnamed	Intermittent Stream/River		
Walsh	36.3	Unnamed	Intermittent Stream/River		
Walsh	37.1	Unnamed	Intermittent Stream/River		
Walsh	37.4	Unnamed	Intermittent Stream/River		
Walsh	38.1	Unnamed	Intermittent Stream/River		
Walsh	38.6	Unnamed	Intermittent Stream/River		
Walsh	39.1	Unnamed	Intermittent Stream/River		
Walsh	41.5	Unnamed	Intermittent Stream/River		
Walsh	42.2	Unnamed	Intermittent Stream/River		
Walsh	42.2	Unnamed	Intermittent Stream/River		
Walsh	42.3	Unnamed	Intermittent Stream/River		
Walsh	42.4	Unnamed	Intermittent Stream/River		
Walsh	42.9	Unnamed	Intermittent Stream/River		
Walsh	43.1	Unnamed	Intermittent Stream/River		
Walsh	43.6	Unnamed	Intermittent Stream/River		
Walsh	43.7	Unnamed	Intermittent Stream/River		
Walsh	43.9	Unnamed	Intermittent Stream/River		
Walsh	44.3	Unnamed	Intermittent Stream/River		
Walsh	44.7	Unnamed	Intermittent Stream/River		
Walsh	45.0	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Walsh	45.2	Unnamed	Intermittent Stream/River		
Walsh	46.0	Unnamed	Intermittent Stream/River		
Walsh	46.3	Unnamed	Intermittent Stream/River		
Walsh	46.8	Unnamed	Intermittent Stream/River		
Walsh	46.9	Unnamed	Intermittent Stream/River		
Walsh	47.2	Unnamed	Intermittent Stream/River		
Walsh	47.7	Unnamed	Intermittent Stream/River		
Walsh	47.8	Unnamed	Intermittent Stream/River		
Walsh	47.8	Unnamed	Intermittent Stream/River		
Walsh	48.3	Unnamed	Intermittent Stream/River		
Walsh	48.5	Unnamed	Intermittent Stream/River		
Walsh	48.5	Unnamed	Intermittent Stream/River		
Walsh	48.9	Unnamed	Intermittent Stream/River		
Walsh	49.3	Unnamed	Intermittent Stream/River		
Walsh	49.8	Unnamed	Intermittent Stream/River		
Walsh	50.0	Unnamed	Intermittent Stream/River		
Walsh	50.3	Unnamed	Intermittent Stream/River		
Walsh	50.6	Unnamed	Intermittent Stream/River		
Walsh	50.7	Unnamed	Intermittent Stream/River		
Walsh	50.7	Unnamed	Intermittent Stream/River		
Walsh	51.0	Unnamed	Intermittent Stream/River		
Walsh	51.1	Unnamed	Intermittent Stream/River		
Walsh	51.5	Unnamed	Intermittent Stream/River		
Walsh	51.8	Unnamed	Intermittent Stream/River		
Walsh	52.0	Unnamed	Intermittent Stream/River		
Walsh	52.6	Unnamed	Intermittent Stream/River		
Walsh	53.1	Unnamed	Intermittent Stream/River		
Walsh	54.0	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Walsh	54.2	Unnamed	Intermittent Stream/River		
Walsh	54.5	Middle Branch Forest River	Perennial Stream/River	Fish and Other Aquatic Biota	Not Supporting
Walsh	55.3	Unnamed	Intermittent Stream/River		
Walsh	55.6	Unnamed	Intermittent Stream/River		
Walsh	56.2	Unnamed	Intermittent Stream/River		
Nelson	57.4	Unnamed	Intermittent Stream/River		
Nelson	58.1	Unnamed	Intermittent Stream/River		
Nelson	58.8	Unnamed	Intermittent Stream/River		
Nelson	59.1	Unnamed	Intermittent Stream/River		
Nelson	59.4	Unnamed	Intermittent Stream/River		
Nelson	60.2	Unnamed	Intermittent Stream/River		
Nelson	60.3	Unnamed	Intermittent Stream/River		
Nelson	60.4	Unnamed	Intermittent Stream/River		
Nelson	61.1	Unnamed	Intermittent Stream/River		
Nelson	61.7	Unnamed	Intermittent Stream/River		
Nelson	61.8	Unnamed	Intermittent Stream/River		
Nelson	62.1	Unnamed	Intermittent Stream/River		
Nelson	62.4	Unnamed	Intermittent Stream/River		
Nelson	62.5	Unnamed	Intermittent Stream/River		
Nelson	62.9	Unnamed	Intermittent Stream/River		
Nelson	63.7	Unnamed	Intermittent Lake/Pond		
Nelson	64.0	Unnamed	Intermittent Stream/River		
Nelson	64.6	Unnamed	Intermittent Stream/River		
Nelson	65.0	Unnamed	Intermittent Lake/Pond		
Nelson	66.0	Unnamed	Intermittent Lake/Pond		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Nelson	66.9	N. Branch Turtle River	Intermittent Stream/River	Class II (Turtle River)	Not Supporting
Nelson	67.8	Unnamed	Intermittent Stream/River		
Nelson	69.0	Unnamed	Intermittent Stream/River		
Nelson	69.4	Unnamed	Intermittent Stream/River		
Nelson	69.5	Unnamed	Intermittent Stream/River		
Nelson	69.7	Unnamed	Intermittent Lake/Pond		
Nelson	75.8	Unnamed	Intermittent Stream/River		
Nelson	76.6	Goose River	Intermittent Stream/River	Fish and Other Aquatic Biota; Recreation, Class IA	Not Supporting; Fully Supporting but Threatenend
Nelson	77.7	Unnamed	Intermittent Stream/River		
Nelson	79.0	Unnamed	Intermittent Stream/River		
Nelson	79.9	Unnamed	Intermittent Stream/River		
Nelson	84.6	Unnamed	Intermittent Stream/River		
Nelson	84.7	Goose Creek	Intermittent Stream/River		
Nelson	84.9	Unnamed	Intermittent Stream/River		
Nelson	87.4	Unnamed	Intermittent Stream/River		
Nelson	91.3	Unnamed	Intermittent Stream/River		
Nelson	91.6	Unnamed	Intermittent Stream/River		
Nelson	93.0	Unnamed	Intermittent Stream/River		
Steele	96.1	Unnamed	Intermittent Stream/River		
Steele	96.2	Unnamed	Intermittent Stream/River		
Steele	101.3	Unnamed	Intermittent Stream/River		
Steele	105.8	Unnamed	Intermittent Stream/River		
Steele	106.9	Unnamed	Intermittent Stream/River		
Steele	107.3	Unnamed	Intermittent Stream/River		
Steele	109.1	Unnamed	Intermittent Stream/River		
Steele	109.5	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Steele	112.6	Unnamed	Intermittent Stream/River		
Steele	113.1	Unnamed	Intermittent Stream/River		
Steele	116.5	Unnamed	Intermittent Stream/River		
Steele	117.9	Unnamed	Intermittent Stream/River		
Steele	119.8	Unnamed	Intermittent Stream/River		
Steele	120.0	Unnamed	Intermittent Stream/River		
Barnes	127.1	Unnamed	Intermittent Stream/River		
Barnes	127.7	Unnamed	Intermittent Stream/River		
Barnes	132.0	Unnamed	Intermittent Stream/River		
Barnes	134.1	Unnamed	Intermittent Stream/River		
Barnes	143.6	Unnamed	Intermittent Stream/River		
Barnes	144.4	Unnamed	Intermittent Stream/River		
Barnes	145.5	Unnamed	Intermittent Stream/River		
Barnes	147.5	Unnamed	Intermittent Stream/River		
Barnes	150.4	Unnamed	Intermittent Stream/River		
Barnes	151.0	Unnamed	Intermittent Stream/River		
Barnes	151.3	Unnamed	Intermittent Stream/River		
Barnes	151.5	Unnamed	Intermittent Stream/River		
Barnes	153.8	Unnamed	Intermittent Stream/River		
Barnes	154.0	Unnamed	Intermittent Stream/River		
Barnes	158.6	Unnamed	Intermittent Stream/River		
Barnes	162.2	Unnamed	Intermittent Stream/River		
Barnes	162.4	Unnamed	Intermittent Stream/River		
Ransom	168.5	Sheyenne River	Perennial Stream/River	Fish and Other Aquatic Biota; Recreation, Class IA	Fully Supporting but Threatened; Fully Supporting but Threatened/Not Supporting
Ransom	168.7	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Ransom	169.6	Unnamed	Intermittent Stream/River		
Ransom	169.7	Unnamed	Intermittent Stream/River		
Ransom	171.6	Unnamed	Intermittent Stream/River		
Ransom	172.5	Unnamed	Intermittent Stream/River		
Ransom	173.1	Unnamed	Intermittent Stream/River		
Ransom	173.2	Unnamed	Intermittent Stream/River		
Ransom	175.7	Unnamed	Intermittent Stream/River		
Ransom	176.8	Unnamed	Intermittent Stream/River		
Ransom	179.9	Unnamed	Intermittent Stream/River		
Ransom	180.2	Unnamed	Intermittent Stream/River		
Ransom	183.3	Unnamed	Intermittent Stream/River		
Sargent	197.2	Pond	Intermittent Lake/Pond		
Sargent	203.5	Unnamed	Intermittent Stream/River		
Sargent	206.6	Unnamed	Intermittent Stream/River		
Dickey	214.1	Unnamed	Intermittent Stream/River		
Dickey	215.4	Unnamed	Intermittent Stream/River		
SOUTH DAKOTA					
Marshall	228.5	Crow Creek	Intermittent Stream/River		
Marshall	228.6	Unnamed Ditch	Canal		
Day	244.3	Antelope Creek	Intermittent Stream/River		
Day	244.8	Unnamed	Intermittent Stream/River		
Day	244.8	Unnamed	Intermittent Stream/River		
Day	244.9	Unnamed	Intermittent Stream/River		
Day	244.9	Unnamed	Intermittent Stream/River		
Day	245.1	Unnamed	Intermittent Stream/River		
Day	248.3	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Day	249.6	Unnamed	Intermittent Stream/River		
Day	251.1	Unnamed	Intermittent Stream/River		
Day	251.8	Unnamed	Intermittent Stream/River		
Day	252.8	Unnamed	Intermittent Stream/River		
Day	253.8	Unnamed	Intermittent Stream/River		
Day	253.9	Pond	Intermittent Lake/Pond		
Day	253.9	Pond	Intermittent Lake/Pond		
Day	255.5	Unnamed	Intermittent Stream/River		
Day	256.2	Unnamed	Intermittent Stream/River		
Day	257.5	Unnamed	Intermittent Stream/River		
Day	258.7	Mud Creek	Perennial Stream/River		
Day	260.1	Unnamed	Intermittent Stream/River		
Day	260.4	Unnamed	Intermittent Stream/River		
Day	261.3	Unnamed	Intermittent Stream/River		
Day	264.5	Unnamed	Intermittent Stream/River		
Day	264.7	Unnamed	Intermittent Stream/River		
Day	265.7	Unnamed	Intermittent Stream/River		
Day	265.9	Unnamed	Intermittent Stream/River		
Day	266.2	Unnamed	Intermittent Stream/River		
Day	267.6	Unnamed	Intermittent Stream/River		
Day	268.1	Unnamed	Intermittent Stream/River		
Day	269.1	Unnamed	Intermittent Stream/River		
Day	269.8	Unnamed	Intermittent Stream/River		
Day	270.7	Unnamed	Intermittent Stream/River		
Day	271.3	Unnamed	Intermittent Stream/River		
Day	271.4	Unnamed	Intermittent Stream/River		
Day	272.1	Unnamed	Intermittent Stream/River		
Day	272.2	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Clark	273.9	Unnamed	Intermittent Stream/River		
Clark	276.4	Unnamed	Intermittent Stream/River		
Clark	276.8	Unnamed	Intermittent Stream/River		
Clark	277.3	Unnamed	Intermittent Stream/River		
Clark	277.7	Unnamed	Intermittent Stream/River		
Clark	279.0	Unnamed	Intermittent Stream/River		
Clark	279.1	Unnamed	Intermittent Stream/River		
Clark	279.7	Unnamed	Intermittent Stream/River		
Clark	280.3	Unnamed	Intermittent Stream/River		
Clark	280.5	Unnamed	Intermittent Stream/River		
Clark	281.5	Unnamed	Intermittent Stream/River		
Clark	282.2	Unnamed	Intermittent Stream/River		
Clark	283.7	Unnamed	Intermittent Stream/River		
Clark	284.8	Unnamed	Intermittent Stream/River		
Clark	285.6	Unnamed	Intermittent Stream/River		
Clark	287.5	Unnamed	Intermittent Stream/River		
Clark	288.2	Unnamed	Intermittent Stream/River		
Clark	288.9	Unnamed	Intermittent Stream/River		
Clark	290.2	Unnamed	Intermittent Stream/River		
Clark	290.7	Unnamed	Intermittent Stream/River		
Clark	292.5	Unnamed	Intermittent Stream/River		
Clark	298.1	Foster Creek	Intermittent Stream/River		
Clark	299.1	Unnamed	Intermittent Stream/River		
Clark	304.1	Unnamed	Intermittent Stream/River		
Clark	304.3	Unnamed	Intermittent Stream/River		
Clark	306.2	Unnamed	Intermittent Stream/River		
Beadle	309.5	Unnamed	Intermittent Stream/River		
Beadle	311.2	Unnamed	Intermittent Lake/Pond		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Beadle	311.2	Unnamed	Intermittent Lake/Pond		
Beadle	311.2	Unnamed	Intermittent Lake/Pond		
Beadle	313.2	Unnamed	Intermittent Lake/Pond		
Beadle	313.8	Unnamed	Intermittent Stream/River		
Beadle	315.0	Unnamed	Intermittent Stream/River		
Beadle	315.1	Pond	Intermittent Lake/Pond		
Beadle	315.6	Pearl Creek	Intermittent Stream/River	Warm water (WW) marginal fish life propagation waters; limited-contact recreation waters	
Beadle	316.7	Unnamed	Intermittent Stream/River		
Beadle	317.1	Unnamed	Intermittent Stream/River		
Beadle	317.8	Middle Pearl Creek	Intermittent Stream/River		
Kingsbury	326.1	South Fork Pearl Creek	Intermittent Stream/River		
Kingsbury	335.0	Unnamed	Intermittent Stream/River		
Kingsbury	337.4	West Redstone Creek	Intermittent Stream/River		
Miner	340.0	Unnamed	Intermittent Stream/River		
Miner	343.1	Redstone Creek	Intermittent Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters (classification for segment in Sanborn county)	
Miner	345.0	Unnamed	Intermittent Lake/Pond		
Miner	346.0	Unnamed	Intermittent Stream/River		
Miner	347.4	Unnamed	Intermittent Stream/River		
Miner	361.4	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Miner	362.1	Rock Creek	Intermittent Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters (classification for segment in Hanson county)	
Miner	362.3	Rock Creek	Intermittent Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters (classification for segment in Hanson county)	
Miner	362.3	Rock Creek	Intermittent Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters (classification for segment in Hanson county)	
Hanson	367.9	Unnamed Pond	Intermittent Lake/Pond		
Hanson	367.9	Unnamed Pond	Intermittent Lake/Pond		
Hanson	372.6	Unnamed	Intermittent Stream/River		
Hanson	375.7	Wolf Creek	Intermittent Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters	No Data
Hanson	377.6	Unnamed	Intermittent Stream/River		
McCook	379.6	Unnamed	Intermittent Stream/River		
McCook	384.0	Wolf Creek	Intermittent Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters	No Data
McCook	386.5	Unnamed	Intermittent Stream/River		
McCook	386.7	Unnamed	Intermittent Stream/River		
McCook	387.6	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Hutchinson	390.5	Pond	Intermittent Lake/Pond		
Hutchinson	391.0	Wolf Creek	Perennial Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters	No Data
Hutchinson	394.8	Unnamed	Intermittent Stream/River		
Hutchinson	396.0	Unnamed	Intermittent Stream/River		
Hutchinson	397.6	Unnamed	Intermittent Stream/River		
Hutchinson	398.7	Unnamed	Intermittent Stream/River		
Hutchinson	400.1	Unnamed	Intermittent Stream/River		
Hutchinson	401.0	Unnamed	Intermittent Stream/River		
Hutchinson	401.7	Unnamed	Intermittent Stream/River		
Hutchinson	406.1	Unnamed	Intermittent Stream/River		
Hutchinson	406.6	Unnamed	Intermittent Stream/River		
Hutchinson	406.8	Unnamed	Intermittent Stream/River		
Hutchinson	408.3	Unnamed	Intermittent Stream/River		
Hutchinson	408.9	Unnamed	Intermittent Stream/River		
Hutchinson	410.4	Unnamed	Intermittent Stream/River		
Yankton	414.0	Unnamed	Intermittent Stream/River		
Yankton	418.0	Unnamed	Intermittent Stream/River		
Yankton	418.4	Unnamed	Reservoir Side		
Yankton	418.4	Unnamed	Reservoir Side		
Yankton	421.7	James River	Perennial Stream/River	WW semiperm fish life propagation waters; limited-contact recreation waters	No Data
Yankton	423.5	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Yankton	428.0	Beaver Creek	Perennial Stream/River	WW marginal fish life propagation waters; limited-contact recreation waters	
Yankton/Cedar	435.8	Missouri River	Artificial Path	Primary Contact Recreation; Aquatic Life Use; Agriculture Water Supply; Industrial Water Supply	Inhibited; Inhibited; Supported; Supported
NEBRASKA					
Cedar	436.8	Unnamed	Intermittent Stream/River		
Cedar	438.2	Antelope Creek	Perennial Stream/River	No Data	No Data
Cedar	439.9	Unnamed	Intermittent Stream/River		
Cedar	440.3	Unnamed	Intermittent Stream/River		
Cedar	440.6	Unnamed	Intermittent Stream/River		
Cedar	441.8	Unnamed	Intermittent Stream/River		
Cedar	442.1	Unnamed	Intermittent Stream/River		
Cedar	442.7	Unnamed	Intermittent Stream/River		
Cedar	443.2	Unnamed	Intermittent Stream/River		
Cedar	443.4	Unnamed	Intermittent Stream/River		
Cedar	444.8	Unnamed	Intermittent Stream/River		
Cedar	445.9	Unnamed	Intermittent Stream/River		
Cedar	446.2	Unnamed	Intermittent Stream/River		
Cedar	446.6	Unnamed	Intermittent Stream/River		
Cedar	447.3	Unnamed	Intermittent Stream/River		
Cedar	447.9	West Bow Creek	Perennial Stream/River		
Cedar	448.9	Unnamed	Intermittent Stream/River		
Cedar	450.1	Unnamed	Intermittent Stream/River		
Cedar	450.7	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Cedar	451.1	Unnamed	Intermittent Stream/River		
Cedar	451.3	Norwegian Bow Creek	Perennial Stream/River	No Data	No Data
Cedar	452.1	Unnamed	Intermittent Stream/River		
Cedar	452.8	Unnamed	Intermittent Stream/River		
Cedar	453.6	Unnamed	Intermittent Stream/River		
Cedar	454.9	Unnamed	Intermittent Stream/River		
Cedar	455.5	Unnamed	Intermittent Stream/River		
Cedar	455.5	Unnamed	Intermittent Stream/River		
Cedar	455.6	Pond	Intermittent Lake/Pond		
Cedar	456.6	Bow Creek	Perennial Stream/River	No Data	No Data
Cedar	457.4	Unnamed	Intermittent Stream/River		
Cedar	459.7	Unnamed	Intermittent Stream/River		
Cedar	460.2	Pearl Creek	Intermittent Stream/River		
Cedar	461.5	Unnamed	Intermittent Stream/River		
Cedar	461.8	Unnamed	Intermittent Stream/River		
Cedar	462.2	Unnamed	Intermittent Stream/River		
Cedar	462.6	Unnamed	Intermittent Stream/River		
Cedar	463.8	Unnamed	Intermittent Stream/River		
Cedar	463.9	Unnamed	Intermittent Stream/River		
Cedar	465.1	Unnamed	Intermittent Stream/River		
Cedar	465.6	Unnamed	Intermittent Stream/River		
Cedar	466.1	Unnamed	Intermittent Stream/River		
Cedar	466.9	Unnamed	Intermittent Stream/River		
Cedar	467.4	Unnamed	Intermittent Stream/River		
Cedar	467.6	Unnamed	Intermittent Stream/River		
Cedar	468.4	Unnamed	Intermittent Stream/River		
Cedar	469.3	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Cedar	470.2	Middle Logan Creek	Perennial Stream/River	No Data	No Data
Cedar	471.0	Unnamed	Intermittent Stream/River		
Wayne	473.9	Dog Creek	Intermittent Stream/River		
Wayne	475.2	Unnamed	Intermittent Stream/River		
Wayne	475.3	Unnamed	Intermittent Stream/River		
Wayne	476.3	Deer Creek	Intermittent Stream/River		
Wayne	477.0	Tributary to Deer Creek	Intermittent Stream/River		
Wayne	478.0	Tributary to Deer Creek	Intermittent Stream/River		
Wayne	480.0	Unnamed	Intermittent Stream/River		
Wayne	481.2	South Branch Deer Creek	Intermittent Stream/River		
Wayne	481.6	Unnamed	Intermittent Stream/River		
Wayne	485.1	Unnamed	Intermittent Stream/River		
Wayne	486.1	Unnamed	Intermittent Stream/River		
Wayne	487.0	Spring Branch	Intermittent Stream/River		
Wayne	489.4	Unnamed	Intermittent Stream/River		
Wayne	490.4	Unnamed	Intermittent Stream/River		
Stanton	491.1	Unnamed	Intermittent Stream/River		
Stanton	492.6	Unnamed	Intermittent Stream/River		
Stanton	494.3	Unnamed	Intermittent Stream/River		
Stanton	495.0	Unnamed	Intermittent Stream/River		
Stanton	496.2	Unnamed	Intermittent Stream/River		
Stanton	497.1	Pleasant Run	Intermittent Stream/River		
Stanton	497.6	Unnamed	Intermittent Stream/River		
Stanton	499.7	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Stanton	502.8	Elkhorn River	Artificial Path	Primary Contact Recreation; Aquatic Life Use	Inhibited; Supported
Stanton	503.5	Union Creek	Perennial Stream/River		
Stanton	506.3	Unnamed	Intermittent Stream/River		
Stanton	507.5	Unnamed	Intermittent Stream/River		
Stanton	508.7	Unnamed	Intermittent Stream/River		
Stanton	508.8	Unnamed	Intermittent Stream/River		
Stanton	509.0	Unnamed	Intermittent Stream/River		
Stanton	510.5	Unnamed	Intermittent Stream/River		
Stanton	510.5	Unnamed	Intermittent Stream/River		
Stanton	512.6	Unnamed	Intermittent Stream/River		
Stanton	513.3	Unnamed	Intermittent Stream/River		
Stanton	515.1	Unnamed	Intermittent Stream/River		
Platte	517.3	Unnamed	Intermittent Stream/River		
Platte	517.9	Unnamed	Intermittent Stream/River		
Platte	519.4	Unnamed	Intermittent Stream/River		
Colfax	522.3	Unnamed	Intermittent Stream/River		
Colfax	522.3	Unnamed	Intermittent Stream/River		
Colfax	524.9	Unnamed	Intermittent Stream/River		
Colfax	525.0	Unnamed	Intermittent Stream/River		
Colfax	532.5	Shell Creek	Perennial Stream/River	No Data	No Data
Colfax	534.5	Unnamed	Intermittent Stream/River		
Colfax	538.2	Unnamed	Canal/Ditch		
Colfax	538.7	Unnamed	Intermittent Stream/River		
Colfax	539.8	Lost Creek	Perennial Stream/River	No Data	No Data
Colfax	539.8	Unnamed	Intermittent Stream/River		
Colfax	540.4	Unnamed	Intermittent Stream/River		
Colfax	541.0	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Colfax	541.3	Unnamed	Intermittent Stream/River		
Colfax	542.0	Platte River	Artificial Path	Primary Contact Recreation; Aquatic Life Use; Agriculture Water Supply	Inhibited; Inhibited; Supported
Colfax	542.3	Trib to Platte River	Artificial Path		
Butler	542.5	Trib to Platte River	Perennial Stream/River		
Butler	544.4	Deer Creek	Perennial Stream/River	No Data	No Data
Butler	547.2	Deer Creek	Perennial Stream/River	No Data	No Data
Butler	547.4	Pond	Perennial Lake/Pond		
Butler	547.6	Unnamed	Intermittent Stream/River		
Butler	550.9	Unnamed	Intermittent Stream/River		
Butler	554.6	Unnamed	Intermittent Stream/River		
Butler	557.1	Unnamed	Intermittent Stream/River		
Butler	559.6	Unnamed	Intermittent Stream/River		
Butler	560.5	Unnamed	Intermittent Stream/River		
Butler	561.1	Unnamed	Intermittent Stream/River		
Butler	563.7	Unnamed	Intermittent Stream/River		
Butler	565.7	Unnamed	Intermittent Stream/River		
Seward	566.6	Unnamed	Intermittent Stream/River		
Seward	573.2	Big Blue River	Perennial Stream/River	Aquatic Life Use; Agriculture Water Supply	Inhibited; Supported
Seward	575.6	Lincoln Creek	Perennial Stream/River		
Seward	576.1	Unnamed	Intermittent Stream/River		
Seward	577.9	Unnamed	Intermittent Stream/River		
Seward	579.2	Lone Tree Creel	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Seward	580.6	Crooked Creek	Perennial Stream/River		
Seward	583.5	Unnamed	Intermittent Stream/River		
Seward	583.7	Pond	Perennial Lake/Pond Side		
Seward	583.9	Unnamed	Intermittent Stream/River		
Seward	585.8	Coon Creek	Intermittent Stream/River		
Seward	586.1	Unnamed	Intermittent Stream/River		
Seward	586.6	Unnamed	Intermittent Stream/River		
Seward	586.8	Unnamed	Intermittent Stream/River		
Seward	587.2	Unnamed	Intermittent Stream/River		
Seward	588.2	Unnamed	Intermittent Stream/River		
Seward	588.8	Unnamed	Intermittent Stream/River		
Seward	589.3	Unnamed	Intermittent Stream/River		
Seward	589.9	Unnamed	Intermittent Stream/River		
Seward	590.1	Unnamed	Intermittent Stream/River		
Saline	590.9	West Fork Big Blue River	Perennial Stream/River	Primary Contact Recreation; Aquatic Life Use; Agriculture Water Supply	Inhibited; Inhibited; Supported
Saline	591.8	Unnamed	Intermittent Stream/River		
Saline	593.1	Unnamed	Intermittent Stream/River		
Saline	595.0	Squaw Creek	Intermittent Stream/River		
Saline	597.3	Turkey Creek	Perennial Stream/River	No Data	No Data
Saline	598.8	Spring Creek	Perennial Stream/River		
Saline	599.7	Unnamed	Intermittent Stream/River		
Saline	600.2	Unnamed	Intermittent Stream/River		
Saline	603.3	Brush Creek	Intermittent Stream/River		
Saline	604.2	Unnamed	Intermittent Stream/River		
Saline	604.8	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Saline	605.5	Dry Creek	Intermittent Stream/River		
Saline	605.8	Unnamed	Intermittent Stream/River		
Saline	606.5	Unnamed	Intermittent Stream/River		
Saline	608.0	Unnamed	Intermittent Stream/River		
Saline	609.4	Plummers Branch	Intermittent Stream/River		
Saline	609.5	Plummers Branch	Intermittent Stream/River		
Saline	609.6	Unnamed	Intermittent Stream/River		
Saline	610.8	Unnamed	Intermittent Stream/River		
Saline	612.8	Swan Creek	Perennial Stream/River	Aquatic Life Use: Agriculture Water Supply	Supported; Supported
Saline	614.6	Unnamed	Intermittent Stream/River		
Jefferson	616.1	Unnamed	Intermittent Stream/River		
Jefferson	616.4	Unnamed	Intermittent Stream/River		
Jefferson	617.1	Unnamed	Intermittent Stream/River		
Jefferson	618.4	Unnamed	Intermittent Stream/River		
Jefferson	621.3	Unnamed	Intermittent Stream/River		
Jefferson	622.1	Cub Creek	Perennial Stream/River	No Data	No Data
Jefferson	623.0	Unnamed	Intermittent Stream/River		
Jefferson	627.0	Unnamed	Intermittent Stream/River		
Jefferson	629.0	Big Indian Creek	Intermittent Stream/River		
Jefferson	630.3	Unnamed	Intermittent Stream/River		
Jefferson	630.7	Unnamed	Intermittent Stream/River		
Jefferson	633.0	Unnamed	Intermittent Stream/River		
Jefferson	633.1	Unnamed	Intermittent Stream/River		
Jefferson	633.5	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Jefferson	634.3	Unnamed	Intermittent Stream/River		
Jefferson	634.6	Unnamed	Intermittent Stream/River		
Jefferson	635.5	Unnamed	Intermittent Stream/River		
Jefferson	636.0	Unnamed	Intermittent Stream/River		
Jefferson	636.2	Unnamed	Intermittent Stream/River		
Jefferson	637.0	Unnamed	Intermittent Stream/River		
Jefferson	637.7	Unnamed	Intermittent Stream/River		
NEBRASKA REX Parallel					
Jefferson	637.8	Unnamed	Canal/Ditch		
Jefferson	638.1	Unnamed	Intermittent Stream/River		
Jefferson	638.7	Unnamed	Intermittent Stream/River		
Jefferson	639.1	Unnamed	Intermittent Stream/River		
Jefferson	639.4	Unnamed	Perennial Stream/River		
Jefferson	640.0	Unnamed	Canal/Ditch		
Jefferson	640.9	Unnamed	Intermittent Stream/River		
Jefferson	641.9	Unnamed	Perennial Stream/River		
Gage	642.0	Unnamed	Intermittent Stream/River		
Gage	643.9	Horseshoe Creek	Perennial Stream/River		
Gage	645.2	Unnamed	Intermittent Stream/River		
Gage	646.6	Unnamed	Intermittent Stream/River		
Gage	648.2	Unnamed	Intermittent Stream/River		
Gage	648.8	Unnamed	Intermittent Stream/River		
Gage	649.1	Little Indian Creek	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Gage	649.2	Little Indian Creek	Intermittent Stream/River		
KANSAS					
Marshall	650.0	Unnamed	Canal/Ditch		
Marshall	651.0	Unnamed	Canal/Ditch		
Marshall	651.0	Unnamed	Canal/Ditch		
Marshall	651.0	Unnamed	Perennial Stream/River		
Marshall	651.0	Unnamed	Canal/Ditch		
Marshall	651.7	Meadow Creek	Canal/Ditch	No Data	No Data
Marshall	652.0	Unnamed	Canal/Ditch		
Marshall	652.6	Unnamed	Perennial Stream/River		
Marshall	653.1	Indian Creek	Perennial Stream/River	No Data	No Data
Marshall	654.0	Unnamed	Canal/Ditch		
Marshall	654.3	Unnamed	Canal/Ditch		
Marshall	654.9	Unnamed	Canal/Ditch		
Marshall	655.4	Unnamed	Intermittent Stream/River		
Marshall	655.8	Unnamed	Intermittent Stream/River		
Marshall	656.0	Unnamed	Canal/Ditch		
Marshall	656.3	Deer Creek	Perennial Stream/River	General Purpose; Aquatic Life; Recreational Use (contact use, not open to public)	No Data
Marshall	656.4	Unnamed	Canal/Ditch		
Marshall	657.4	Unnamed	Intermittent Stream/River		
Marshall	658.6	Big Blue River	Perennial Stream/River	No Data	No Data
Marshall	658.9	North Elm Creek	Perennial Stream/River	General Purpose; Aquatic Life; Recreational Use (contact use, not open to public)	No Data

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Marshall	659.5	Trib To North Elm Creek	Perennial Stream/River	General Purpose; Aquatic Life; Recreational Use (contact use, not open to public)	No Data
Marshall	659.6	Trib To North Elm Creek	Perennial Stream/River	General Purpose; Aquatic Life; Recreational Use (contact use, not open to public)	No Data
Marshall	659.6	Unnamed	Intermittent Stream/River		
Marshall	662.2	Unnamed	Intermittent Stream/River		
Marshall	662.2	North Elm Creek	Perennial Stream/River	General Purpose; Aquatic Life; Recreational Use (contact use, not open to public)	No Data
Marshall	662.6	Trib to North Elm Creek	Intermittent Stream/River		
Marshall	664.7	Unnamed	Intermittent Stream/River		
Marshall	667.9	Unnamed	Intermittent Stream/River		
Marshall	668.5	Trib To Robidoux Creek	Perennial Stream/River		
Marshall	668.6	Unnamed	Manmade Ditch		
Marshall	668.9	Unnamed	Intermittent Stream/River		
Marshall	669.0	Unnamed	Intermittent Pond		
Marshall	669.6	Unnamed	Manmade Ditch		
Marshall	670.2	Trib To Robidoux Creek	Perennial Stream/River		
Marshall	670.4	Unnamed	Intermittent Stream/River		
Marshall	671.4	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Marshall	671.6	Unnamed	Intermittent Stream/River		
Marshall	671.7	Robidoux Creek	Perennial Stream/River	General Purpose; Aquatic Life; Recreational Use (contact use, not open to public)	No Data
Marshall	672.7	Unnamed	Manmade Ditch		
Marshall	673.6	Unnamed	Manmade Ditch		
Marshall	675.7	Unnamed	Manmade Ditch		
Nemaha	681.2	Negro Creek	Intermittent Stream/River	No Data	No Data
Nemaha	682.5	Unnamed	Intermittent Stream/River		
Nemaha	682.9	Unnamed	Intermittent Stream/River		
Nemaha	683.2	Unnamed	Intermittent Stream/River		
Nemaha	683.5	Unnamed	Intermittent Stream/River		
Nemaha	683.8	Unnamed	Intermittent Stream/River		
Nemaha	684.0	Unnamed	Intermittent Stream/River		
Nemaha	684.4	Unnamed	Intermittent Stream/River		
Nemaha	684.5	North Fork Wildcat Creek	Intermittent Stream/River	No Data	No Data
Nemaha	684.6	Unnamed	Intermittent Stream/River		
Nemaha	685.0	Unnamed	Intermittent Stream/River		
Nemaha	685.2	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Nemaha	685.8	Wildcat Creek	Perennial Stream/River	General Purpose; Special Aquatic Life; (contact use, not open to public); Domestic Water Supply; Food Procurement Use; Ground Water Recharge; Irrigation Use;	No Data
Nemaha	686.1	Unnamed	Intermittent Stream/River		
Nemaha	686.5	Unnamed	Intermittent Stream/River		
Nemaha	686.7	Unnamed	Manmade body		
Nemaha	688.4	Unnamed	Intermittent Stream/River		
Nemaha	688.7	Unnamed	Manmade body		
Nemaha	689.6	South Fork Big Nemaha River	Perennial Stream/River	General Purpose; Special Aquatic Life; (contact use, not open to public); Domestic Water Supply; Food Procurement Use; Ground Water Recharge; Irrigation Use;	No Data
Nemaha	690.2	Unnamed	Intermittent Stream/River		
Nemaha	690.3	Unnamed	Intermittent Stream/River		
Nemaha	691.2	Harris Creek	Perennial Stream/River	General Purpose; Expected Aquatic Life Use	No Data
Nemaha	691.9	Unnamed	Intermittent Stream/River		
Nemaha	692.9	Unnamed	Manmade Pond		
Nemaha	693.3	Unnamed	Manmade Pond		
Nemaha	693.6	Unnamed	Intermittent Stream/River		
Nemaha	693.9	Trib To Harris Creek	Perennial Stream/River		
Nemaha	694.5	Unnamed	Intermittent Stream/River		
Nemaha	694.5	Unnamed	Perennial Stream/River		
Nemaha	696.5	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Nemaha	696.6	Unnamed	Intermittent Stream/River		
Nemaha	697.1	Unnamed	Intermittent Stream/River		
Nemaha	697.4	Unnamed	Intermittent Stream/River		
Nemaha	698.3	Unnamed	Intermittent Stream/River		
Nemaha	700.3	Unnamed	Intermittent Stream/River		
Nemaha	700.5	Craig Creek	Perennial Stream/River	No Data	No Data
Nemaha	700.7	Unnamed	Intermittent Stream/River		
Nemaha	701.1	Unnamed	Manmade Ditch		
Nemaha	702.4	Unnamed	Intermittent Stream/River		
Nemaha	702.9	Unnamed	Intermittent Stream/River		
Nemaha	703.0	Unnamed	Intermittent Stream/River		
Brown	704.1	Unnamed	Intermittent		
Brown	704.5	Unnamed	Intermittent Stream/River		
Brown	704.7	Unnamed	Intermittent Stream/River		
Brown	704.8	Unnamed	Intermittent Stream/River		
Brown	705.2	Unnamed	Intermittent Stream/River		
Brown	705.3	Unnamed	Intermittent Stream/River		
Brown	705.7	Delaware River	Perennial Stream/River	No Data	No Data
Brown	706.7	Trib To Delaware River	Perennial Stream/River		
Brown	707.6	Trib To Delaware River	Perennial Stream/River		
Brown	708.5	Unnamed	Intermittent Stream/River		
Brown	709.3	Walnut Creek	Perennial Stream/River	General Purpose; Expected Aquatic Life Use	No Data

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Brown	710.2	Walnut Creek	Perennial Stream/River	General Purpose; Expected Aquatic Life Use	No Data
Brown	710.8	Unnamed	Intermittent Stream/River		
Brown	711.5	Unnamed	Intermittent Stream/River		
Brown	712.5	Unnamed	Intermittent Stream/River		
Brown	712.5	Unnamed	Intermittent Stream/River		
Brown	712.9	Wolf River	Perennial Stream/River		
Brown	713.8	Unnamed	Intermittent Stream/River		
Brown	714.4	Unnamed	Intermittant Lake/Pond		
Brown	714.5	Unnamed	Intermittant Lake/Pond		
Brown	716.5	Unnamed	Intermittent Stream/River		
Brown	716.7	Unnamed	Intermittent Stream/River		
Brown	716.8	Unnamed	Intermittent Stream/River		
Brown	717.0	Unnamed	Intermittent Stream/River		
Brown	717.8	Unnamed	Intermittent Stream/River		
Brown	718.2	Unnamed	Intermittent Stream/River		
Brown	718.4	Unnamed	Intermittent Stream/River		
Brown	718.9	Unnamed	Intermittent Stream/River		
Brown	719.8	Unnamed	Intermittent Stream/River		
Brown	719.9	Unnamed	Intermittent Stream/River		
Brown	720.1	Unnamed	Intermittent Stream/River		
Brown	720.3	Middle Fork Wolf River	Perennial Stream/River	General Purpose; Expected Aquatic Life Use; Domestic Water Supply; Food Procurement Use; Groundwater Recharge; Industrial Water Supply; Irrigation Use	No Data
Brown	721.3	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Brown	722.0	Unnamed	Manmade Ditch		
Brown	722.6	Buttermilk Creek	Perennial Stream/River	General Purpose; Expected Aquatic life use; Primary Contact Recreation is by Law or Written Permission of the Landowner	No Data
Brown	722.8	Unnamed	Intermittent Stream/River		
Brown	723.0	Unnamed	Manmade Ditch		
Brown	723.2	Unnamed	Intermittent Stream/River		
Brown	723.2	Unnamed	Intermittent Stream/River		
Brown	724.0	Unnamed	Intermittent Stream/River		
Brown	725.0	South Fork Wolf River	Perennial Stream/River	General Purpose; Expected Aquatic Life Use; Domestic Water Supply; Food Procurement Use; Ground Water Recharge; Industrial Water Supply; Irrigation Use;	No Data
Brown	725.1	Unnamed	Intermittent Stream/River		
Brown	725.4	Unnamed	Intermittent Stream/River		
Brown	725.9	Unnamed	Intermittent Stream/River		
Brown	727.6	Squaw Creek	Perennial Stream/River	General Purpose; Expected Aquatic life use; Primary Contact Recreation is by Law or Written Permission of the Landowner	No Data
Brown	727.7	Unnamed	Intermittent Stream/River		
Brown	727.9	Unnamed	Intermittent Stream/River		
Brown	728.1	Unnamed	Canal/Ditch		
Doniphan	728.4	Unnamed	Intermittent Stream/River		
Doniphan	728.7	Unnamed	Manmade Pond		
Doniphan	729.1	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Doniphan	729.5	Unnamed	Perennial Stream/River		
Doniphan	729.7	Halling Creek	Perennial Stream/River	General Purpose; Aquatic Life Use	No Data
Doniphan	734.9	Unnamed	Intermittent Stream/River		
Doniphan	736.1	Unnamed	Perennial Stream/River		
Doniphan	736.8	Unnamed	Intermittent Stream/River		
Doniphan	737.8	Jordan Creek	Intermittent Stream/River		
Doniphan	738.3	Unnamed	Intermittent Stream/River		
Doniphan	739.9	Unnamed	Intermittent Stream/River		
Doniphan	740.1	Unnamed	Intermittent Stream/River		
Doniphan	740.6	Rock Creek	Perennial Stream/River	General Purpose; Aquatic Life Use	No Data
Doniphan	741.7	Unnamed	Intermittent Stream/River		
Doniphan	741.8	Unnamed	Intermittent Stream/River		
Doniphan	742.5	Unnamed	Intermittent Stream/River		
Doniphan	742.5	Unnamed	Intermittent Stream/River		
Doniphan	742.7	Unnamed	Intermittent Stream/River		
Doniphan	743.0	Unnamed	Intermittent Stream/River		
Doniphan	743.0	Trib to Brush Creek	Intermittent Stream/River		
Doniphan	743.0	Trib to Brush Creek	Intermittent Stream/River		
Doniphan	743.6	Brush Creek	Intermittent Stream/River	General Purpose; Aquatic Life Use	No Data
Doniphan	744.4	Unnamed	Intermittent Stream/River		
Doniphan	745.1	Trib to Missouri River	Perennial Stream/River		
Doniphan	745.3	Unnamed	Intermittent Stream/River		
Doniphan	745.5	Unnamed	Intermittent Stream/River		
Doniphan	745.9	Unnamed	Intermittent Stream/River		
Doniphan	746.2	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Doniphan	746.9	Unnamed	Intermittent Stream/River		
Doniphan	747.1	Unnamed	Intermittent Stream/River		
Doniphan	747.8	Unnamed	Intermittent Stream/River		
MISSOURI REX Parallel					
Buchannan	748.5	Missouri River	Artificial Path	Irrigation Use; Livestock and Wildlife; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation; Drinking Water Supply; Industrial Process and Industrial Cooling Water	KS - State-listed fish species occurrence; MO - State-listed pallid sturgeon occurrence; No Data
Buchannan	752.0	Unnamed	Canal/Ditch		
Buchannan	752.5	Unnamed	Intermittent Stream/River		
Buchannan	752.8	Unnamed	Intermittent Stream/River		
Buchannan	753.1	Unnamed	Intermittent Stream/River		
Buchannan	753.3	Unnamed	Intermittent Stream/River		
Buchannan	754.0	Contrary Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation	No Data
Buchannan	754.2	Unnamed	Canal/Ditch		
Buchannan	754.8	Unnamed	Intermittent Stream/River		
Buchannan	755.5	Unnamed	Intermittent Stream/River		
Buchannan	757.0	Trib to Pigeon Creek	Perennial Stream/River		
Buchannan	757.1	Unnamed	Intermittent Stream/River		
Buchannan	757.3	Unnamed	Manmade Ditch		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Buchannan	757.6	Unnamed	Intermittent Stream/River		
Buchannan	757.9	Trib to Pigeon Creek	Perennial Stream/River		
Buchannan	758.0	Unnamed	Intermittent Stream/River		
Buchannan	758.3	Unnamed	Intermittent Stream/River		
Buchannan	758.5	Unnamed	Intermittent Stream/River		
Buchannan	759.0	Unnamed	Intermittent Stream/River		
Buchannan	759.1	Unnamed	Canal/Ditch		
Buchannan	759.3	Unnamed	Intermittent Stream/River		
Buchannan	759.5	Trib to Pigeon Creek	Perennial Stream/River		
Buchannan	759.7	Trib to Pigeon Creek	Perennial Stream/River		
Buchannan	760.3	Unnamed	Intermittent Stream/River		
Buchannan	760.5	Unnamed	Intermittent Stream/River		
Buchannan	760.7	Pigeon Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation	No Data
Buchannan	760.9	Pigeon Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation	No Data
Buchannan	761.7	Unnamed	Canal/Ditch		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Buchannan	762.2	Platte River	Perennial Stream/River	Irrigation Use; Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation; Drinking Water Supply	No Data
Buchannan	762.6	Unnamed	Intermittent Stream/River		
Buchannan	762.7	Unnamed	Intermittent Stream/River		
Buchannan	763.0	Trib to Platte River	Perennial Stream/River		
Buchannan	763.4	Unnamed	Intermittent Stream/River		
Buchannan	763.5	Unnamed	Intermittent Stream/River		
Buchannan	763.7	Trib to Platte River	Perennial Stream/River		
Buchannan	763.9	Unnamed	Intermittent Stream/River		
Buchannan	764.1	Trib to Platte River	Perennial Stream/River		
Buchannan	764.3	Unnamed	Intermittent Stream/River		
Buchannan	764.6	Unnamed	Intermittent Stream/River		
Buchannan	764.7	Unnamed	Intermittent Stream/River		
Buchannan	765.9	Unnamed	Intermittent Stream/River		
Buchannan	766.7	Malden Creek	Perennial Stream/River	No Data	No Data
Buchannan	768.6	Wolfpen Creek	Perennial Stream/River	No Data	No Data
Clinton	769.2	Jenkins Branch	Perennial Stream/River	No Data	No Data
Clinton	771.2	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Clinton	772.9	Castile Creek	Perennial Stream/River	Class C, Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation; Drinking Water Supply	
Clinton	773.6	Unnamed	Intermittent Stream/River		
Clinton	777.2	Unnamed	Manmade Pond		
Clinton	777.4	Unnamed	Intermittent Stream/River		
Clinton	777.8	Unnamed	Intermittent Stream/River		
Clinton	778.1	Unnamed	Intermittent Stream/River		
Clinton	778.2	Unnamed	Intermittent Stream/River		
Clinton	778.4	Unnamed	Intermittent Stream/River		
Clinton	778.6	Horse Fork	Perennial Stream/River		
Clinton	778.8	Unnamed	Intermittent Stream/River		
Clinton	779.2	Unnamed	Manmade Pond		
Clinton	780.0	Unnamed	Intermittent Stream/River		
Clinton	780.2	Unnamed	Intermittent Stream/River		
Clinton	780.5	Unnamed	Intermittent Stream/River		
Clinton	780.6	Unnamed	Intermittent Stream/River		
Clinton	780.9	Little Platte River	Perennial Stream/River	Class C, Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation, Class C	State spawning water (3/15-6/15)

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Clinton	781.8	Trib to Little Platte River	Perennial Stream/River		
Clinton	781.9	Trib to Little Platte River	Perennial Stream/River		
Clinton	784.2	Unnamed	Intermittent Stream/River		
Clinton	784.6	Unnamed	Intermittent Stream/River		
Clinton	784.8	Unnamed	Canal/Ditch		
Clinton	785.1	Unnamed	Intermittent Stream/River		
Clinton	785.2	Unnamed	Intermittent Stream/River		
Clinton	785.3	Unnamed	Intermittent Stream/River		
Clinton	785.6	Shoal Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation	No Data
Clinton	786.3	Little Shoal Creek	Perennial Stream/River	No Data	No Data
Clinton	786.5	Unnamed	Intermittent Stream/River		
Clinton	786.6	Unnamed	Intermittent Stream/River		
Clinton	786.8	Unnamed	Intermittent Stream/River		
Clinton	787.0	Unnamed	Intermittent Stream/River		
Clinton	787.3	Unnamed	Intermittent Stream/River		
Clinton	788.0	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Clinton	788.2	Deer Creek	Perennial Stream/River	No Data	No Data
Clinton	788.6	Unnamed	Intermittent Stream/River		
Clinton	789.6	Plum Creek	Perennial Stream/River	No Data	No Data
Clinton	789.8	Unnamed	Intermittent Stream/River		
Clinton	789.9	Unnamed	Intermittent Stream/River		
Clinton	790.0	Unnamed	Intermittent Stream/River		
Caldwell	790.3	Unnamed	Manmade Ditch		
Caldwell	790.9	Trib to Plum Creek	Perennial Stream/River		
Caldwell	791.2	Unnamed	Intermittent Stream/River		
Caldwell	792.2	Unnamed	Canal/Ditch		
Caldwell	792.4	Unnamed	Intermittent Stream/River		
Caldwell	792.7	Unnamed	Intermittent Stream/River		
Caldwell	793.9	Unnamed	Intermittent Stream/River		
Caldwell	794.4	Log Creek	Perennial Stream/River	No Data	No Data
Caldwell	794.7	Unnamed	Perennial Lake/Pond		
Caldwell	795.0	Unnamed	Canal/Ditch		
Caldwell	795.4	Log Creek	Perennial Stream/River	No Data	No Data

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Caldwell	796.3	Trib to Log Creek	Perennial Stream/River	No Data	No Data
Caldwell	796.3	Trib to Log Creek	Perennial Stream/River	No Data	No Data
Caldwell	796.6	Unnamed	Intermittent Stream/River		
Caldwell	796.9	Unnamed	Intermittent Stream/River		
Caldwell	797.3	Unnamed	Intermittent Stream/River		
Caldwell	798.5	Long Creek	Perennial Stream/River		
Caldwell	798.9	Unnamed	Intermittent Stream/River		
Caldwell	799.1	Trib to Log Creek	Perennial Stream/River		
Cladwell	799.3	Unnamed	Manmade Ditch		
Caldwell	799.5	Unnamed	Perennial Stream/River		
Caldwell	800.3	Unnamed	Intermittent Stream/River		
Caldwell	800.5	Unnamed	Intermittent Stream/River		
Caldwell	801.2	Brush Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption	State spawning water (3/15-6/15)
Caldwell	801.6	Unnamed	Intermittent Stream/River		
Caldwell	801.7	Trib to Brush Creek	Perennial Stream/River		
Caldwell	802.3	Unnamed	Intermittent Stream/River		
Caldwell	802.5	Unnamed	Canal/Ditch		
Caldwell	803.2	Unnamed	Intermittent Stream/River		
Caldwell	803.2	Unnamed	Intermittent Stream/River		
Caldwell	803.7	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Caldwell	804.5	Crabapple Creek	Perennial Stream/River	Class C, Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation	State spawning water (3/15-6/15)
Caldwell	804.7	Unnamed	Intermittent Stream/River		
Caldwell	804.9	Unnamed	Canal/Ditch		
Caldwell	805.0	Unnamed	Intermittent Stream/River		
Caldwell	805.3	Unnamed	Intermittent Stream/River		
Caldwell	805.3	Unnamed	Intermittent Stream/River		
Caldwell	806.2	Unnamed	Intermittent Stream/River		
Caldwell	807.3	Trib to Mud Creek	Perennial Stream/River		
Caldwell	807.7	Trib to Mud Creek	Perennial Stream/River		
Caldwell	807.9	Unnamed	Intermittent Stream/River		
Caldwell	808.2	Unnamed	Canal/Ditch		
Caldwell	808.3	Trib to Mud Creek	Perennial Stream/River		
Caldwell	808.3	Unnamed	Intermittent Stream/River		
Caldwell	808.6	Unnamed	Intermittent Stream/River		
Caldwell	808.7	Trib to Mud Creek	Perennial Stream/River		
Caldwell	809.0	Unnamed	Intermittent Stream/River		
Caldwell	809.0	Unnamed	Intermittent Stream/River		
Caldwell	809.5	Unnamed	Intermittent Stream/River		
Caldwell	809.8	Trib to Mud Creek	Perennial Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Caldwell	809.9	Unnamed	Intermittent Stream/River		
Caldwell	810.0	Trib to Mud Creek	Perennial Stream/River		
Caldwell	810.4	Unnamed	Canal/Ditch		
Caldwell	811.2	Trib to Mud Creek	Perennial Stream/River		
Caldwell	811.3	Unnamed	Intermittent Stream/River		
Caldwell	812.2	Mud Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation	No Data
Caldwell	812.5	Jimmy Bond	Canal/Ditch		
Caldwell	812.7	Willow Creek	Perennial Stream/River		
Caldwell	813.4	Unnamed	Pond		
Caldwell	813.9	Trib to Mud Creek	Perennial Stream/River		
Caldwell	814.1	Unnamed	Intermittent Stream/River		
Caldwell	814.4	Unnamed	Intermittent Stream/River		
Carroll	814.7	Unnamed	Canal/Ditch		
Carroll	814.9	Unnamed	Intermittent Stream/River		
Carroll	815.5	Unnamed	Canal/Ditch		
Carroll	815.9	Turkey Creek	Perennial Stream/River		
Carroll	816.1	Trib to Turkey Creek	Perennial Stream/River		
Carroll	816.4	Unnamed	Intermittent Stream/River		
Carroll	816.6	Unnamed	Intermittent Stream/River		
Carroll	817.6	Unnamed	Manmade Ditch		
Carroll	818.0	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Carroll	818.5	Unnamed	Intermittent Stream/River		
Carroll	818.9	Unnamed	Intermittent Stream/River		
Carroll	819.0	Unnamed	Intermittent Stream/River		
Carroll	819.9	Trib to Turkey Creek	Perennial Stream/River		
Carroll	820.5	Trib to Turkey Creek	Perennial Stream/River		
Carroll	820.7	Trib to Turkey Creek	Perennial Stream/River		
Carroll	821.3	Unnamed	Intermittent Stream/River		
Carroll	821.4	Unnamed	Canal/Ditch		
Carroll	821.7	Trib to Turkey Creek	Perennial Stream/River		
Carroll	821.8	Trib to Turkey Creek	Perennial Stream/River		
Carroll	822.1	Trib to Turkey Creek	Perennial Stream/River		
Carroll	822.9	Trib to Big Creek	Perennial Stream/River		
Carroll	823.1	Trib to Big Creek	Perennial Stream/River		
Carroll	823.4	Trib to Big Creek	Perennial Stream/River		
Carroll	823.5	Unnamed	Manmade Ditch		
Carroll	824.3	Unnamed	Manmade Ditch		
Carroll	824.9	Unnamed	Intermittent Stream/River		
Carroll	825.3	Trib to Big Creek	Perennial Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Carroll	825.3	Unnamed	Intermittent Stream/River		
Carroll	825.8	Unnamed	Canal/Ditch		
Carroll	826.0	Unnamed	Intermittent Stream/River		
Carroll	827.1	Trib to Big Creek	Perennial Stream/River		
Carroll	827.6	Unnamed	Intermittent Stream/River		
Carroll	827.9	Unnamed	Intermittent Stream/River		
Carroll	829.5	Unnamed	Perennial Stream/River		
Carroll	829.8	Unnamed	Canal/Ditch		
Carroll	830.2	Unnamed	Perennial Stream/River		
Carroll	830.4	Unnamed	Intermittent Stream/River		
Carroll	831.7	Bridge Creek	Perennial Stream/River		
Carroll	832.0	Big Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation	No Data
Carroll	832.5	Unnamed	Intermittent Stream/River		
Carroll	832.8	Unnamed	Intermittent Stream/River		
Carroll	833.6	Wolf Branch	Perennial Stream/River		
Carroll	834.0	Unnamed	Perennial Stream/River		
Carroll	834.2	Unnamed	Perennial Stream/River		
Carroll	835.0	Unnamed	Intermittent Stream/River		
Carroll	835.8	Unnamed	Manmade Ditch		
Carroll	835.5	Unnamed	Intermittent Stream/River		
Carroll	836.0	Unnamed	Intermittent Stream/River		
Carroll	837.2	Little Hurricane	Intermittent Stream/River		
Carroll	837.5	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Carroll	838.2	Unnamed	Perennial Stream/River		
Carroll	838.4	Unnamed	Intermittent Stream/River		
Carroll	838.5	Unnamed	Perennial Stream/River		
Carroll	839.8	Unnamed	Perennial Stream/River		
Carroll	840.4	Unnamed	Intermittent Stream/River		
Carroll	840.4	Unnamed	Intermittent Stream/River		
Carroll	840.6	Grand River	Perennial Stream/River	Irrigation Use; Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation; Drinking Water Supply	No Data
Chariton	841.1	Unnamed Slough	Perennial Stream/River		
Chariton	842.1	Unnamed	Intermittent Stream/River		
Chariton	842.6	Unnamed	Intermittent Stream/River		
Chariton	842.7	Unnamed	Intermittent Stream/River		
Chariton	842.8	Potter Slough	Intermittent Stream/River		
Chariton	843.9	Unnamed	Intermittent Stream/River		
Chariton	845.9	Salt Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation;	No Data
Chariton	846.1	Unnamed	Intermittent Stream/River		
Chariton	846.7	Unnamed	Intermittent Stream/River		
Chariton	846.9	Unnamed	Intermittent Stream/River		
Chariton	847.7	Unnamed	Intermittent Stream/River		
Chariton	848.3	Brush Creek	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Chariton	848.8	Unnamed	Intermittent Stream/River		
Chariton	849.2	Unnamed	Intermittent Stream/River		
Chariton	849.5	Unnamed	Intermittent Stream/River		
Chariton	849.6	Unnamed	Perennial Lake/Pond		
Chariton	849.7	Unnamed	Intermittent Stream/River		
Chariton	849.8	Unnamed	Intermittent Stream/River		
Chariton	849.9	Unnamed	Intermittent Stream/River		
Chariton	850.1	Unnamed	Intermittent Stream/River		
Chariton	851.0	Unnamed	Intermittent Stream/River		
Chariton	851.7	Unnamed	Intermittent Stream/River		
Chariton	851.8	Lake Creek	Perennial Stream/River	Irrigation use; Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Chariton	852.0	Unnamed	Intermittent Stream/River		
Chariton	852.9	Unnamed	Intermittent Lake/Pond		
Chariton	853.2	Unnamed	Intermittent Stream/River		
Chariton	853.6	Unnamed	Canal/Ditch		
Chariton	854.1	Unnamed	Perennial Stream/River		
Chariton	854.3	Palmer Creek	Perennial Stream/River		
Chariton	854.7	Unnamed	Intermittent Stream/River		
Chariton	855.5	Unnamed	Intermittent Stream/River		
Chariton	856.0	Unnamed	Intermittent Stream/River		
Chariton	856.4	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Chariton	857.7	Mussel Fork	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Chariton	858.2	Unnamed	Intermittent Stream/River		
Chariton	859.1	Unnamed	Pond		
Chariton	859.6	Unnamed	Intermittent Stream/River		
Chariton	860.7	Unnamed	Intermittent Stream/River		
Chariton	860.7	Unnamed	Intermittent Stream/River		
Chariton	860.8	Long Creek	Perennial Stream/River		
Chariton	861.6	Unnamed	Intermittent Stream/River		
Chariton	861.9	Unnamed	Intermittent Stream/River		
Chariton	862.4	Chariton River	Perennial Stream/River	Irrigation Use; Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation	No Data
Chariton	863.1	Unnamed	Intermittent Stream/River		
Chariton	863.5	Unnamed	Intermittent Stream/River		
Chariton	863.7	Unnamed	Intermittent Stream/River		
Chariton	863.9	Unnamed	Intermittent Stream/River		
Chariton	864.2	Unnamed	Intermittent Stream/River		
Chariton	865.0	Puzzle Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Chariton	866.5	Unnamed	Intermittent Stream/River		
Chariton	867.0	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Chariton	867.1	Unnamed	Intermittent Stream/River		
Chariton	867.3	Unnamed	Intermittent Stream/River		
Chariton	867.3	Unnamed	Intermittent Stream/River		
Chariton	867.9	Unnamed	Intermittent Stream/River		
Chariton	868.0	Middle Fork Little Chariton River	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Chariton	868.2	Unnamed	Pond		
Chariton	868.4	Lake Branch	Intermittent Stream/River		
Chariton	868.7	Lake Branch	Intermittent Stream/River		
Chariton	869.1	Unnamed	Intermittent Stream/River		
Chariton	870.1	Unnamed	Intermittent Stream/River		
Chariton	870.3	Unnamed	Intermittent Stream/River		
Chariton	870.3	Unnamed	Intermittent Stream/River		
Chariton	870.6	Unnamed	Intermittent Stream/River		
Chariton	871.1	Unnamed	Intermittent Stream/River		
Chariton	871.6	East Fork Little Chariton River	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Chariton	871.9	Unnamed	Pond		
Rand	872.2	Unnamed	Intermittent Stream/River		
Rand	873.2	Unnamed	Intermittent Stream/River		
Rand	873.6	Unnamed	Intermittent Stream/River		
Rand	874.5	Unnamed	Intermittent Stream/River		
Rand	874.8	Unnamed	Intermittent Stream/River		
Rand	875.9	Unnamed	Intermittent Stream/River		
Rand	876.2	Unnamed	Perennial Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Rand	876.5	Unnamed	Intermittent Stream/River		
Rand	876.6	Unnamed	Intermittent Stream/River		
Rand	877.1	Unnamed	Intermittent Stream/River		
Rand	877.6	Unnamed	Perennial Lake		
Rand	877.8	Unnamed	Intermittent Stream/River		
Rand	878.1	Unnamed	Intermittent Stream/River		
Rand	878.2	Unnamed	Intermittent Stream/River		
Rand	878.3	Unnamed	Intermittent Stream/River		
Rand	878.7	Unnamed	Intermittent Stream/River		
Rand	878.7	Unnamed	Intermittent Stream/River		
Rand	878.8	Unnamed	Intermittent Stream/River		
Rand	879.5	Unnamed	Intermittent Stream/River		
Rand	879.6	Unnamed	Intermittent Stream/River		
Rand	879.9	Unnamed	Intermittent Stream/River		
Rand	880.0	Unnamed	Intermittent Stream/River		
Rand	880.2	Unnamed	Intermittent Stream/River		
Rand	880.5	Unnamed	Intermittent Stream/River		
Rand	881.0	Unnamed	Perennial Lake/Pond		
Rand	881.3	Unnamed	Intermittent Stream/River		
Rand	881.4	Unnamed	Intermittent Stream/River		
Rand	882.0	Unnamed	Intermittent Stream/River		
Rand	882.3	Unnamed	Intermittent Stream/River		
Rand	882.5	Unnamed	Intermittent Stream/River		
Rand	882.7	Unnamed	Intermittent Stream/River		
Rand	882.8	Unnamed	Intermittent Stream/River		
Rand	883.1	Unnamed	Intermittent Stream/River		
Rand	883.3	Unnamed	Intermittent Stream/River		
Rand	883.8	Unnamed	Perennial Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Rand	885.5	Moniteau Creek	Intermittent Stream/River		
Rand	891.0	Unnamed	Intermittent Stream/River		
Rand	891.5	Unnamed	Intermittent Stream/River		
Rand	892.1	Unnamed	Intermittent Stream/River		
Rand	892.8	Unnamed	Intermittent Stream/River		
Rand	893.0	Unnamed	Intermittent Stream/River		
Rand	893.4	Unnamed	Lake/Pond		
Rand	893.5	Unnamed	Intermittent Stream/River		
Rand	893.6	Unnamed	Intermittent Stream/River		
Rand	894.1	Unnamed	Intermittent Stream/River		
Rand	894.2	Big Creek	Perennial Stream/River	No Data	No Data
Audrain	895.4	Boat Branch	Intermittent Stream/River		
Audrain	895.4	Unnamed	Intermittent Stream/River		
Audrain	896.8	Unnamed	Intermittent Stream/River		
Audrain	897.3	Sailing Creek	Perennial Stream/River	No Data	No Data
Audrain	897.3	Unnamed	Intermittent Stream/River		
Audrain	897.7	Unnamed	Intermittent Stream/River		
Audrain	900.9	Long Branch	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Audrain	901.8	Unnamed	Intermittent Stream/River		
Audrain	902.4	Unnamed	Intermittent Stream/River		
Audrain	903.2	Unnamed	Intermittent Stream/River		
Audrain	903.7	Unnamed	Intermittent Stream/River		
Audrain	904.0	Goodwater Creek	Perennial Stream/River	No Data	No Data
Audrain	904.1	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Audrain	905.2	Unnamed	Intermittent Stream/River		
Audrain	905.8	Unnamed	Perennial Stream/River		
Audrain	907.6	Unnamed	Intermittent Stream/River		
Audrain	907.6	Unnamed	Intermittent Stream/River		
Audrain	908.3	Youngs Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Audrain	912.9	Unnamed	Intermittent Stream/River		
Audrain	913.4	Unnamed	Intermittent Stream/River		
Audrain	913.4	Unnamed	Intermittent Stream/River		
Audrain	913.7	Unnamed	Intermittent Stream/River		
Audrain	913.9	Unnamed	Intermittent Stream/River		
Audrain	914.2	Unnamed	Intermittent Stream/River		
Audrain	914.4	Unnamed	Intermittent Stream/River		
Audrain	914.8	Unnamed	Intermittent Stream/River		
Audrain	915.2	Unnamed	Intermittent Stream/River		
Audrain	916.1	Unnamed	Intermittent Stream/River		
Audrain	916.6	Skull Lick Creek	Perennial Stream/River	No Data	No Data
Audrain	916.8	Unnamed	Intermittent Stream/River		
Audrain	917.7	Unnamed	Perennial Stream/River		
Audrain	918.5	Salt Creek	Perennial Stream/River		
Audrain	919.1	Unnamed	Intermittent Stream/River		
Audrain	919.5	Unnamed	Intermittent Stream/River		
MISSOURI					
Audrain	921.7	Trib to Bean Branch	Perennial Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Audrain	921.7	Trib to Bean Branch	Perennial Stream/River		
Audrain	921.9	Unnamed	Lake/Pond		
Audrain	921.9	Unnamed	Lake/Pond		
Audrain	922.4	Bean Branch	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Audrain	923.7	Unnamed	Intermittent Stream/River		
Audrain	925.0	Unnamed	Intermittent Stream/River		
Audrain	925.2	Unnamed	Intermittent Stream/River		
Audrain	925.9	Trib of Littleby Creek	Intermittent Stream/River		
Audrain	926.1	Littleby Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Audrain	928.6	West Fork Cuivre River	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Audrain	929.5	Trib to West Fork Cuivre River	Perennial Stream/River		
Audrain	930.8	Mams Slough	Perennial Stream/River		
Audrain	931.1	Unnamed	Perennial Stream/River		
Audrain	931.7	Unnamed	Intermittent Stream/River		
Audrain	932.5	Johns Branch	Perennial Stream/River		
Montgomery	934.6	Unnamed	Intermittent Stream/River		
Montgomery	935.0	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Montgomery	936.9	Unnamed	Intermittent Stream/River		
Montgomery	937.4	Unnamed	Perennial Stream/River		
Montgomery	938.6	Unnamed	Intermittent Stream/River		
Montgomery	939.2	Unnamed	Intermittent Stream/River		
Montgomery	939.8	Coon Creek	Perennial Stream/River		
Montgomery	940.4	Unnamed	Intermittent Stream/River		
Montgomery	941.0	Unnamed	Channel Intermittent Stream/River		
Montgomery	941.3	Unnamed	Lake/Pond		
Montgomery	941.4	Unnamed	Lake/Pond		
Montgomery	942.0	Unnamed	Intermittent Stream/River		
Montgomery	942.6	Unnamed	Channel Intermittent Stream/River		
Montgomery	943.0	Unnamed	Channel Intermittent Stream/River		
Montgomery	943.2	Unnamed	Channel Intermittent Stream/River		
Montgomery	943.3	Unnamed	Channel Intermittent Stream/River		
Montgomery	943.4	Unnamed	Channel Intermittent Stream/River		
Montgomery	943.4	Unnamed	Channel Intermittent Stream/River		
Montgomery	945.8	Unnamed	Intermittent Stream/River		
Montgomery	946.6	Unnamed	Intermittent Stream/River		
Montgomery	947.3	Long Branch Creek	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Montgomery	947.4	Unnamed	Channel Intermittent Stream/River		
Montgomery	947.6	Unnamed	Lake/Pond		
Montgomery	948.1	Unnamed	Intermittent Stream/River		
Montgomery	948.4	Unnamed	Intermittent Stream/River		
Montgomery	948.7	Elkhorn Creek	Perennial Stream/River		
Montgomery	948.8	Unnamed	Intermittent Stream/River		
Montgomery	949.5	Unnamed	Intermittent Stream/River		
Montgomery	950.6	Unnamed	Intermittent Stream/River		
Montgomery	950.9	Unnamed	Intermittent Stream/River		
Montgomery	951.0	Brush Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation	No Data
Montgomery	951.6	Unnamed	Intermittent Stream/River		
Montgomery	952.1	Unnamed	Lake/Pond		
Montgomery	952.6	Unnamed	Intermittent Stream/River		
Montgomery	952.7	Unnamed	Intermittent Stream/River		
Montgomery	952.7	Unnamed	Intermittent Stream/River		
Montgomery	953.3	Unnamed	Intermittent Stream/River		
Montgomery	953.6	Unnamed	Intermittent Stream/River		
Lincoln	955.4	Bear Creek	Perennial stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Heath-Fish Consumption; Whole Body Contact Recreation; Class C	No Data
Lincoln	955.6	Unnamed	Intermittent Stream/River		
Lincoln	957.0	Camp Creek	Perennial Stream/River	No Data	No Data
Lincoln	958.4	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Lincoln	958.6	Unnamed	Intermittent Stream/River		
Lincoln	959.3	Unnamed	Perennial Stream/River		
Lincoln	960.8	Unnamed	Perennial Stream/River		
Lincoln	961.6	Unnamed	Intermittent Stream/River		
Lincoln	961.9	Turkey Creek	Perennial Stream/River		
Lincoln	962.5	Unnamed	Intermittent Stream/River		
Lincoln	962.9	Unnamed	Intermittent Stream/River		
Lincoln	963.4	Unnamed	Intermittent Stream/River		
Lincoln	963.8	Unnamed	Lake/Pond		
Lincoln	963.8	Unnamed	Lake/Pond		
Lincoln	964.3	Cottonwood Branch	Intermittent Stream/River		
Lincoln	965.0	Unnamed	Intermittent Stream/River		
Lincoln	965.6	Unnamed	Intermittent Stream/River		
Lincoln	966.0	Unnamed	Intermittent Stream/River		
Lincoln	967.6	Spring Creek	Intermittent Stream/River		
Lincoln	967.8	Unnamed	Intermittent Stream/River		
Lincoln	969.3	Unnamed	Intermittent Stream/River		
Lincoln	970.3	Unnamed	Intermittent Stream/River		
Lincoln	970.5	Unnamed	Intermittent Stream/River		
Lincoln	971.1	Cuivre River	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation	No Data
Lincoln	971.9	Sugar Creek	Intermittent Stream/River		
Lincoln	972.7	Unnamed	Intermittent Stream/River		
Lincoln	973.6	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Lincoln	974.2	Unnamed	Intermittent Stream/River		
Lincoln	974.4	Unnamed	Intermittent Stream/River		
Lincoln	975.3	Unnamed	Intermittent Stream/River		
Lincoln	975.8	Unnamed	Lake/Pond		
Lincoln	976.4	Unnamed	Intermittent Stream/River		
Lincoln	976.9	Keelstone Branch	Intermittent Stream/River		
Lincoln	977.3	Unnamed	Lake/Pond		
Lincoln	977.9	Groshong Branch	Intermittent Stream/River		
Lincoln	979.0	Campbell Branch	Intermittent Stream/River		
Lincoln	979.5	Unnamed	Intermittent Stream/River		
Lincoln	980.4	Unnamed	Intermittent Stream/River		
Lincoln	981.6	Cuivre River	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation	No Data
St. Charles	982.2	Unnamed	Intermittent Stream/River		
St. Charles	986.0	Unnamed	Perennial Stream/River		
St. Charles	986.9	Unnamed	Intermittent Stream/River		
St. Charles	989.3	Peruque Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation	No Data
St. Charles	990.4	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
St. Charles	991.4	Bellaeau Creek	Intermittent Stream/River		
St. Charles	995.3	Unnamed	Intermittent Stream/River		
St. Charles	995.7	Dardenne Creek	Perennial Stream/River	Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation	No Data
St. Charles	998.0	Unnamed	Intermittent Stream/River		
St. Charles	998.5	Unnamed	Intermittent Stream/River		
St. Charles	999.9	Unnamed	Intermittent Stream/River		
St. Charles	1000.1	Unnamed	Intermittent Stream/River		
St. Charles	1001.0	Unnamed	Intermittent Stream/River		
St. Charles	1001.7	Unnamed	Intermittent Stream/River		
St. Charles	1009.8	Unnamed	Lake/Pond		
St. Charles	1009.8	Unnamed	Lake/Pond		
ILLINOIS					
Madison	1021.1	Mississippi River	Perennial Stream/River	Irrigation; Livestock and Wildlife Watering; Protection of Warm Water Aquatic Life and Human Health-Fish Consumption; Whole Body Contact Recreation; Secondary Contact Recreation; Drinking Water Supply; Industrial Process Water and Cooling Water	Not Assessed

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Madison	1021.6	Mississippi River	Perennial Stream/River	Aquatic Life; Fish Consumption; Public Water Supply; Primary Contact; Secondary Contact; Aesthetic Quality	Fully Supporting; Not Supporting; Fully Supporting; Not Supporting; Not Assessed; Not Assessed
Madison	1025.0	Unnamed	Lake/Pond		
Madison	1025.0	Unnamed	Lake/Pond		
Madison	1026.2	Indian Creek	Perennial Stream/River	Aquatic Life; Fish Consumption; Primary Contact; Secondary Contact; Aesthetic Quality	Not Supporting; Fully Supporting; Not Assessed; Not Assessed; Not Assessed
Madison	1027.2	Cahokia Canal	Perennial Stream/River	Aquatic Life; Fish Consumption; Primary Contact; Secondary Contact; Aesthetic Quality	Fully Supporting; Fully Supporting; Not Supporting; Not Assessed; Not Assessed
Madison	1028.4	Unnamed	Intermittent Stream/River		
Madison	1031.3	Mooney Creek	Perennial Stream/River	Aquatic Life; Fish Consumption; Primary Contact; Secondary Contact; Aesthetic Quality	Not Assessed
Madison	1031.4	Unnamed	Perennial Stream/River		
Madison	1031.8	Unnamed	Perennial Stream/River		
Madison	1032.0	Unnamed	Intermittent Stream/River		
Madison	1033.0	Unnamed	Perennial Stream/River		
Madison	1034.7	Unnamed	Intermittent Stream/River		
Madison	1035.0	Unnamed	Intermittent Stream/River		
Madison	1035.0	Unnamed	Intermittent Stream/River		
Madison	1036.8	Unnamed	Intermittent Stream/River		
Madison	1036.9	Unnamed	Intermittent Stream/River		
Madison	1036.9	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Madison	1037.0	Silver Creek	Perennial Stream/River	Aquatic Life; Fish Consumption; Primary Contact; Secondary Contact; Aesthetic Quality	Not Supporting; Fully Supporting; Not Assessed; Not Assessed; Not Assessed
Madison	1037.8	Unnamed	Perennial Stream/River		
Madison	1038.6	Unnamed	Channel Intermittent Stream/River		
Madison	1040.6	Unnamed	Channel Intermittent Stream/River		
Madison	1041.0	Sugar Fork	Perennial Stream/River	Aquatic Life; Fish Consumption; Primary Contact; Secondary Contact; Aesthetic Quality	Not Assessed
Madison	1042.7	Sand Creek	Perennial Stream/River	Aquatic Life; Fish Consumption; Primary Contact; Secondary Contact; Aesthetic Quality	Not Assessed
Madison	1043.2	Tributary of Sand Creek	Perennial Stream/River		
Madison	1046.0	Silver Lake	Lake	Aquatic Life; Fish Consumption; Public Food and Processing Water Supplies; Primary Contact; Secondary Contact; Aesthetic Quality	Not Supporting; Not Supporting; Not Supporting; Not Assessed; Not Assessed; Not Supporting
Madison	1047.7	Unknown	Perennial Stream/River		
Madison	1048.1	Unknown	Perennial Stream/River		
Madison	1049.0	Unnamed	Perennial Stream/River		
Fayette	1050.9	Unnamed	Perennial Stream/River		
Fayette	1053.4	Trib of Shoal Creek	Perennial Stream/River		
Fayette	1054.3	Unnamed	Intermittent Stream/River		
Fayette	1054.5	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Fayette	1055.0	Unnamed	Intermittent Stream/River		
Fayette	1055.3	Shoal Creek	Perennial Stream/River	Aquatic Life; Fish Consumption; Public and Food Processing Water Supplies; Primary Contact; Secondary Contact; Aesthetic Quality	Not Supporting/Fully Supporting; Fully Supporting/Not Assessed; Not Supporting; Not Supporting/Not Assessed; Not Assessed
Fayette	1056.1	Unnamed	Perennial Stream/River		
Fayette	1056.6	Trib of Shoal Creek	Perennial Stream/River		
Fayette	1056.8	Trib of Shoal Creek	Intermittent Stream/River		
Fayette	1056.9	Unnamed	Perennial Stream/River		
Fayette	1058.7	Pond	Pond Side		
Fayette	1058.7	Trib of Beaver Creek	Perennial Stream/River		
Fayette	1059.4	Beaver Creek	Perennial Stream/River		
Fayette	1061.0	Pond	Lake/Pond		
Fayette	1061.6	Little Beaver Creek	Perennial Stream/River	Aquatic Life; Fish Consumption; Primary Contact; Secondary Contact; Aesthetic Quality	Not Assessed
Fayette	1061.8	Trib of Little Beaver Creek	Perennial Stream/River		
Fayette	1062.0	Pond	Lake/Pond		
Fayette	1062.0	Pond	Lake/Pond		
Fayette	1062.3	Trib of Little Beaver Creek	Perennial Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Fayette	1062.3	Trib of Little Beaver Creek	Perennial Stream/River		
Fayette	1062.4	Unnamed	Intermittent Stream/River		
Fayette	1063.1	Unnamed	Intermittent Stream/River		
Fayette	1063.3	Unnamed	Intermittent Stream/River		
Fayette	1064.2	Unnamed	Intermittent Stream/River		
Fayette	1066.0	Unnamed	Perennial Stream/River		
Fayette	1066.5	Unnamed	Intermittent Stream/River		
Fayette	1067.1	Spring Branch Creek	Perennial Stream/River		
Fayette	1067.5	Tributary of Spring	Perennial Stream/River		
Fayette	1068.3	Unnamed	Lake/Pond		
Bond	1069.7	Unnamed	Lake/Pond		
Bond	1070.3	Hurricane Creek	Perennial Stream/River		
Bond	1070.7	Unknown	Perennial stream/river		
Bond	1070.8	Unknown	Drainage slough		
Bond	1071.9	Unknown	Lake/Pond		
Bond	1072.0	Unknown	Lake/Pond		
Bond	1072.1	Kaskaskia River	Perennial Stream/River	Aquatic Life; Fish Consumption; Public Food and Processing Water Supplies; Primary Contact; Secondary Contact; Aesthetic Quality	Not Supporting/Not Assessed; Fully Supporting; Not Supporting; Not Supporting/Fully Supporting/Not Assessed; Not Assessed
Bond	1072.6	Unnamed	Perennial Stream/River		
Bond	1074.1	Unnamed	Manmade Ditch		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Bond	1074.5	Unnamed	Manmade Ditch		
Bond	1074.7	Unnamed	Manmade Ditch		
Marion	1075.5	Unnamed	Manmade Ditch		
Marion	1076.4	Unnamed	Intermittent Stream/River		
Marion	1076.9	Unnamed	Intermittent Artificial Path		
Marion	1077.0	Unnamed	Intermittent Artificial Path		
Marion	1077.1	Willet RD Creek	Perennial Stream/River		
CUSHING EXTENSION					
NEBRASKA					
Jefferson	0.6	Unnamed	Intermittent Stream/River		
Jefferson	1.7	Unnamed	Intermittent Stream/River		
Jefferson	1.8	Unnamed	Intermittent Stream/River		
Jefferson	1.9	Unnamed	Intermittent Stream/River		
Jefferson	1.9	Unnamed	Intermittent Stream/River		
KANSAS					
Washington	4.1	Little Blue River	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Primary Contact Recreation Not Open to Public; Secondary Contact Recreation Not Open To Public; Domestic Water Supply; Food Procurement Use; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Washington	6.8		Perennial Stream/River		
Washington	9.1	Unnamed	Connector		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Washington	9.6	Mill Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public; Food Procurement Use	Supporting
Washington	12.1	Mill Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public; Food Procurement Use	Supporting
Washington	13.5	Mill Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public; Food Procurement Use	Supporting
Washington	22.6	Coon Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Primary Contact Recreation Not Open to Public; Food Procurement	Supporting
Washington	23.9	Unnamed	Perennial Stream/River		
Washington	26.2	Unnamed	Connector		
Washington	28.7	Unnamed	Intermittent Stream/River		
Washington	29.7	Unnamed	Intermittent Stream/River		
Washington	31.3	Unnamed	Intermittent Stream/River		
Washington	32.1	Unnamed	Intermittent Stream/River		
Clay	33.3	Unnamed	Intermittent Stream/River		
Clay	34.7	Carter Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public	Supporting
Clay	34.8	Carter Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public	Supporting
Clay	34.8	Carter Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public	Supporting

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Clay	34.9	Carter Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public	Supporting
Clay	35.0	Carter Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public	Supporting
Clay	36.3	West Fancy Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Primary Contact Recreation Not Open to Public; Food Procurement	Supporting
Clay	36.4	Unnamed	Intermittent Stream/River		
Clay	37.9	Unnamed	Intermittent Stream/River		
Clay	37.9	Unnamed	Intermittent Stream/River		
Clay	39.6	Unnamed	Intermittent Stream/River		
Clay	40.8	Unnamed	Intermittent Stream/River		
Clay	43.8	Unnamed	Intermittent Stream/River		
Clay	43.9	Unnamed	Intermittent Stream/River		
Clay	43.9	Lincoln Creek	Intermittent Stream/River	General Purpose Waters; Expected Aquatic Life Use; Secondary Contact Recreation Not Open to Public	Supporting
Clay	45.5	Unnamed	Intermittent Stream/River		
Clay	51.2	Republican River	Artificial Path	General Purpose Waters; Special Aquatic Life Use; Primary Contact Recreation Not Open to Public; Domestic Water Supply; Food Procurement Use; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Clay	52.5	Unnamed	Intermittent Stream/River		
Clay	54.0	Unnamed	Perennial Stream/River		
Clay	54.9	Unnamed	Intermittent Stream/River		
Clay	55.4	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Clay	57.8	Unnamed	Intermittent Stream/River		
Clay	58.1	Unnamed	Intermittent Stream/River		
Clay	59.3	Unnamed	Intermittent Stream/River		
Clay	60.1	Unnamed	Intermittent Stream/River		
Clay	60.8	Unnamed	Intermittent Stream/River		
Clay	62.0	Unnamed	Intermittent Stream/River		
Clay	62.7	Unnamed	Intermittent Stream/River		
Dickinson	63.9	Unnamed	Intermittent Stream/River		
Dickinson	64.6	Unnamed	Intermittent Stream/River		
Dickinson	68.8	Chapman Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Primary Contact Recreation Not Open to Public; Domestic Water Supply; Food Procurement Use; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Dickinson	69.5	Unnamed	Intermittent Stream/River		
Dickinson	70.3	Unnamed	Perennial Stream/River		
Dickinson	70.7	Unnamed	Intermittent Stream/River		
Dickinson	71.2	Unnamed	Intermittent Stream/River		
Dickinson	71.9	Unnamed	Intermittent Stream/River		
Dickinson	72.0	Unnamed	Intermittent Stream/River		
Dickinson	76.6	Smoky Hill River	Artificial Path	General Purpose Waters; Expected Aquatic Life Use; Primary Contact Recreation Not Open to Public; Domestic Water Supply; Food Procurement Use; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Dickinson	78.3	Unnamed	Intermittent Stream/River		
Dickinson	78.6	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Dickinson	79.5	Unnamed	Intermittent Stream/River		
Dickinson	80.1	Unnamed	Intermittent Stream/River		
Dickinson	80.1	Unnamed	Intermittent Stream/River		
Dickinson	81.5	Unnamed	Intermittent Stream/River		
Dickinson	83.6	Unnamed	Intermittent Stream/River		
Dickinson	85.1	Unnamed	Perennial Stream/River		
Dickinson	86.2	Unnamed	Intermittent Stream/River		
Dickinson	87.1	Carry Creek	Perennial Stream/River	General Purpose Waters; Special Aquatic Life Use; Food Procurement	Supporting
Dickinson	87.7	Unnamed	Intermittent Stream/River		
Dickinson	89.7	Unnamed	Intermittent Stream/River		
Dickinson	90.3	Unnamed	Intermittent Stream/River		
Dickinson	91.1	Unnamed	Intermittent Stream/River		
Dickinson	91.7	Unnamed	Intermittent Stream/River		
Dickinson	92.1	West Branch Lyon Creek	Perennial Stream/River	General Purpose Waters; Special Aquatic Life Use; Food Procurement	Supporting
Dickinson	95.3	Unnamed	Intermittent Stream/River		
Dickinson	95.9	Unnamed	Intermittent Stream/River		
Dickinson	96.3	Unnamed	Perennial Stream/River		
Dickinson	97.2	Unnamed	Perennial Stream/River		
Dickinson	98.8	Unnamed	Perennial Stream/River		
Marion	100.0	Unnamed	Perennial Stream/River		
Marion	101.4	Unnamed	Intermittent Stream/River		
Marion	101.7	Unnamed	Intermittent Stream/River		
Marion	103.3	Unnamed	Intermittent Stream/River		
Marion	105.2	Unnamed	Intermittent Stream/River		
Marion	105.2	Unnamed	Intermittent Stream/River		
Marion	105.3	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Marion	106.4	Unnamed	Intermittent Stream/River		
Marion	108.7	Unnamed	Intermittent Stream/River		
Marion	109.4	Unnamed	Intermittent Stream/River		
Marion	111.6	Unnamed	Intermittent Stream/River		
Marion	111.6	Unnamed	Intermittent Stream/River		
Marion	111.9	Unnamed	Intermittent Stream/River		
Marion	112.7	Unnamed	Intermittent Stream/River		
Marion	114.1	Mud Creek	Perennial Stream/River	General Purpose Waters; Special Aquatic Life Use; Domestic Water Supply; Food Procurement	Supporting
Marion	116.9	Unnamed	Intermittent Stream/River		
Marion	117.1	Cottonwood River	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Primary Contact Recreation Not Open to Public; Domestic Water Supply; Food Procurement; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Marion	118.9	Spring Branch	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Marion	118.9	Unnamed	Intermittent Stream/River		
Marion	119.9	Unnamed	Intermittent Stream/River		
Marion	120.6	Unnamed	Intermittent Stream/River		
Marion	122.6	Unnamed	Intermittent Stream/River		
Marion	123.4	Catlin Creek	Perennial Stream/River	General Purpose Waters; Special Aquatic Life Use; Food Procurement	Supporting
Marion	124.2	Unnamed	Intermittent Stream/River		
Marion	124.3	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Marion	128.2	Doyle Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Domestic Water Supply; Food Procurement; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Marion	129.0	Unnamed	Intermittent Stream/River		
Marion	129.1	Unnamed	Intermittent Stream/River		
Marion	129.2	Unnamed	Intermittent Stream/River		
Marion	129.5	Unnamed	Intermittent Stream/River		
Marion	133.1	Unnamed	Intermittent Stream/River		
Marion	133.4	Unnamed	Intermittent Stream/River		
Marion	134.5	Unnamed	Intermittent Stream/River		
Butler	136.2	Unnamed	Perennial Stream/River		
Butler	136.3	Unnamed	Intermittent Stream/River		
Butler	136.8	Unnamed	Intermittent Stream/River		
Butler	137.4	Unnamed	Intermittent Stream/River		
Butler	139.4	Unnamed	Intermittent Stream/River		
Butler	140.1	Unnamed	Perennial Stream/River		
Butler	140.2	Unnamed	Perennial Stream/River		
Butler	140.2	Unnamed	Perennial Stream/River		
Butler	142.5	East Branch Whitewater River	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Domestic Water Supply; Food Procurement; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Butler	145.0	Diamond Creek	Perennial Stream/River	No Data	No Data

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Butler	145.6	Brush Creek	Intermittent Stream/River	No Data	No Data
Butler	146.5	Unnamed	Intermittent Stream/River		
Butler	148.8	Fourmile Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Food Procurement	Supporting
Butler	150.4	Unnamed	Intermittent Stream/River		
Butler	150.9	Rock Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Butler	151.6	Unnamed	Intermittent Stream/River		
Butler	152.4	Unnamed	Intermittent Stream/River		
Butler	153.3	Unnamed	Intermittent Stream/River		
Butler	155.0	Spring Branch	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Butler	156.0	Unnamed	Intermittent Stream/River		
Butler	158.3	Whitewater River	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Domestic Water Supply; Food Procurement; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Butler	159.1	Badger Creek	Intermittent Stream/River	General Purpose Waters; Expected Aquatic Life Use; Domestic Water Supply	Supporting
Butler	160.0	Unnamed	Intermittent Stream/River		
Butler	160.6	Unnamed	Intermittent Stream/River		
Butler	160.6	Unnamed	Intermittent Stream/River		
Butler	160.6	Unnamed	Perennial Stream/River		
Butler	164.1	Dry Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Butler	165.4	Unnamed	Perennial Stream/River		
Butler	167.6	Unnamed	Perennial Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Butler	168.0	Fourmile Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Primary Contact Recreation Not Open To Public; Domestic Water Supply; Food Procurement; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Butler	169.6	Unnamed	Intermittent Stream/River		
Butler	170.9	Unnamed	Intermittent Stream/River		
Butler	172.5	Unnamed	Intermittent Stream/River		
Butler	174.9	Eightmile Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Domestic Water Supply; Food Procurement; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Butler	175.7	Unnamed	Intermittent Stream/River		
Butler	176.2	Unnamed	Intermittent Stream/River		
	176.9	Unnamed	Intermittent Stream/River		
Butler	177.5	Unnamed	Intermittent Stream/River		
Butler	178.1	Unnamed	Intermittent Stream/River		
Cowley	178.9	Unnamed	Intermittent Stream/River		
Cowley	180.9	Polecat Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use; Food Procurement	Supporting
Cowley	182.3	Unnamed	Intermittent Stream/River		
Cowley	183.1	Unnamed	Intermittent Stream/River		
Cowley	185.4	Stewart Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Cowley	185.5	Stewart Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Cowley	185.6	Stewart Creek	Perennial Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Cowley	187.0	Unnamed	Intermittent Stream/River		
Cowley	188.2	Unnamed	Intermittent Stream/River		
Cowley	188.3	Crooked Creek	Intermittent Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Cowley	188.4	Unnamed	Intermittent Stream/River		
Cowley	190.2	Unnamed	Intermittent Stream/River		
Cowley	191.2	Unnamed	Intermittent Stream/River		
Cowley	191.6	Unnamed	Intermittent Stream/River		
Cowley	195.2	Unnamed	Intermittent Stream/River		
Cowley	196.2	Unnamed	Intermittent Stream/River		
Cowley	196.5	Unnamed	Intermittent Stream/River		
Cowley	198.3	Unnamed	Intermittent Stream/River		
Cowley	200.0	Unnamed	Intermittent Stream/River		
Cowley	201.4	Spring Creek	Intermittent Stream/River	General Purpose Waters; Expected Aquatic Life Use	Supporting
Cowley	201.8	Unnamed	Intermittent Stream/River		
Cowley	205.3	Unnamed	Intermittent Stream/River		
Cowley	206.4	Arkansas River	Artificial Path	General Purpose Waters; Special Aquatic Life Use; Primary Contact Recreation by Law or Written Permission; Domestic Water Supply; Food Procurement; Groundwater Recharge; Industrial Water Supply; Irrigation; Livestock Watering	Supporting
Cowley	207.8	Unnamed	Intermittent Stream/River		
Cowley	209.8	Unnamed	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
OKLAHOMA					
Kay	212.5	Chilocco Creek	Intermittent Stream/River		
Kay	213.3	Unnamed	Intermittent Stream/River		
Kay	216.3	Bois d'Arc Creek	Intermittent Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	217.2	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	219.5	Unnamed	Intermittent Stream/River		
Kay	222.6	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	223.0	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	226.2	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Kay	230.8	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	232.6	Unnamed	Intermittent Stream/River		
Kay	234.1	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	235.0	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	236.8	Bois d'Arc Creek	Perennial Stream/River	Agriculture; WW Aquatic Community; Hydropower; Primary Contact Recreation; Public and Private Water Supply; Fish Consumption; Aesthetics	Fully Supporting; Insufficient Information; Insufficient Information; Not Supporting; Fully Supporting; Not Assessed; Fully Supporting
Kay	238.5	Cowskin Creek	Intermittent Stream/River	No Data	No Data
Kay	239.0	Salt Fork Arkansas River	Artificial Path	Aesthetics; Agriculture;WW Aquatic Community; Industrial and Municipal Process and Cooling Water;Primary Contact Recreation; Public and Private water supply; Fish Consumption	Insufficient Data; Fully Supporting/Not Assessed; Not Supporting, Fully Supporting; Not Supporting; Not Assessed; Not Assessed
Kay	240.8	Deadman Creek	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Noble	248.5	Red Rock Creek	Perennial Stream/River		
Noble	252.7	Unnamed	Intermittent Stream/River		
Noble	254.3	Unnamed	Intermittent Stream/River		
Noble	254.8	Greasy Creek	Intermittent Stream/River		
Noble	257.8	Unnamed	Intermittent Stream/River		
Noble	258.7	Unnamed	Intermittent Stream/River		
Noble	260.3	Black Bear Creek	Perennial Stream/River		
Noble	261.6	Unnamed	Intermittent Stream/River		
Noble	262.6	Unnamed	Intermittent Stream/River		
Noble	264.2	Long Branch	Intermittent Stream/River		
Noble	266.7	Unnamed	Intermittent Stream/River		
Payne	269.2	East Brush Creek	Intermittent Stream/River		
Payne	270.0	Unnamed	Intermittent Stream/River		
Payne	271.1	Little Stillwater Creek	Intermittent Stream/River		
Payne	271.3	Unnamed	Intermittent Stream/River		
Payne	273.0	Unnamed	Intermittent Stream/River		
Payne	274.4	Unnamed	Intermittent Stream/River		
Payne	275.8	Unnamed	Intermittent Stream/River		
Payne	278.0	Unnamed	Intermittent Stream/River		
Payne	279.0	Unnamed	Intermittent Stream/River		
Payne	279.7	Unnamed	Intermittent Stream/River		
Payne	283.2	Long Branch	Intermittent Stream/River		

Table F-1 Major and Sensitive Waterbodies

State / County	Approx. MP	Waterbody Name	Intermittent, Perennial, Reservoir, or Lake	State Water Quality Classification	Supports Use Designation
Payne	284.7	Cimarron River	Artificial Path		
Payne	286.5	Unnamed	Intermittent Stream/River		
Payne	287.6	Cabin Creek	Intermittent Stream/River		
Payne	288.9	Cabin Creek	Intermittent Stream/River		
Payne	289.0	Cabin Creek	Intermittent Stream/River		
Payne	289.0	Cabin Creek	Intermittent Stream/River		
Payne	289.2	Cabin Creek	Intermittent Stream/River		

Appendix G
Special Status Species
and
Species of Concern Tables

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Mammals					
Gray bat *Myotis grisescens*	FE; IL-E	This species forages primarily within forested areas along streams and lakes. Winter roosts are in deep vertical caves with domed halls. Large summer colonies utilize caves that trap warm air and provide restricted rooms or domed ceilings. Maternity roosts typically are in caves with stream flow and are separate from summer bachelor roosts.	None. Although the project crosses the historic range of this species, the species is not known to occur along the project route.	Yes. The project does not occur within roosting habitat for this species. Occurrence would be limited to migrating individuals.	Tuttle 1979; Brady et al. 1992.
Indiana bat *Myotis sodalis*	FE; MO-E; IL-E	This species forages primarily in riparian forests and flood-plains, as well as in upland forests, low field, and pastures. Maternity roosts are located beneath loose bark of living and dead trees (especially oak and hickory spp.). Young are generally born in June. Winter hibernacula occur in caves and mines with 85% of this species population hibernating in Shannon, Washington, and Iron counties, MO.	High. Suitable roosting and foraging habitats occur in Missouri and Illinois. No winter hibernacula and maternity roosts are known to occur within the project vicinity.	No.	Harvey et al. 1999; MDC 2000a.
Gray wolf *Canis lupus*	FT; ND-SC	No particular habitat preference. Habitats may include: alpine, desert, conifer forest, hardwood forest, mixed forest, grasslands, savannas, shrubland/ chaparral, tundra, and woodlands.	Low. This species has been extirpated from most of the project route. However, wolves from Canada may wander into north end of ROW in North Dakota in Pembina and Walsh counties.	No.	Hoffmeister 1986; Clark and Stromberg 1987; Mech 1970; Mech and Boitani 2003.
Plains spotted skunk *Spilogale putorius interrupta*	SD-SC; MO-E	This species inhabits upland grassland prairie, brushy areas, cultivated land, and forests. Their dens are located below ground in grassy banks, rocky crevices or along fence rows, as well as above ground in hay stacks, woodpiles, hollow logs, trees, or on brushy heaps. Young are born from April to July.	None.	Yes. The project does not occur within the geographic range of this species.	

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Eastern spotted skunk *Spilogale putorius*	KS-T; MO-E; SD-SC	This species prefers forest edge, prairie, brushy areas, and cultivated land, especially if rock outcrops and shrubs are present. Their dens are located below ground in grassy banks, rocky crevices or along fence rows, as well as above ground in hay stacks, woodpiles, brushy heaps, hollow logs, and abandoned buildings or outbuildings. Young are born in May or June.	Moderate. Habitat for this species occurs along the project route. This species has been recorded in Marshall, Nemaha, Brown, and Doniphan counties in KS.	No.	Collins et al. 1995; MDC 2000a.
River otter *Lontra Canadensis*	NE-T; IL-E	Key habitats are rivers, streams, lakes, ponds, marshes, estuaries, and beaver flowages, especially near waterbodies with wooded shorelines or nearby wetlands. When inactive, occupies hollow logs, spaces under roots, logs, or overhangs, abandoned beaver lodges, dense thickets near water, or burrows of other animals; such sites also are used for rearing young	Moderate. This species has been identified as occurring along the project route at the Elkhorn and Platte River crossings in Stanton and Colfax counties, NE. This species is also known to occur within 5 miles of ROW in IL.	No.	NatureServe 2006.
Birds					
Least bittern *Ixobrychus exilis*	MO-SC; IL-T	Nest in freshwater wetlands with dense, tall growths of emergent vegetation (particularly *Typha* spp, *Carex* spp., *Scirpus* spp., or *Phragmites australis*) interspersed with some woody vegetation and open, fresh water. In the north-central U.S., breeding and nesting may occur from May-July. Incubation lasts for 17-20 days; young usually leave nest by the 13th-15th day.	Moderate. Suitable nesting habitat for this species could occur along the project route. Thsi species has been identified in Buchanan, Chariton, Lincoln, and St. Charles counties in MO, and in Madison and Fayette counties in IL.	No.	Weller 1961; Bohlen 1989; Gibbs et al. 1992.

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Bald eagle *Haliaeetus leucocephalus*	FT; ND-SC; SD-T; NE-T; KS-T; MO-E; IL-T; OK-T	This species typically occurs near large bodies of water that support suitable roosting and foraging habitat. Nest sites are located in proximity to open water and generally are found in mature heterogeneous stands of multi-storied trees, but also may nest on cliffs. Winter habitat typically includes areas of open water, adequate food sources, and sufficient diurnal perches and night roosts. Breeding season: January through July. Winter season: November 15 through March 15.	Moderate. Nesting and winter roosts would be limited to river corridors along the project route. A historic nest has been documented in the vicinity of the project ROW at the Missouri River crossing in Yankton, SD. State designated critical habitat occurs at the Big Blue and Missouri river crossings in KS.	No.	Collins et al. 1995; Kingery 1998; MDC 2000a.
Peregrine falcon *Falco peregrinus*	IL-T; NE-SC; KS-E	This species is found over a wide variety of habitats, but are generally located near open water or marshes that support high concentration of shorebirds or waterfowl. Nest sites occur on tall steep-walled cliffs, bridges, or buildings. Preferred foraging habitat includes lakes, rivers, and wet meadows. Breeding season: April 15 to July 15.	None. No nesting habitat occurs in the project vicinity.	Yes. Occurrence by this species along the project route would be limited to foraging and migrating individuals.	Collins et al. 1995; MDC 2000a.
Greater Prairie-chicken *Tympanuchus cupido*	MO-E; ND-SC	Prime habitat for this species includes mid-grass and tall-grass prairies bordered by open oak woodlands, oak forests, and cropland. In western Kansas, they nest in sand-sage prairie and forage in corn and wheat fields. In Missouri, nesting habitat is limited to cropland and nearby prairies mainly on the Osage Plains. Breeding season: March through July.	Low. This species could potentially be found in Audrain County MO. This species is known to occur within 5 miles of the projexct route in Sargent County, ND.	No.	http://mdc.mo.gov/nathis/birds/birdatlas/maintext/0400024.htm

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
King rail *Rallus elegans*	MO-E; NE-SC	This species inhabits fresh and brackish wetlands. King rails prefer wetlands with abundant grasses, sedges, rushes and cattails. Nest sites occur in herbaceous cover over shallow water in river floodplains. The adult King Rail molts completely after nesting and is flightless for nearly a month. Breeding season: April-June	Low. Potentially suitable wetland habitat could ocur along the project route in Buchanan, Carroll, Chariton, Lincoln, and St. Charles counties, MO. This species has also been identified in Seward County, NE.	No.	MDC 2000a; Meanley 1992.
Whooping crane *Grus americana*	FE; ND-SC; SD-E; NE-E; OK-E; KS-E	During migration, this species feeds and roosts in a variety of habitats including croplands, large and small freshwater marshes, the margins of lakes and reservoirs, and submerged sandbars in rivers. Spring and Fall migration through the project regions generally occurs from February through April and from October through November, respectively.	Low. The project area occurs east of the primary migration route for this species. However, this species has been documented in Barnes County, ND; Beadle and Clark counties, SD; Saline County, NE; Marshall County, KS; and Noble Pawnee, and Payne counties, OK.	No.	Collins et al. 1995; Meine and Archibald 1996.
Snowy plover *Charadrius alexandrinus*	KS-T	This species inhabits open alkaline flats, mudflats, sandy shorelines, sandbars with little vegetation along rivers, lakes, ponds, and marshlands. Nesting often occurs on white saline flats. Breeding season: May 1 through August 15.	Low. Habitat for this species could potentially occur along the project route in KS. This species has been recorded in Cowley County, KS.	No.	Collins et al. 1995.

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Piping plover *Charadrius melodus*	FT; ND-SC; SD-T; NE-T; KS-T	This species inhabits open sandy areas and saline flats with little vegetation along rivers, lakes, ponds, and marshlands. It nests on sandbars and sand and gravel beaches with short, sparse vegetation along inland lakes, on natural and dredge islands in rivers, on gravel pits along rivers, and on salt-encrusted bare areas on interior alkali ponds and lakes. Sparse clumps of grass or herbaceous vegetation are important habitat components. Breeding season: May 1 through August 15.	Low. Potential breeding habitat would be limited to the Missouri River (Yankton, County, SD), Elkhorn River (Stanton County, NE), and Platte River (Colfax, NE).	No.	Collins et al. 1995; PRESP 2004.
Eskimo curlew *Numenius borealis*	FE; SD-E; KS-E	This species is an extremely rare spring migrant that feeds and rests in burned-over prairies, agricultural areas, wetlands, and marshes.	None.	Yes. This has not been documented in the project vicinity since the mid 1900's.	Meine and Archibald 1996.
Interior least tern *Sterna antillarum athalassos*	FE; SD-E; NE-E; MO-E; OK-E; KS-E	Nesting habitat consists of sparsely vegetated sandy, gravelly, or silty, beaches and sandbars within wide, unobstructed river channels or salt flats along lake shorelines and irrigation reservoirs. Nest locations are generally away from the water's edge since nesting typically begins while river flows are high and relatively small amounts of sandy habitat is exposed. Breeding season: May 1 through August 15.	Low. Potential breeding habitat would be limited to the Missouri River (Yankton, County, SD), Elkhorn River (Stanton County, NE), and Platte River (Colfax, NE).	No.	USFWS 1990.
Barn owl *Tyto alba*	MO-E; IL-E	This cavity-nesting species is primarily a bird of open country - residential and agricultural areas, old fields and woodland edges. Nests in buildings, tree cavities, caves, cliff crevices, and cut bank burrows Breeding season: late winter, spring, and/or early summer.	Low. Potential breeding habitat could occur along the project route. crossed by ROW. This species has been recorded in St. Charles County, MO; and Fayette and Marion counties in IL.	No.	INHS 2005; Hands et al. 1989a; Bunn et al. 1982; Taylor 1994.

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Loggerhead shrike *Lanius ludovicianus*	MO-SC; IL-T	This species is found in open areas with mixed shrub/brush hedgerows and scattered thorny trees. Thorny plant species (osage orange, honey locus, multiflora rose, wild crabapple) are important for impaling prey. In MO and IL, nesting peaks in late April, with a second peak in late May in MO.	Low. Potential breeding habitat could occur along the project route. crossed by ROW. This species has been recorded in Buchanan County, MO; and Bond, Fayette, and Marion counties in IL.	No.	INHS 2005; Yosef and Grubb 1994; Tyler 1992; Kridelbaugh 1983; Porter et al. 1975.
Henslow's sparrow *Ammodramus henslowii*	KS-SC; MO-SC; IL-E	This species breeds in a variety of grassland habitats with tall, dense grass and herbaceous vegetation. Meadows, open grasslands and weedy and abandoned fields, all with wet areas, dense grass-forb mosaics and scattered small woody growths appear to be essential. Breeding season: April-July.	Low. Potential breeding habitat could occur along the project route. This species has been recorded in Butler, Dickinson, and Nemaha counties, KS; Randolph and Clinton counties, MO; and Marion County, IL.	No.	INHS 2005; Robins 1971; Clawson 1991; Zimmerman 1988; Skinner 1975; Herkert 1994, 1997.
Yellow-crownded night heron *Nyctanassa violacea*	IL-E	This species nests on barrier islands, dredge spoil islands, and bay islands that contain forested wetlands or scrub/shrub thickets. Colonies may be located in dense shrubby thickets, forests with an open understory. They use similar habitat types for nesting and roosting, avoiding areas with insufficient cover. They hunt along the shores of tidal creeks and tide pools within salt and brackish marshes dominated by salt marsh cordgrass.	Low. Potential nesting could be crossed by the project ROW. This species has been identified within 5 miles from the ROW in Fayette County, IL.	No.	http://www.state.nj.us/dep/fgw/ensp/pdf/end-thrtened/ycnheron.pdf

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Pied-billed grebe *Podilymbus podiceps*	IL-T	This species breeds on seasonal or permanent ponds with dense stands of emergent vegetation, bays and sloughs. Uses most types of wetlands in winter.	Low. Potential nesting could be crossed by the project ROW. This species has been identified within 5 miles from the ROW in Fayette County, IL.	No.	Cornell Lab of Ornithology 2003.
Northern Harrier *Cicus cyaneus*	MO-E	This species breeds in marshes, meadows, grasslands, and cultivated fields. Perches on ground or on stumps or posts. Nests on the ground, commonly near low shrubs, in tall weeds or reeds, sometimes in bog; or on top of low bush above water, or on knoll of dry ground, or on higher shrubby ground near water, or on dry marsh vegetation.	Low. Potential nesting could be crossed by the project ROW in MO.	No.	NatureServe 2006.
Fish					
Chestnut lamprey *Ichthyomyzon castaneus*	KS-T	This species is found in moderate-sized rivers and large creeks. Spawning occurs in smaller tributary streams in swift shallow riffles where the gravel is clean. Eggs are laid in a nest in the river bottom. Spawning period: spring or summer.	Moderate. Known to occur in Missouri River in Kansas.	No.	KDWP 2004; Haslouer et al. 2005; Becker 1983.
Pallid sturgeon *Scaphirhynchus albus*	FE; SD-E; NE-E; KS-E; MO-E; IL-E	This species is distributed from the headwaters of the Missouri River (Fort Benton-Great Falls, Montana) through the Mississippi River to New Orleans, Louisiana. It inhabits bottom areas of large turbid rivers that have strong current and a firm sandy substrate. They also may be found along sandbars and behind wing dikes. Spawning period: April through August.	Moderate. Known to occur in South Dakota, Nebraska, Kansas, Missouri, and Illinois in the Missouri, James, and Mississippi rivers.	No.	Collins et al. 1995; Lee et al. 1980. PRESP 2004.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Lake sturgeon *Acipenser fulvescens*	NE-T; MO-E; IL-E	This species is generally bottom dwelling and occurs in large rivers and shallow areas of large lakes. They are most often associated with silt-free deep run and pool habitats of rivers (i.e., >5 ft deep), and generally avoid aquatic vegetation. Gravelly tributary streams of rivers and lakes serve as spawning habitat, although rocky, wave-swept areas near lake shores and islands serve as spawning habitat when preferred habitats are unavailable. Spawning period: late-spring.	Moderate. Known to occur in South Dakota and Nebraska in the Missouri River.	No.	USFWS 2001; Harkness and Dymond 1961; MDC 2000a.
Flathead chub *Platygobio gracilis*	KS-T	This species occurs from the Rio Grande to the Arctic Circle in small creeks and the largest rivers that have turbid fluctuating water levels and unstable sand bottoms. This species relies on flood flows to spawn successfully. Spawning occurs after water levels have subsided after peak flows, when water temperatures are warmer and substrate is more stable. Relies on flood flows to spawn successfully. Spawns after rivers have subsided following peak flow.	Low. Known to occur in Kansas in the Missouri and South Fork Nemaha rivers.	No.	KDWP 2004; Collins et al. 1995; Haslouer et al. 2005.
Silver chub *Macrhybopsis storeriana*	MO-SC KS-E	This species is a fish of large sandy rivers. It lives on or near the bottom where it finds food by sight or taste. It is found in deep water during the summer months. Little is known about the reproductive biology of this species.	Low. Known to occur in Kansas in Cowley County streams and Missouri in Chariton County streams.	No.	KDWP 2004; Haslouer et al. 2005.
Sturgeon chub *Macrhybopsis gelida*	NE-E; KS-T MO-SC SD-T	This species prefers large turbid sandy rivers over substrate of small gravel and coarse sand. It is often found in areas swept by currents especially at heads of islands or exposed sandbars. Spawning period: late spring to midsummer.	Low. Known to occur in South Dakota, Nebraska, Kansas, and Missouri in the Platte and Missouri rivers.	No.	KDWP 2004; Haslouer et al. 2005; MDC 2000a.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Sicklefin chub *Macrhybopsis meeki*	NE-SC; KS-E MO-SC SD-E	This species requires continuously and heavily turbid waters of large rivers where it frequents areas of strong current flowing over sand or gravel substrate. Spawning period: spring (likely from late March and May).	Low. Known to occur in South Dakota, Nebraska, Kansas, and Missouri in the Platte and Missouri rivers.	No.	KDWP 2004; Haslouer et al. 2005; MDC 2000a.
Western silvery minnow *Hybognathus argyritis*	KS-T; MO-SC	This species prefers protected areas in large, turbid rivers and prairie streams. In streams they are typically found in water less than one foot deep and shallow shore water heavily vegetated with emergent grasses and reeds. In protected areas of larger rivers, they move in large schools of 50 to 100 individuals along the bottom in deep, quiet water. While little is known about spawning, this species probably scatters eggs on silt substrate in quiet water.	Low. Known to occur in Kansas in the Missouri and South Fork Big Nemaha rivers and in Missouri in the Missouri River.	No.	KDWP 2004; Pflieger 1997.
Blacknose shiner *Notropis heterolepsis*	ND-SC; NE-E; MO-SC	This species prefers clean weedy lakes and streams.	Low. Known occurrence in Nebraska and Kansas in the Missouri River. Potential occurrence in North Dakota in the Sheyenne River.	No.	Lee et al. 1980.
Silverband shiner *Notropis shumard*	KS-T	This species is found in slow-flowing pools of large, turbid rivers. It prefers moderately deep, flowing water along sand or gravel bars. The life history of this fish is relatively unknown but it probably spawns in summer. Spawning period: late spring or summer.	None. Potential occurrence in Kansas.	Yes. No records for streams crossed by pipeline route.	Collins et al. 1995.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Topeka shiner *Notropis topeka*	FE; SD-SC; KS-T; MO-E; NE-E	This species inhabits pool and run areas in the headwaters of small prairie streams with high water quality and cool temperatures. These streams generally exhibit intermittent flow during summer; however pools are maintained by spring or groundwater percolation. The substrate of these occupied streams consist mainly of clean gravel, however bedrock and clay hardpan overlain by a thin silt layer are not uncommon. Spawning period: late spring and summer.	Moderate. Known to occur in South Dakota in Wolf Creek, in Nebraska in the Missouri River and in Kansas in the Missouri River and North Fork Elm Creek and potential occurrence in Cowley County.	No.	KDWP 2004; Besskeri 1997; Cross and Collins 1995; Pflieger 1997.
Northern redbelly dace *Chrosomus eos*	NE-T	This species occurs a variety of habitats ranging from streams to bog lakes.	Low. Known occurrence in Nebraska in the Missouri River.	No.	Lee et al. 1980.
Finescale dace *Phoxinus neogaeus*	NE-T	This species occurs in a variety of habitats ranging from streams to bog lakes.	None. Known occurrence in Nebraska in the Missouri River.	No.	Lee et al. 1980.
Amphibians					
Illinois chorus frog *Pseudacris strecheri illino*	IL-T	Sand prairies and remnants such as sandy agricultural fields and waste areas. Burrows in sand and emerges after heavy, early spring rains to breed in nearby flooded fields, ditches, and other vernal ponds.	Low. Potential habitat could occur along the project route. This species has been recorded within 5 miles of ROW in Madison County, IL.	No.	INHS 2006.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Reptiles					
Western fox snake *Elaphe vulpine vulpina*	MO-E	This species inhabits cultivated fields, along wooded stream valleys and in natural prairies that adjoin marshes. It is active between late April and October. Small mammal burrows and brush piles are used as den sites during winter hibernation. Mating begins in April and females lay eggs under logs or leaf litter in May or June. Young hatch in August or September.	Low. Potential habitat could occur along the project route. This species has been recorded in Lincoln and Buchanan counties, MO.	No.	MDC 2000a.
Smooth earth snake *Virginia valeriae*	KS-T	This species inhabits rocky hillsides in moist woodlands and woodland edges in river and stream valleys where they may be found on the slopes under leaf litter, rocks, or logs. During winter, it utilizes deep crevices on rocky hillsides. Mating begins in the spring after emergence from hibernation. Mating may also occur in the fall. Young hatch in August or September.	None.	Yes. The project does not occur within the geographic range of this species.	GPNC 2005; Collins 1993.
Massasauga *Sistrurus catenatus* spp.	FC; NE-T MO-E; IL-E	This subspecies prefers marshy and swamp areas dominated by cordgrass, sedges, and bulrushes, as well as lowland areas along river and lakes. The snakes hibernate singly in mammal burrows, crayfish burrows, and in crevices or rock piles close to water. Courtship and mating occurs in spring and young are born in late July through early September.	Moderate. Potential habitat could occur along the project route. This species has been recorded in Jefferson and Gage counties, NE; Chariton, Randolph, and St. Charles counties, MO; and Bond, Fayette, and Madison counties, IL.	No.	Briggler and Johnson 2004; Collins 1993; Johnson and Figg 1993; MDC 2000a; Seigel 1986.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
False map turtle *Graptemys pseudogeo-graphica*	SD-T	This species inhabits slow to swift current rivers and streams, river sloughs, oxbow lakes, ponds, impoundments, and backwaters. They are devoted baskers, often resting just below the surface on submerged branches from fallen trees and projecting logs.	Low. Occurrence by this species would be limited to the Missouri River crossing in Yankton, SD. This species has been documented near Gavin's Point along the Missouri River.	No.	USGS 1995.
Kirtland's snake *Clonophis kirtlandi*	IL-T	This species inhabits prairie wetlands, wet meadows, and grassy edges of creeks, ditches, and ponds, usually in association with crayfish burrows. It also has been found in damp habitat remnants in vacant lots of urban settings. Secretive and nocturnal, it shelters beneath logs and surface debris, or in crayfish burrows, by day.	Moderate. Potential habitat could occur along the project route. This species has been recorded within 5 miles of ROW in Fayette County, IL.	No.	INHS 2006.
Invertebrates					
Dakota skipper *Hesperia dacotae*	FC; ND-SC; SD-SC	This species is considered an obligate of undisturbed native prairie. The butterfly inhabits wet lowland prairie dominated by bluestem grasses and dry upland prairie dominated by mixed bluestem and needle stem grasses. Both habitat types contain an abundance of flowering plants and have alkaline soils. Adults emerge in mid-June to early July, and mate during a flight period that lasts for about three weeks.	High. The project ROW occurs within the known range of this species. This species has been documented in Ransom, Sargent, and Barnes counties, ND; and marshall and Day counties, SD.	No.	Vaughn and Shepherd 2005; Dana 1983; McCabe 1981.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Spectaclecase *Cumberlandia monodonta*	FC; MO-SC	This species occurs in large rivers and is a habitat-specialist. It is found in riverine microhabitats sheltered from the main force of current. Occurs in substrates from mud and sand to gravel, cobble, and boulders in relatively shallow riffles and shoals with slow to swift current. The species appears to spawn twice a year during relatively short periods in the autumn and spring.	Low. Potential occurrence in Lincoln County, MO.	No.	USFWS 2002; Baird 2000.
Scaleshell mussel *Leptodea leptodon*	FE; SD-SC; NE-E	Occurs in riffles with moderate to high gradients in creeks to large rivers. Typically associated with riffles, relatively strong currents, and substrate of mud, sand, or assemblages of gravel, cobble, and boulder. Restricted to rivers with relatively good water quality in stretches with stable channels. Little is known concerning the reproduction of this species.	Low. Known to occur in South Dakota and Nebraska in the Missouri River.	No.	Oesch 1995; Cummings and Mayer 1992; Roberts 2004.
Higgins' eye pearlymussel *Lampsilis higginsi*	FE; SD-SC	Found in substrates of mud with a mixture of gravel and stones. Prefers rapidly flowing water. The exact breeding season is unknown.	Low. Known to occur in South Dakota in the Missouri River and Illinois in the Mississippi River.	No	Hornbach 2004; Cummings and Mayer 1992.
Winged mapleleaf *Quadrula gragosa*	FE; SD-SC	The species is found in riffles with clean gravel, sand, or rubble bottoms.	Low. Known to occur in South Dakota in the James River.	No.	USFWS 2005.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Plants					
Decurrent false aster *Boltonia decurrens*	FT; MO-E; IL-T	The species grows in open muddy bottomlands and is dependent upon disturbance from cyclical flooding to maintain the habitat suitable for its survival. Historically, it was found on the shores of lakes and the banks of streams. Currently, it is most common in disturbed lowland areas where human-caused disturbance provides adequate habitat. Flowers: July-October.	Moderate. Potential habitat could occur along the project route. Populations currently known for the Mississippi River near St. Louis and along the Illinois River in west-central Illinois.	No.	USFWS 1990; MDC 2000b.
Small white lady's-slipper *Cypripedium candidum*	NE-T	This species is found in wetland prairie habitats: mesic blacksoil prairie, wet blacksoil prairie, glacial till hill prairie, sedge meadow, calcareous fen, glade. Found on calcareous soils. Flowering occurs May-June.	Low. Potential habitat could occur along the project route. Known distribution includes wetland areas in Nebraska.	No.	Bowles 1983; NatureServe 2005.
Eastern prairie fringed orchid *Platanthera leucophaea*	FT; IL-E	Mesic-wet calcareous tallgrass sand or silt loam prairie. May also be found in open graminoid portions of lake margins, sedge, meadows, and marshes, wet prairie or open swamps, or bogs and shores. Flowering begins late June to early July. Flowers do not appear annually.	Moderate. Potential habitat could occur along the project route. Known distribution includes prairie and wetland areas in Missouri, Illinois, and Oklahoma.	No.	Bowles 1983; USFWS 1991.
Western prairie fringed orchid *Platanthera praeclara*	FT; SD-SC; NE-T	Occurs in mesic upland tallgrass prairie in the southern part of its range, often in swales, and wet-mesic tallgrass prairie and sedge meadows in the northern part of its range. Also known from prairies and swales in sand dune complexes that are fed by shallow underground water. Flowers June-July.	Moderate. Potential habitat could occur along the project route. Known distribution includes all states along ROW except Oklahoma. Native prairie crossed by ROW in North Dakota, Nebraska, and Kansas.	No.	MDC 2000b; Seig and King 1995; Sieg and Bjugstad 1994.

Table G-1 Special Status Species Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Prairie bush-clover *Lespedeza leptostachya*	FT; IL-E	In Illinois, this species is generally found on dry gravel prairies and dry-mesic prairies it is often found on north-facing prairie slopes. On these slopes, it typically occurs either in thin soil at the margins of rocks or in gravelly loamy soil. Flowers in July, August.	None.	Yes. Known primarily from northern Illinois and not known from any Illinois counties crossed by ROW. Also no suitable native prairie crossed by ROW in Illinois.	CPC 2005; TNC 1995; Sather 1990; http://www.centerforplantconservation.org; http://plants.usda.gov/java/nameSearch
Running buffalo clover *Trifolium stoloniferum*	FE; MO-E	This species is commonly found in areas of rich soils in the ecotone between open forest and prairie; and moist, partially shaded woodlands- sometimes along stream or river terraces. Also found in areas disturbed by grazing or mowing. This species historically grew along bison trails. Flowers: April-June.	Moderate. Potential habitat could occur along the project route. Known distribution includes Kansas, Missouri, and Illinois. Suitable habitat may be crossed by ROW.	No.	MDC 2000b; USFWS 2005.
Royal Catchfly *Silene regia*	IL-E	This species is found in habitats that include mesic black soil prairies, openings in upland forests, savannas, scrubby barrens, and open areas along roadsides and railroads.	High. The project ROW occurs within the known range of this species. This species has been documented in Madison County, IL within 5 miles of ROW.	No.	Hilty 2006; EIU 2006.
Prairie Spiderwort *Tradescantia bracteata*	IL-T	Common spiderwort likes sandy soils and seems to be most abundant where grazing is light to moderate. Dry typical prairie and dry sand prairies.	High. The project ROW occurs within the known range of this species. This species has been documented in Madison County, IL within 5 miles of ROW.	No.	USFS 2002.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Spring Ladies' Tresses *Spiranthes vernalis*	IL-E	This species is typically found in upland dry to mesic forests, dry to mesic prairies, and successional cultured fields.	High. The project ROW occurs within the known range of this species. This species has been documented in Madison County, IL within 5 miles of ROW.	No.	USFS 2002.

FE = Federally endangered
FT = Federally threatened
FC = Federal candidate

ND-SC = North Dakota 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.
MO-E = Missouri endangered.
MO-SC = Missouri species of conservation concern.
IL-E = Illinois endangered.
IL-T = Illinois threatened.
OK-E = Oklahoma endangered.
OK-T = Oklahoma threatened.

Table G-2 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Mammals					
Fisher *Martes pennanti*	ND-SC	This species inhabits upland and lowland forests, including coniferous, mixed, and deciduous forests. Fishers generally avoid areas with little forest cover or significant human disturbance and conversely prefer large areas of contiguous interior forest.	None. The historic range of this species extends into the extreme northeast portion of North Dakota in Pembina County.	Yes. The project does not cross suitable habitat for this species.	Powell et al. 2003; NatureServe 2005.
Long-tailed weasel *Mustela frenata*	MO-SC	This species is commonly found in woodlands, field edges, riparian grasslands, swamps, and marshes; preferred habitat in MO is woodlands and thickets near water. Dens are in abandoned mammal burrows, rock crevices, brushpiles, stump hollows, or spaces among tree roots. Breeding period: July-August. Litters born April through May.	High. Suitable habitat for this species occurs along the project route. This species has been located in Randolph and Carroll counties in MO.	No.	MDC 2004a; Svendsen 2003.
Southern flying squirrel *Glaucomys volans*	KS-SC	In Kansas southern flying squirrels are found in the eastern third of the state, being fairly restricted to thick stands of deciduous forest. Pine and hardwood trees provide suitable foraging and nesting habitat. Snags are important for nesting. Breeding period: February to March and again from June-July; gestation is 40 days; pups weaned at 5 weeks.	Low. Relatively small amounts of forest habitat would be crossed in Kansas. This species has been recorded in Doniphan County, KS.	No.	MOK 2002; Hall 1951; Fitzgerald 1994.

Table G-2 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Southern bog lemming *Synaptomys cooperi*	KS-SC	Two subspecies occur in Kansas, *Synaptomys cooperi gossi* in the eastern half of the state, and *S. c. paludis* in a small area in the southwestern part of the state. Southern bog lemmings inhabit communities of thick matted ground cover with high overhead vegetation in both forest and grassland, but are not restricted to bogs. Favored habitats include vegetation surrounding springs, damp to wet grasslands, and marshes. Upland grasslands near wetland and riparian areas are also used. Breeds year-round; peak April-September.	Low. Relatively small amounts of forest habitat would be crossed in Kansas. This species has been recorded in Nemaha and Brown counties in KS.	No.	MOK 2002; Schwartz and Schwartz 1981.
Birds					
Red-necked grebe *Podiceps grisegena*	SD-SC	Nesting habitat includes wetlands with patches of open water and stands of bulrush or similar emergent vegetation. Fresh water lakes, lagoons, floodwaters, and calm rivers with some emergent vegetative cover are commonly used. Prefers areas having both open water and wetland vegetation. Eggs laid from May-June; incubate for 22-27 days; young fledge at about 8-10 weeks.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been recorded in Marshall and Day counties in SD.	No.	WIDNR 2005; NatureServe 2005.
Pied-billed grebe *Podilymbus podiceps*	MO-SC	This species inhabits ponds with much shoreline and emergent vegetation, marshes with areas of open water 15 to 25 inches deep and marshy inlets and bays. Found on ponds, sloughs, flooded areas, marshy parts of lakes and rivers. Nesting occurs May-July; incubate 23 days; young fledge in approximately 35 days.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been recorded in Carroll and Buchanan counties in MO.	No.	NPWRC 2005; MDC 2004b.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
American white pelican *Pelecanus erythrorhynchos*	SD-SC	This species inhabits rivers, lakes, reservoirs, estuaries, bays, marshes. Rests on islands and peninsulas. Nests usually on islands or peninsulas in brackish or freshwater lakes, isolated from mammalian predators. Nests on low, flat or gently sloping terrain in a slight depression or on a mound of earth and debris. Nesting begins in May or June; incubation averages 31-32 days; young fledge at 9-10 weeks.	Low. Suitable breeding habitat for this species would be limited to the Missouri River crossing in Yankton County, SD.	No.	Evans and Knopf 1993; NatureServe 2005.
Great egret *Ardea alba*	MO-SC	This species is a rare breeder in Missouri. They may be found in marshes, swampy woodlands, streams, lakes, and ponds; also fields and meadows. Nests primarily in tall trees, usually with other colonial water birds; in woods or thickets near water. Returns to the same colony sites year after year. Nesting occurs May-July; incubation lasts 23-25 days; young fledge at about 6 weeks.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been documented in Chariton County, MO.	No.	Parnell et al. 1988; Robbins and Easterla 1992; MDC 2004b.
Cooper's hawk *Accipiter cooperii*	SD-SC MO-SC	Breeds in deciduous, mixed, and coniferous forests. In MO, this species nests in mature, even-aged forests with moderate canopy closure, frequently consisting of short-leaf pine *(Pinus echinata)*. Breeding season April-June. Eggs usually laid April-May. Incubation 30–35 days; young remain in nest about 4 weeks; fledglings remain in vicinity of nest and continue to be fed by parents until about 8 weeks old.	High. Suitable breeding habitat for this species occurs along the project route. This species has been located in Marshall County in SD, and Chariton, Lincoln, and St. Charles counties in MO.	No.	MDC 2004b; Rosenfield and Bielefeldt 1993; CLO 2005.

Table G-2 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Red-shouldered hawk *Buteo lineatus*	MO-SC	This species is found along rivers and swamps in extensive bottomland hardwood forests. It requires mature canopy structure with large, low-branching hardwoods for nesting, and prefers areas with wetland openings nearby. Like the red-tailed hawk, this species hunts from a perch. Breeding occurs February-April; eggs laid March-June; young leave the nest at 5-6 weeks.	Moderate. Suitable habitat for this species would be limited to riverine woodland habitats. This species has been located in Chariton and Lincoln counties, MO.	No.	MDC 2004b; Crocoll 1994; Hands et al. 1989b; Robbins and Easterla 1992.
Broad-winged hawk *Buteo platypterus*	SD-SC	Breeding habitat includes broadleaf and mixed forest, preferring denser situations, less frequently in open woodland. Regularly nests near wet areas and forest openings, edges, and woodland roads. Migrates along ridges, river valleys, and shorelines. Eggs laid mid-May; incubation 30-38 days; leave nest at 29-31 days.	Low. This species is considered to be a rare breeder in eastern SD. This species has been documented in Marshall County, SD.	No.	NatureServe 2005; Palmer 1988.
Sora *Porzana carolina*	MO-SC	Primarily found in shallow freshwater emergent wetlands (e.g., marshes of cattail, sedge, blue-joint, or bulrush), less frequently in bogs, fens, wet meadows, and flooded fields. Can use very small marshes (e.g., < one-half-acre). Nesting begins April-May; incubation lasts 18-20 days; young leave nest within a few days.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been documented in Buchanan County, MO.	No.	MDC 2004b; NatureServe 2005.
Black tern *Chlidonias niger*	ND-SC; SD-SC; KS-SC	This species is found in marshes, along sloughs, rivers, lakeshores, and impoundments, or in wet meadows, typically in sites with mixture of emergent vegetation and open water. Nests may be placed in a variety of vegetative situations, from dense stands of emergent vegetation to open water. Nesting begins in April; eggs generally laid in May.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been located in Marshall County in SD, and Marshall, Brown, and Doniphan counties in KS.	No.	NDGF 2005; NatureServe 2005.

Table G-2 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Common tern *Sterna hirundo*	SD-SC	This species is commonly found on lakes, rivers, and marshes. Nests on sandy, pebbly, or stony beaches, matted vegetation, marsh islands, and grassy areas; in large lakes or along rivers. Eggs are laid mostly May-July; incubation lasts 21-27 days; young first fly at about 4 weeks.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been located in Marshall and Day counties in SD.	No.	NatureServe 2005.
Short-eared owl *Asio flammeus*	KS-SC; MO-SC	This species breeds and forages in grasslands, prairies, wetlands, and croplands. Large blocks of suitable habitat (100 ha; 250 ac) seem necessary to support breeding pairs. The birds nest on the ground, usually on a dry site, often elevated on a small hummock. Eggs laid in April or May; young leave the nest by June.	Low. Suitable habitat for this species occurs along the project route. This species has been located in Marshall and Doniphan counties in KS, and Carroll and St. Charles counties in MO.	No.	RMBO 2000.
Whip-poor-will *Caprimulgus vociferus*	KS-SC	This species is generally found in open woodlands with well spaced trees and a low canopy. Lays eggs on ground in open site under trees or under bush. Eggs laid mostly May-June; incubation 17-20 days; young first fly at about 20 days.	Low. Relatively small amounts of forest and woodland habitat would be crossed in Kansas. This species has been documented in Doniphan County, KS.	No.	NatureServe 2005.
Sprague's pipit *Anthus spragueii*	ND-SC	This species is found in grasslands with mid-height vegetation including upland mixed-grass prairie, alkaline meadows, and wet meadow zones around alkali and freshwater lakes. The breeding season in North Dakota extends from late April through early September, with peak singing in mid-May. Nests with eggs have been found range from June 7 to June 30 in North Dakota; incubation period is unknown.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been recorded in Grand Forks, ND.	No.	Stewart 1975; NatureServe 2005

Table G-2 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Cerulean warbler *Dendroica cerulea*	KS-SC	Most commonly found in large, contiguous forest tracts, composed of structurally mature hardwoods with a high, variably closed canopy, usually near water. Eggs laid from May to July; incubation 9-10 days by female. Young fledge 12 days after hatching.	Moderate. Suitable breeding habitat for this species would be crossed by the ROW. This species has been documented in Brown, Doniphan, and Cowley counties in KS.	No.	CLO 2005; Hamel 2000; Robbins et al. 1992.
Baird's sparrow *Ammodramus bairdii*	ND-SC	This species is most often found in ungrazed or lightly grazed mixed-grass prairie, wet meadows, local pockets of tall grass prairie, and some types of disturbed habitats. Nests on ground in dry area in tangled grass, sometimes under low shrub. Breeding season is from late May through mid-August in ND. Eggs laid mostly June-July; incubation 11-12 days; young leave nest at 8-10 days, hide in grass, first fly at 13 days, and begin to leave parents' territory at 19 days.	Low. Small amounts of grassland habitat would be crossed in ND. This species has been recorded in Grand Forks, ND.	No.	Stewart 1975; Terres 1980; NatureServe 2005.
Bobolink *Dolichonyx oryzivorus*	KS-SC	This species prefers tall grasslands such as wet meadows, hayfields, and moist tallgrass prairie. It is an irregular transient and summer resident in eastern and central Kansas, arriving in May and departing in the Fall. Nesting commences on the ground in a shallow depression.	Low. Relatively small amounts of grassland habitat would be crossed in KS. This species has been recorded in Marshall and Nemaha counties in KS.	No.	KDWP 2004; Martin and Gavin 1995.
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	MO-SC	This species is primarily found in prairie wetlands, but is also common in wetlands associated with prairie parklands, mountain meadows, and arid regions. Typically the species nests in deeper-water palustrine wetlands dominated by cattail (*Typha* spp.), bulrush (*Schoenoplectus* spp.), or reed (*Phragmites* spp.). Breeding season: April-June. Incubation lasts 12-13 days. Young leave nest 9-12 days after hatching; unable to fly until about 21 days old.	Low. Suitable breeding habitat for this species occurs along the project route. This species has been recorded in Buchanan County in MO.	No.	Twedt and Crawford 1995; Terres 1980; NatureServe 2005.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Pileated woodpecker *Dryocopus pileatus*	ND-SC	This species prefers habitats of dense deciduous, coniferous, mixed forest, open woodland, and second growth forests. Prefers woods with a tall closed canopy and a high basal area. Most often in areas of extensive forest or minimal isolation from extensive forest. Nests are in cavities excavated by both sexes usually in dead stubs in shaded places, where the cavity entrance averages about 14 m above ground	Low. This species has been recorded in Sargent County, ND.	Yes. The project would not cross potential nesting habitat for this species.	NatureServe 2006.
Swamp sparrow *Melospiza georgianan*	ND-SC	This species prefers to breed in marshes, wet brushy fields, meadows, lakeshores, stream borders, swamps, pine barrens shrub-sedge bogs. It will build nests in tussocks of grass, sedge, or in low bush, commonly over water. In migration and winter it is found in weedy fields, brush, thickets, scrub, and forest edges.	Low. Small amounts of wetland habitat would be crossed in ND. This species has been recorded in Sargent County, ND.	No.	NatureServe 2006.
Fish					
Hornyhead chub *Nocomis biguttatus*	ND-SC	Generally in small to medium size, moderate to low gradient, cool to warm, typically clear, gravelly streams; in pools and slow to moderate runs, occasionally associated with higher aquatic plants. Spawns in spring and early summer over gravel nest made by male in relatively shallow water often below a riffle.	Low. Known to occur in North Dakota in the Forest River.	No.	Lee et al. 1980; Vives 1990; NatureServe 2005.
Spotted sucker *Minytrema melanops*	KS-SC	This species avoids currents, living in pools of small streams and overflow ponds in the floodplains of rivers. The pools occupied usually have firm bottoms and aquatic vegetation or other plant debris. They seem to require clear, relatively soft water. This fish spawns in late spring or summer. Intolerant of extensive siltation. Spawns in riffle areas in late winter and spring.	Low. Potential occurrence in Cowley and Butler counties in Kansas.	No.	KDWP 2004; NatureServe 2005.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Blue sucker *Cycleptus elongatus*	KS-SC; MO-SC; NE-SC	This species is typically found in large rivers and lower parts of major tributaries. It concentrates in "chutes" or rapids where the water is deep and the bottom is rocky, wholly free of silt. It probably spawns in spring, often migrating upstream following egg-laying.	Moderate. Known to occur in Kansas and Missouri in the Missouri River	No.	Moss et al. 1983; Cross and Collins 1995; Pflieger 1997; KDWP 2004.
Highfin carpsucker *Carpiodes velifer*	MO-SC	This species favors clean streams with clear water and rocky bottoms. Found in rivers, oxbows, sloughs, and ponds over sand or gravel bottom; generally in rivers where current is moderate to swift or in quiet water adjacent to river channels. Spawns in spring and summer.	None. Potentially occurs in Missouri in Lincoln County.	Yes. No records for streams crossed in Missouri.	Becker 1983; NatureServe 2005.
Pugnose shiner *Notropis anogenus*	ND-SC	Found in clear, heavily vegetated glacial lakes and vegetated pools and runs of low gradient creeks and rivers, over bottoms of sand, mud, marl, or gravel. Mostly in shallows in warm months, probably in deep water during rest of year. Spawns June-July.	Low. Potential occurrence in North Dakota in the Forest and Sheyenne rivers.	No.	Becker 1983; NatureServe 2005.
River shiner *Notropis blennius*	KS-SC; SD-SC	This species is found in pools and main channels of large rivers and the lower parts of main tributaries, in water of varying clarity (usually turbid) over substrate of silt, sand, and gravel. Spawns from June to late August.	High. Known to occur in Kansas in the Missouri River, and South Dakota near Gavin's Point Dam.	No.	NatureServe 2005.
Ghost shiner *Notropis buchanani*	MO-SC	This species is found in low-gradient sections of creeks and rivers having moderate flow and moderately clear to turbid water, and near the confluence of large rivers or creeks where they inhabit quiet pools, eddies, or backwaters away from the current. Spawns from May to August.	Moderate. Potential occurrence in Missouri in Audrain, Montgomery, Lincoln, and St. Charles counties.	No.	Page and Burr 1991; Nico and Jacobs 2005; NatureServe 2005.
Brassy minnow *Hybognathus hankinsoni*	KS-SC; MO-SC	This species is typically found in small, clear, sluggish weedy creeks or small rivers with sand, gravel, or mud bottoms. Also common in cool ponds, lakes, and in overflow ponds near rivers. Spawns in spring.	Low. Known to occur in Kansas and Missouri in the Missouri River.	No.	Becker 1983; Cross and Collins 1995.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Plains minnow *Hybognathus placitus*	KS-SC; MO-SC	This species is found in silt-laden streams and rivers, slower water and side pools over beds of sand and silt with slight to moderate erratic flows. Spawns in spring and summer.	Low. Known to occur in Kansas in the Missouri and South Fork Big Nemaha rivers and Missouri in the Missouri River.	No.	Rees et al. 2005; Cross and Collins 1995; Eberle 1995.
Blacknose dace *Rhinichthys atratulus*	KS-SC	This species prefers small, usually cool, gravelly streams of high to moderate gradient. They use pools, slower runs, and backwaters as microhabitats. The Kansas population appears to be a remnant, found only in areas where the last glacier extended. Spawns from about May to July.	None. Potential occurrence in Kansas in Marshall and Nemaha counties.	Yes. No known records of occurrence for streams crossed in Marshall and Nemaha counties.	KDWP 2004; NatureServe 2005.
Plains killifish *Fundulus zebrinus*	MO-SC	This species is found in channels, backwaters, or edges of shallow in sandy-bottomed, turbid headwaters, creeks, and small to medium rivers with slow to moderate current. Spawns in summer.	Low. Potential occurrence in Missouri in Clinton County.	No.	Rahel and Thel 2004; Pflieger 1997.
Western sand darter *Etheostoma clarum*	MO-SC	This species is usually found in medium and large rivers; most common in slight to moderate current over sandy bottom, though also known from areas of gravel or silt. Buries in sand. Spawns in summer.	Low. Potential occurrence in Missouri in Lincoln County.	No.	Pflieger 1997; NatureServe 2005.
American eel *Anguilla rostrata*	SD-SC	This occurs in large pools in streams during their freshwater life stage. They are nocturnal and usually spend the day hidden under rocks or logs.	Low. Known to occur in North Dakota in the Missouri River.	No.	Eddy and Underhill 1974.
Trout-perch *Percopsis omiscomaycus*	SD-SC	This species prefers lakes and large rivers. They spawn in May through June by ascending rivers and using sand or gravel substrates.	Low. Known to occur in North Dakota in the Sheyenne and Pembina rivers.	No.	Eddy and Underhill 1974.
Rosyface shiner *Notopis rubellus*	ND-SC	This species was in the Table 3.7 SOC1 but not this one so it was added but we need to get habitat information references from Rollin.	Low. Known to occur in North Dakota in the Sheyenne and Pembina rivers.	No.	

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Bigmouth shiner *Nortropis dorsalis*	KS-SC	This species appears to favor small streams, up to 12 meters in width and one meter in depth, although its presence in larger rivers has been noted. It is found in runs and pools of shallow open headwaters, creeks, and small to medium rivers with sand substrate, and,sometimes also in lakes. Channelization of prairie streams has increased favorable habitat in some areas. This species spawns in mid-water, with eggs drifting downstream.	Low. Known to occur in Kansas in Brown County streams.	No.	NatureServe 2006, COSEWIC 2003.
Amphibians					
Ringed salamander *Ambystoma annulatum*	MO-SC	Found in forested areas in vicinity of breeding pools; usually under objects or underground. Brief breeding period occurs after heavy late summer to early fall rains, September-November in Missouri. Eggs hatch in about 2-4 weeks; larval period lasts 6-8 months; metamorphosis occurs April-June.	None. Although this species is known to occur in Montgomery and Lincoln counties in MO, its known range is south of the ROW.	Yes. The project occurs outside the geographic range of the species.	Briggler et al. 2004; Trauth et 1989; Petranka 1998.
Great Plains toad *Bufo cognatus*	MO-SC	This species is found in grasslands, semidesert shrublands, open floodplains, and agricultural areas; typically in stream valleys. Burrows underground when inactive. Breeds after heavy warm rains in spring or summer.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Buchanan and Carroll counties in MO.	No.	Johnson 2000; NatureServe 2005.
Northern cricket frog *Acris crepitans*	SD-SC	This species inhabits the edges of sunny marshes, marshy ponds, and small slow-moving streams in open country. It may periodically range into adjacent non-wetland habitats. Eggs laid late spring-early summer. Hibernation sites are underground on land near water; may hibernate communally.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Hanson, Hutchinson, and Yankton counties in SD.	No.	Hammerson 1999; Conant and Collins 1998; NatureServe 2005.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Northern crawfish frog *Rana areolata circulosa*	MO-SC	Generally found in grasslands, prairies, and woodlands near small creeks or marshes. Often, this species takes shelter in crayfish burrows or other animal burrows. Breeds February to April. Breeding takes place in early spring after heavy rains.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Lincoln County, MO.	No.	Johnson 1982; Wright and Wright 1995.
Reptiles					
Blanding's turtle *Emydoidea blandingii*	SD-SC; MO-SC	This species inhabits productive, clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates. It is found in ponds, marshes, swamps, bogs, wet prairies, river backwaters, sloughs, slow moving rivers, protected coves, and lake shallows and inlets. Extensive marshes bordering rivers provide excellent habitat.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Yankton County, SD, and in St. Charles County, MO.	No.	Behler and King 1996; Conant and Collins 1998; Ernst et al. 1994.
Spiny softshell *Apalone spinifera*	SD-SC	These turtles are found in large rivers, impoundments, lakes, ponds along rivers, pools along intermittent streams, oxbows; usually in areas with open sandy or mud banks and soft bottom. Basks on shores or on partially submerged logs. Burrows in bottom of pool during winter inactivity. Eggs are laid June-July in nests dug in open areas in sand, gravel, or soft soil near water. Eggs hatch September-October.	Moderate. This species has been documented along the Missouri River in Yankton , SD.	No.	Collins 1993; Ernst et al. 1994; NatureServe 2005.
Smooth softshell *Apalone mutica*	SD-SC	This species occurs in large rivers and streams with moderate to fast currents. Very infrequently found in lakes, impoundments, and shallow bogs. Waterways with sandy bottoms and a few rocks or aquatic plants are preferred. Sandbars are important for basking and egg laying sites. They seem to prefer larger rivers and live in colonies along certain portions.	Moderate. This species has been recorded at the James River and other locations in Yankton County, SD.	No.	http://el.erdc.usace.army.mil/elpubs/pdf/si06.pdf http://www.herpnet.net/Iowa-Herpetology/reptiles/turtles/smooth_softshell.html

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Northern prairie skink *Eumeces septentrionalis*	ND-SC	Habitat includes open sandy areas of pine barrens and bracken grassland, grassy dunes, sandy banks of creeks and rivers and along roadsides, open grass-covered rocky hillsides near streams, and forest edges and woodland. Eggs are laid in shallow nests dug in loose moist soil under logs, boards, rocks, or other objects. Usually hatch in 1-2 months (mid-late July).	Low. Relatively small amounts of habitat would be crossed by the ROW. This species has been recorded in Barnes, Ransom, and Sargent counties in ND.	No.	Conant and Collins 1998; Somma 1987; Collins 1993; NatureServe 2005.
Eastern hognose snake *Heterodon platirhinos*	KS-SC	This species found in open areas with sandy soil near water; wooded upland hillsides, fields, woodland meadows, prairie, forest-grassland ecotone, river valleys, and stream courses. Burrows into soil. Overwinters in burrows. Eggs laid May-August; hatch in 39-65 days.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Doniphan County, KS.	No.	Collins 1993; NatureServe 2005.
Timber rattlesnake *Crotalus horridus*	KS-SC; NE-SC	In the central mid-west, optimum habitat for this species is high, dry ridges with oak-hickory forest interspersed with open areas (Minton 1972), and "deciduous forest, especially along hilltop rock outcrops in thick woods" (Fitch 1958). It may also be found in swampy areas and floodplains (Mount 1975). Mating season is in the early spring when the snake emerges from hibernation. The young are born in Autumn from August through October.	Moderate. This species could occur within suitable habitat along the project route. This species has been recorded in Marshall and Doniphan counties in KS.	No.	Fitch 1958, 1982, 1985; Collins 1993.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Ringneck snake *Diadophis punctatus*	SD-SC	This species prefers moist habitats in prairie areas of the mid-west. It has become an ecotonal species, occurring both in the patches of woods and the prairie. It is found in open grassland, pasture, and prairie to forested areas, usually hardwoods but also in other wooded areas. It prefers south or west facing hillsides and is generally found under rocks or on rocky hillsides in forested areas. It requires rocks, logs, stumps, fallen bark; habitats are usually moist. Sometimes found in moist caves.	Low. This species could occur within suitable habitat along the project route. This species has been recorded within 5 miles of ROW in Yankton County, SD.	No.	http://wfs.sdstate.edu/sdgap/herps.html
Fox Snake *Elaphe vulpine*	SD-SC	This species prefers moist areas, such as river valleys, marsh borders, river bottom forests, upland hardwoods, pine barrens, open prairies, scrub areas, and hedge rows; they rarely are far from rivers or streams. May be abundant in heavily farmed prairie areas, frequently found in alfalfa fields and bromegrass.	Low. This species could occur within suitable habitat along the project route. This species has been recorded within 5 miles of ROW in Yankton County, SD.	No.	http://wfs.sdstate.edu/sdgap/herps.html
Invertebrates					
Ottoe skipper *Hesperia ottoe*	SD-SC	This butterfly is found in mid-grass to tall grass undisturbed prairies on the Great Plains. It is strictly a species of prairie habitat. It is an avid nectar feeder, and needs abundant nectar sources to maintain a population. adult males emerging before females in late June and July; females may be found as late as early August in some years.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Day County, SD.	No.	MNFI 2005; Brock and Kaufmann 2003; NatureServe 2005.
Poweshelk skipperling *Oarisma poweshelk*	SD-SC	This species is an obligate resident of undisturbed tall-grass prairies. Primary habitat is virgin prairie, but this butterfly also occurs in fens and grassy lakeshores. There is one brood between June and August.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Marshall and Day counties, SD.	No.	Shepherd et al. 2005; NatureServe 2005.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Regal fritillary *Speyeria idalia*	ND-SC; MO-SC	Found in tall-grass prairie and other open sites including damp meadows, marshes, wet fields, and pastures. Larvae are obligate feeders on *Viola*. Flight: One brood from mid-June to mid-August; Most eggs are laid in August. Violets, including bird's foot violet (*Viola pedata*), are the only suitable larval hosts.	Moderate. This species could occur within suitable habitat along the project route. This species has been recorded in Sargent and Ranson counties, ND, and Buchanan, Randolph, and Caldwell counties in MO.	No.	Opler et al. 1995; Heitzman and Heitzman 1987; MDC 2000c.
Prairie mound ant *Formica montana*	MO-SC	This species is found in tall-grass prairies, but may occasionally also occur in open oak or pine-dominated woodlands.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Chariton County, MO.	No.	Trager 1998.
Wallace's deepwater mayfly *Raptoheptagenia cruentata*	KS-SC	The microhabitat for this species has not been documented.	Low. This species could occur within suitable habitat along the project route. This species has been recorded in Doniphan County, KS.	No.	NatureServe 2006.
Round hickorynut *Obovaria olivaria*	MO-SC	This species is found in large rivers and lakes in sand or sand/gravel substrates.	Low. Potential occurrence in Lincoln County, MO.	No.	Cummings and Mayer 1992; Oesch 1995; Box and Mossa 1999.
Fat mucket mussel *Lampsilis siliquoidea*	KS-SC	This mussel is an obligate riverine species preferring slow moving current. They can tolerate a wide variety of substrates, but generally do not occur in areas of shifting sand.	Low. Potential occurrence in Marshall County, KS.	No.	Cummings and Mayer 1992; KDWP 2004.
Creeper mussel *Strophitus undulates*	KS-SC	This species is an obligate riverine species found in perennial streams where it prefers gravel substrates.	Low. Potential occurrence in Marshall County, KS.	No.	Cummings and Mayer 1992; KDWP 2004.
Threeridge *Amblema plicata*	SD-SC	This species is found in small to large rivers and impoundments in sand, mud or gravel.	Low. Known to occur in South Dakota in Wolf Creek and James River.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Rock pocketbook *Arcidens confragosus*	SD-SC	This species is found in medium to large rivers in pools and areas of reduced flow in mud and sand.	Low. Known to occur in South Dakota in Wolf Creek and James River.	No.	Cummings and Mayer 1992 (online field guide, INHS).

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Plain pocketbook *Lampsilis cardium*	SD-SC	This species is found in small creeks to large rivers in mud, sand, or gravel.	Low. Known to occur in South Dakota in Wolf Creek.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Black sandshell *Ligumia recta*	SD-SC	This species is found in medium to large rivers in riffles or raceways in gravel or firm sand.	Low. Known to occur in South Dakota in Wolf Creek.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Yellow sandshell *Lampsilis teres*	SD-SC KS-SC	This species is found in medium to large rivers in sand or fine gravel.	Low. Known to occur in South Dakota in the James River. Known to occur in Kansas in Cowley County streams within 5 miles of ROW.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Mapleleaf *Quadrula quadrula*	SD-SC	This species is found in medium to large rivers and reservoirs with a mud, sand, or gravel bottom.	Low. Known to occur in South Dakota in Wolf Creek.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Deertoe *Truncilla truncata*	SD-SC	This species is found in medium to large rivers in mud, sand, or gravel.	Low. Known to occur in South Dakota in Wolf Creek, James River, and Missouri River.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Wabash pigtoe *Fusconaia flava*	SD-SC	This species is found in creeks to large rivers in mud, sand, or gravel.	Low. Known to occur in South Dakota in the James River.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Hickorynut *Obovaria olivaria*	SD-SC MO-SC	This species is found in large rivers (rarely in medium or small streams) in sand or mixed sand and gravel.	Low. Known to occur in South Dakota in the James River.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Pimpleback *Quadrula pustulosa*	SD-SC	This species is found in medium to large rivers in mud, sand, or gravel.	Low. Known to occur in South Dakota in the James River.	No.	Cummings and Mayer 1992 (online field guide, INHS).
Fawnsfoot *Truncilla donaciformis*	SD-SC KS-SC	This species is found in large rivers or the lower reaches of medium-sized streams in sand or gravel.	Low. Known to occur in South Dakota in the James and Missouri Rivers. Known to occur in Kansas in Marion County streams within 5 miles of ROW.	No.	Cummings and Mayer 1992 (online field guide, INHS).

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Plants					
Indian rice grass *Achnatherum hymenoides*	KS-SC	Adapted to a wide variety of soils, but does not do well on wet or poorly drained soils. It is dominant on sandy stony, gravelly, and shallow soils in the upland and semi-desert climatic zones. It is also adapted to soils high in lime. It is moderately salt and alkali tolerant. Flowering: May-August.	High. Known to occur in Kansas in Marshall County within 5 miles of ROW.	No.	Tirmenstein 1999; Owensby 2002; Gould 1988; Hitchcock 1971.
Auriculate false foxglove *Agalinis auriculata*	MO-SC	This species is found in mesic to wet-mesic tallgrass prairie. A fall-blooming hemiparasitic annual, this species requires open places in the vegetation for its seed to germinate - perhaps created in the past by herds of bison or elk. Flowering Period: Early August to late August.	None.	Yes. Known county distribution in Missouri is near ROW, but no native tallgrass prairie crossed by ROW.	CPC 2005; ONHI 1999.
Wild sarsaparilla *Aralia nudicaulis*	MO-SC	Typically occurs on rich wooded slopes of limestone soils; in MO it is known from dry to moist deciduous forests, coniferous forests, and mixed woods, and also in swamps, and on stabilized dunes- surviving as a Pleistocene relic. Flowers: May-June.	None.	Yes. Known county distribution in Missouri outside of ROW.	Steyermark 1963; Weber and Whitman 2001; NatureServe 2005.
Wooley milkweed *Asclepias lanuginosa*	SD-SC	This species is found in dry woods, prairies, hillside prairies, rocky soils. Flowering: June-July.	High. Known to occur in South Dakota in Clark County within 5 miles of ROW.	No.	Larson 1993.
Subarctic lady-fern *Athyrium filix-femina*	ND-SC	In the Dakotas, this species is found along swamp margins, wooded banks and alluvial woods. Categorized as an aquatic or wetland species.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Larson 1993.
Texas bergia *Bergia texana*	MO-SC	This species is found on muddy or sandy shores and flats; rare. Flowers: June-October.	Moderate. Known county distribution in Missouri near ROW.	No.	Steyermark 1963; NPWRC 2005; USDA [no date].
Earlyleaf brome *Bromus latiglumis*	MO-SC	Found on wooded slopes and bluffs and the alluvial banks of streams, usually in limestone areas. Flowers: July-August.	Moderate. Known range includes ROW and potential habitat crossed by ROW.	No.	Steyermark 1963; Hitchcock and Chase 1971.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Nottoway Valley brome *Bromus nottowayanus*	MO-SC	Usually grows on rich, loamy soils in bottomland forests along rivers and streams, and occasionally in mesic woods. It is typically not far (<50 m) from a river or stream.	Moderate. Known range includes ROW and potential habitat crossed by ROW.	No.	Mackenzie and Ladd 1995; Hitchcock and Chase 1971.
Bellow-beaked sedge *Carex albicans* var. *australis*	MO-SC	This species is found on acidic, dry soils of sandstone and granite, also calcareous regions, wooded slopes, sandstone ridges, woodland clearings, in partial shade of deciduous forests. Fruiting April-June.	Moderate. Known range includes ROW and potential habitat crossed by ROW.	No.	FNAA 2004.
Bauxbaum's sedge *Carex Buxbaumii*	ND-SC	This species is found in bogs, wet meadows, springs and fens. Flowering: late May-June.	High. Known to occur in North Dakota in Barnes County within 3 miles of ROW.	No.	Larson 1993.
Creseted sedge *Carex cristatella*	KS-SC	Habitats include openings in wet meadows, moist woodlands, swamps, soggy thickets, wet prairies, sedge meadows, sloughs, low-lying areas along rivers, powerline clearances in woodlands, and ditches. This sedge occurs in both degraded and higher quality habitats. Flowering: late spring – early summer.	High. Known to occur in Kansas in Brown County within 5 miles of ROW.	No.	Hilty 2006; USDA no date.
Raven-foot sedge *Carex crus-corvi*	KS-SC	This species is found in wet meadows, wet prairies, swamps, floodplain woods, and roadside ditches. Flowering: May-July.	High. . Known to occur in Kansas in Doniphan County within 5 miles of ROW.	No	FNA 2004; USDA no date.
Bristly-stalk sedge *Carex leptalea*	ND-SC	This species is found in bogs, and wet woodlands. Flowering: June-July.	High. Known to occur in North Dakota in Pembina and Cavalier counties within 3 miles of ROW.	No.	Larson 1993.
Blue cohosh *Caulophyllum thalictroides*	ND-SC	This species is found in rich valley woodlands, ravines, north-facing wooded slopes, moist base of bluffs. Flowering: April-May.	High. Known to occur in North Dakota in Ransom County within 3 miles of ROW.	No.	Tenaglia 2006.
Coast sandbur *Cenchrus incertus*	KS-SC	This species is found on dry, sandy, cultivated and disturbed areas. Flowering: May-September.	High. Known to occur in Kansas in Cowley County within 5 miles of ROW.	No.	Hall and Vandiver 1990.

Table G-2 Species of Special Concern Identified for the Keystone Pipeline Project

Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Lanceleaf coreopsis *Coreopsis lanceolata*	KS-SC	This species is found in dunes, dry woods, and meadows, in full sun to partial sun, and very dry to somewhat moist sites. Naturally occurs in open sandy banks, roadsides, grasslands, banks, bluffs, in oak-pine woodland, and in other sandy areas. Flowering: April-June.	High. Known to occur in Kansas in Brown County within 5 miles of ROW.	No.	Hilty 2006; Tenaglia 2006.
American yellow lady's-slipper *Cypripedium parviflorum*	ND-SC	Look for yellow lady's slipper in moist places in tallgrass prairie, especially near trees or shrubs along lakeshores. Plants likely will not tolerate heavy grazing as the roots would be easily damaged by trampling in the soft soils that the plant prefers. Flowering: 25 May-20 June.	High. Known to occur in North Dakota in Pembina, Cavalier, and Sargent counties within 3 miles of ROW.	No.	Kantrud 1995; Mergen 2006; Hapeman 2006.
Showy lady's-slipper *Cypripedium reginae*	ND-SC	This species is found almost exclusively in calcareous wetlands, though it may also occur in wet woodlands. Flowering: 20 June – 5 July.	High. Known to occur in North Dakota in Pembina and Cavalier counties within 3 miles of ROW.	No.	Hapeman 2006.
Spinulose woodfern *Dryopteris carthusiana*	ND-SC	This species is found in wet alluvial woods or swamps.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Larson 1993.
Crested woodfern *Dryopteris cristata*	ND-SC	This species is found in wet alluvial woods or swamps.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Larson 1993.
Walter's barnyard grass *Echinochloa walteri*	MO-SC	This species is distributed on low ground; rarely in standing water; it is basic to alkaline marshes.	High. Known to occur in St.Charles County, MO within 1 mile of ROW.	No.	USFS 2002.
Lance-like spike rush *Eleocharis lanceolata*	MO-SC	This species is found on wet, sandy, open ground, muddy margins of small ponds, and in moist depressions on glades. May also be found along stream banks and in pine woodlands. Flowers: June-October	None.	Yes. Known distribution only in three counties in southern portion of Missouri not near ROW.	Steyermark 1963; FNAA 2004; http://plants.usda.gov/
Small spikerush *Eleocharis parvula*	ND-SC	This species is found on wet saline or alkaline flats and shores. Flowering: July-early Sept.	High. Known to occur in North Dakota in Nelson and Sargent counties within 3 miles of ROW.	No.	Larson 1993.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Green keeled cottongrass *Eriophorum viridi-carinatum*	ND-SC	This species grows in cold, calcareous sphagnum bogs, and swamps, and as well as on permafrost tussocks and calcicoles.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Williams 1990.
Spotted Joe-pye-weed *Eupatorium maculatum var bruneri*	KS-SC	This species is found in moist black soil prairies, sand prairies, sedge meadows, marshes, fens, and swampy thickets with small trees or shrubs. It's not often found in highly disturbed areas. Flowering: July-September.	High. Known to occur in Kansas in Doniphan County within 5 miles of ROW.	No.	Hilty 2006; FNA 2004.
Fringed gentian *Gentianopsis crinita*	ND-SC	This species typically occurs in low, moist native grassland. Flowering: September-October.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Kantrud 1995.
Plains frostweed *Helianthemum bicknellii*	ND-SC	This species inhabits prairies, rocky open areas. Usually found in dry, sandy soil. Also in woodlands and glades Flowering Period: Early June to late July.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	KYNPC 2006.
Greater Canadian St. John's wort *Hypericum majus*	KS-SC	The taxon grows along ponds, lakesides or other low, wet places. It is a facultative wetland species. Flowering: July-September.	High. Known to occur in Kansas in Washington County within 5 miles of ROW.	No.	WA DNR no date.
Narrow leaf morning glory *Ipomoea shumardiana*	KS-SC	This species is found in eastern Kansas through central Oklahoma to north Texas. It is described as a prairie species. Flowering: June-August.	High. Known to occur in Kansas in Cowley County within 5 miles of ROW.	No.	Shinners 1961; Correll and Johnston 1970.
Butternut *Juglans cinerea*	MO-SC	This tree species is found in mixed hardwood forests; often on stream benches and terraces, on slopes, in the talus of rock ledges, and on other sites with good drainage. Flowers: April-May.	Moderate. . Known county distribution in Missouri near ROW, and suitable habitat may be crossed by ROW.	No.	Harlow et al. 1996, Steyermark 1963.
Star duckweed *Lemna trisulca*	MO-SC	This species is found in cool, freshwater creeks, and in shallow lakes, ponds and marshes. Flowering: (rare) late spring-summer.	High. Known to occur in St. Charles County, MO within 1 mile of ROW.	No.	Armstrong 2006.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Loesel's twayblade *Liparis loeselii*	ND-SC	This species is found in bogs, wet ditches, old sand pits and moist meadows. While it often grows in acidic soils, it can be found just as frequently in strongly basic soils. The critical factor seems to be a lack of competing vegetation. Flowering: 10 July- 20 July.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Hapeman 2006.
Prairie loosestrife *Lysimachia quadriflora*	SD-SC	This species is found in wet meadows and around pond margins, usually where sandy. Often found on calcareous soils. Flowering: July-August.	High. Known to occur in South Dakota in Brown County within 5 miles of ROW.	No.	Larson 1993; Tenaglia 2006.
Yellow false mallow *Malvastrum hispidum*	MO-SC	Occurs usually on rocky prairies, limestone, sandstone, or cherty limestone glades, bluffs, open alluvial valleys, and along gravel bars. Flowers: July-September.	Moderate. Known county distribution in Missouri near ROW, and suitable habitat may be crossed by ROW.	No.	Steyermark 1963.
Tender creeping-cucumber *Melothria pendula*	KS-SC	This species is found in rich or rocky low woods, at the base of limestone bluffs, and in alluvial woods, often along streams. Flowering: July-September.	High. Known to occur in Kansas in Cowley County within 5 miles of ROW.	No.	Tenaglia 2006.
Prairie false dandelion *Microseris cuspidata*	MO-SC	This species occurs on dry, open prairies. Prefers rocky, loose, or gravelly soils. Flowers: April-June.	None.	Yes. ROW near known distribution near Lincoln County, Missouri but no prairie habitat crossed by ROW.	Haddock 2005; GPFA 1986.
Naked Bishop's cap *Mitella nuda*	ND-SC	Moist forests, thickets, bogs and swamps, often growing among mosses; rare, with records from Bottineau and Pembina counties, ND.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Larson 1993.
Thread-like naiad *Najas gracillima*	MO-SC	This submersed annual herb is found in the clear water of natural, soft-water lakes. Flowers July-Sept.; fruits Aug.-Oct.	None.	Yes. No suitable habitat crossed by ROW.	OHDNR 2005; Steyermark 1963.
Adder's tongue *Ophioglossum vulgatum*	MO-SC	This species is found in shaded secondary woods, wooded slopes, forested bottomlands, and floodplain woods. Leaves appear spring-early summer. Spores mature April-June.	Low. This species could occur within suitable habitat along the project route, especially woodlands crossed by ROW in MO.	No.	FNAA 2004; Steyermark 1963.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Lanceolateleaf rock moss *Orthotrichum elegans*	MO-SC	An epiphytic moss generally found on tree trunks and branches.	Low. This species could occur within suitable habitat along the project route, especially woodlands crossed by ROW in Missouri.	No.	Anderson et al. 1990.
Pendant-pod point vetch *Oxytropis deflexa*	ND-SC	This species is found primarily on drier prairies and plains; also open wooded areas. Flowering: June-July.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Sedivec and Barker 1998.
Oklahoma phlox *Phlox oklahomensis*	KS-SC	This species is adapted to tallgrass and midgrass prairies and populations thrive in areas of low to moderate grazing. Populations occur both on the gently rolling uplands (0-15% slopes) and on steeper slopes of canyons. Plants are most abundant on north-facing slopes, and well-drained grassland soils that have weathered from calcareous shales. Flowering: March-May.	High. . Known to occur in Kansas in Butler County within 5 miles of ROW.	No	Springer and Tyrl 1989, 2003.
Heart-leaved plantain *Plantago cordata*	MO-SC	This species is semi-aquatic, found in areas of dolomitic limestone. It often grows in rock crevices or gravel bars in shallow, clear streams (and adjacent floodplains) running through heavily wooded areas. This species requires a very specific stream habitat, in which the processes of erosion and deposition are regular and predictable. Flowers: April-June.	Moderate. Known county distribution in Missouri near ROW, and suitable habitat may be crossed by ROW.	No.	Bowles and Apfelbaum 1989; CPC 2005; NatureServe 2005.
Jacon's ladder *Polemonium reptans*	KS-SC	Typical habitat for this species is rich low woods, thickets at the base of bluffs, and moist ground near streams. Flowering: April-June.	High. Known to occur in Kansas in Brown County within 5 miles of ROW.	No.	Tenaglia 2006; Hilty 2006.
Prickly gooseberry *Ribes cynosbati*	ND-SC	Habitats include thin rocky woodlands, wooded slopes, woodland borders, and limestone bluffs. Some disturbance is beneficial to this species if it reduces the overhead tree canopy.	High. Known to occur in North Dakota in Ransom County within 3 miles of ROW.	No.	Hilty 2006.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Prairie Willow *Salix humilis*	SD-SC	Habitats include moist to slightly dry black soil prairies, sand prairies, sandy savannas, barrens, and gravelly seeps. It can be found in either lowland or upland areas, depending on the variety or local ecotype.	High. Known to occur in South Dakota in Brown and Marshall counties within 5 miles of ROW.	No.	Hilty 2006; Larson 1993.
Rocky Mountain bulrush *Schoenoplectus saximontanus*	MO-SC	This species is generally found on damp sandy soils near freshwater ponds, ditches, or watercourses. Fruiting occurs summer to fall.	Moderate. Known range includes ROW and potential habitat crossed by ROW.	No.	FNAA 2004.
Oval ladies' tresses *Spiranthes ovalis* var. *erostellata*	MO-SC	This species is typically found in moist, rich woodlands, thickets, old fields, second-growth woodlands, wooded hillsides. Flowering: September-October.	Moderate. Known range includes ROW and potential habitat crossed by ROW.	No.	Steyermark 1963; FNAA 2004.
Goat's-rue *Tephrosia virginiana*	NE-SC	This species is found on sandy soils in open woods, glades, prairies, and along roadsides. It is often an indicator of shallow soils. Flowering: May -July.	Moderate. Known range includes ROW and potential habitat crossed by ROW.	No.	FNAA 2004; Steyermark 1963; MDC 2004c; GPFA 1986.
Nodding pogonia *Triphora trianthophora*	KS-SC	This species is mainly found in moist lowland woods, ravines, stream valleys, bottoms in the lower 1/2 of Missouri. The white flowers only last for one day and are frequented by bees from the family *Halictidae*. Flowering: August-Sept.	Moderate. Known range includes ROW and potential habitat crossed by ROW.	No.	FNAA 2004; GPFA 1986.
Rock elm *Ulmus thomasii*	MO-SC	This species is found in mesic hardwood forests, moist, well-drained uplands, rocky ridges, flood plains, streambanks and on limestone outcrops.	Moderate. Known county distribution in Missouri near ROW, and suitable habitat may be crossed by ROW.	No.	Harlow et al. 1996; FNAA 2004; Steyermark 1963.
Flatleaf bladderwort *Utricularia intermedia*	ND-SC	This aquatic species is found in bogs, ponds, swamps, slow-moving streams, and wet sedge or rush meadows. Flowering: July-August.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	WA DNR no date.
Lesser bladderwort *Utricularia minor*	ND-SC	This species is found in open bogs, sedge meadows, and marshlands; preferring calcium-rich shallow water.	High. Known to occur in North Dakota in Pembina County within 3 miles of ROW.	No.	Neid 2006.

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Species	Status	Habitat Association	Potential for Occurrence Within the Project ROW	Eliminated From Detailed Analysis	References
Bird's-foot violet *Viola pedata*	NE-SC	Found in rocky or dry open woodlands; on slopes, ridges, prairies, glades, and roadsides, most always in acid soils. Flowers: April-June, often again Sept.-Dec.	Low. This species could occur within suitable habitat along the project route, especially woodlands crossed by ROW in Nebraska.	No.	Steyermark 1963; GPFA 1986.

ND-SC = North Dakota Species of Conservation Priority
SD-SC = South Dakota Species of Concern
IA-SC = Iowa special concern species.
NE-SC = Nebraska species of special concern.
KS-SC = Kansas species in need of conservation.
MO-SC = Missouri species of conservation concern.