BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, L.P. FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT	)	APPLICATION NO.: _____
	)	
	)	**APPLICATION**
	)	
	)	

TransCanada Keystone Pipeline, LP (Keystone), pursuant to the Major Oil Pipeline Siting Act, submits this application for approval of the Preferred Route as defined in this application. For the reasons stated in this application, Keystone requests an order from the Nebraska Public Service Commission pursuant to Neb. Rev. Stat. § 57-1408 finding that the Preferred Route is in the public interest and authorizing Keystone to act under Neb. Rev. Stat. § 57-1101. In addition to its application, Keystone submits the written testimony of Tony Palmer, Meera Kothari, John Beaver, Sandra Barnett, Michael Portnoy, Jon Schmidt, Paul Fuhrer, and Dr. Ernie Goss. Keystone also provides its executed agreement to pay expenses assessed in accordance with the provisions of the Major Oil Pipeline Siting Act.

The following is Keystone's written application:

Acronyms

ACRONYM	DEFINITION
CFC	The Central Flyway Council
CFR	Code of Federal Regulations
CMRP	Construction, Mitigation, and Reclamation Plan
Con/Rec	Construction and Reclamation
CRP	Conservation Reserve Program
CWS	Canadian Wildlife Service
DOS	US Department of State
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
FSA	Farm Seed Act
FEIS	Final Environmental Impact Statement
FSEIS	Final Supplemental Environmental Impact Statement
HCA	High consequence area
HDD	Horizontal directional drill
IMLV	Intermediate Mainline Valve
LB	Legislative Bill
MSDS	Material safety data sheets
MLRA	Major Land Resource Area
MOP	Maximum Operating Pressure
MOPSA	Major Oil Pipeline Siting Act
NDEQ	Nebraska Department of Environmental Quality
NEPA	National Environmental Policy Act
NGPC	Nebraska Game and Parks Commission
NHD	National Hydrological Dataset
NLCD	National Landcover Dataset
NPDES	National Pollutant Discharge Elimination System
NPPD	Nebraska Public Power District
NRCS	Natural Resource Conservation Service
OCC	Operations Control Centre
PSAP	Public safety answering point
PSC	Public Service Commission
R-EMAP	Regional Environmental Monitoring and Assessment Program
RENEW	Recovery of Nationally Endangered Wildlife
RWBC	Rainwater Basin Complex
SDPUC	South Dakota Public Utilities Commission
SPCC	Spill Prevention, Control, and Countermeasure
TSS	Total suspended solids
US	United States
USC	United States Code
USFWS	US Fish and Wildlife Service
WEG	Wind erodibility group
WPA	Wellhead Protection Area

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Major Oil Pipeline Application

JURISDICTION

TransCanada Keystone Pipeline, L.P. (Keystone) is filing this Application pursuant to Nebraska Revised Statute Sections 57-1401 to 57-1413, which is known as the Major Oil Pipeline Siting Act (MOPSA). In January of 2013, as part of a prior application for a Presidential Permit, Keystone obtained approval in Nebraska for the Project pursuant to Nebraska Revised Statute Section 57-1501 et seq., and Keystone commenced eminent domain proceedings to acquire land necessary to construct the Project on that approved route. After the eminent domain actions were filed, Keystone agreed to stay the suits and no land has been acquired pursuant to these actions. Keystone voluntarily agreed to stay the eminent domain actions pending the outcome of litigation challenging the constitutionality of Legislative Bill (LB) 1161. Keystone has now dismissed the eminent domain actions and, pursuant to Nebraska Revised Statute Sections 57-1101 and 57-1501 et seq., Keystone may no longer proceed on the Governor's approval.

Keystone is filing this Application for route approval. Keystone also has submitted a renewed application for a Presidential Permit to allow the border crossing from Canada to the United States.

1.0 NAME AND ADDRESS OF PIPELINE CARRIER (SUBSECTION 023.02A1)

TransCanada Keystone Pipeline, L.P.
700 Louisiana Street
Houston, Texas, 77002-2700

1.1 BACKGROUND

Keystone proposes to construct, operate, and maintain a crude oil pipeline and ancillary facilities from Hardisty, Alberta, Canada, to Steele City, Nebraska, referred to as the Keystone XL Pipeline project (Project).

In 2012, Keystone presented an application for a border-crossing permit for Keystone XL to the United States (US) Department of State (DOS). The original route of Keystone XL crossed the Nebraska Sandhills. However, in response to concerns about the sensitive nature of the Nebraska Sandhills, Keystone developed a route that avoids the area as defined by the Nebraska Department of Environmental Quality (NDEQ). Keystone submitted a revised pipeline route (Nebraska Reroute) to the Nebraska Department of Environmental Quality (NDEQ) in September 2012. The proposed Nebraska Reroute, which is approximately 195 miles long, would start about one mile south of the Nebraska-South Dakota border in Keya Paha County and would terminate about five miles northwest of York in York County, where it would join the route proposed by Keystone in the FEIS. In addition to avoiding the Sandhills, the Nebraska Reroute reflects adjustments to avoid areas of fragile soils and shallow groundwater identified by the NDEQ and recommendations found in the January 2014 Final Supplemental Environmental Impact Statement (FSEIS).

The NDEQ evaluated the Nebraska Reroute in accordance with Nebraska Revised Statue 57-1501, et seq. The NDEQ submitted a Final Evaluation Report to the Governor who approved the Nebraska Reroute in a letter to the President and DOS dated January 22, 2013 (see Appendix A). The route filed in this application has been refined to reflect the recommendations made by the NDEQ and the Governor's approval[1].

[1] See NDEQ's Final Evaluation Report Section 2.1.1 Project Facilities "NDEQ understands that Keystone would make minor adjustments to the proposed pipeline alignment during final design based on additional information obtained from field surveys or landowners. These minor route variations (micro-alignments) could be implemented to address specific landowner concerns, avoid

On October 5, 2015, Keystone filed a route approval application with the Nebraska Public Service Commission (PSC) pursuant to MOPSA. However, due to the denial of Keystone's requested Presidential Permit for a border crossing facility between Canada and the U.S., on November 6, 2015, Keystone filed a request with the PSC that its application, be dismissed, without prejudice. The PSC granted Keystone's request on November 23, 2015. On January 24, 2017, President Trump issued a Presidential Memorandum inviting TransCanada to resubmit its application for a Presidential Permit for the Project and directing DOS to make a determination within 60 days of a new application. TransCanada submitted its application to DOS on January 26, 2017.

The Nebraska Reroute was used as the basis for developing the Preferred Route that is the subject of this Application. The Preferred Route is 275.2 miles long and would start at the Nebraska-South Dakota border in Keya Paha County, Nebraska and terminate at Steele City in Jefferson County, Nebraska. The Preferred Route passes through Keya Paha, Boyd, Holt, Antelope, Boone, Nance, Merrick, Polk, York, Fillmore, Saline, and Jefferson counties.

2.0 DESCRIPTION OF NATURE AND PROPOSED ROUTE OF THE MAJOR OIL PIPELINE INCLUDING A MAP OF THE PROPOSED ROUTE AND EVIDENCE OF CONSIDERATION OF ALTERNATIVE ROUTES (SUBSECTION 023.02A2)

2.1 DEVELOPMENT OF THE PROPOSED PREFERRED AND ALTERNATIVE ROUTES

Keystone employed a multidisciplinary approach and conducted a comprehensive analysis of various potential corridor alternatives in Nebraska. The constraints, goals and objectives that were used to identify the preferred and alternative routes for this Application included:

- Utilizing the existing fixed starting point: the pipeline entry location at the South Dakota–Nebraska border in Keya Paha County, Nebraska, north of Mills, Nebraska. This location was approved by the South Dakota Public Utilities Commission (SDPUC) in 2010 under the South Dakota Energy Conversion and Transmission Facilities Siting Act[2];
- Utilizing the existing fixed ending point: the existing Keystone Steele City Pump Station near Steele City in Jefferson County, Nebraska. This end point is the connection point to the existing Keystone system;
- Minimizing the route length and the construction of permanent aboveground facilities;
- Avoiding the "Sandhills" regions as defined by the NDEQ (see December 29, 2011 NDEQ Press Release attached as Appendix B), including impacts to highly water and wind erodible soils, and to the habitat of special status species and to sensitive habitats;
- Avoiding well head protection areas;
- Maximizing the utilization of the Keystone XL route previously studied by the DOS in the 2011 FEIS and the 2014 FSEIS;
- Crossing the Niobrara River at a location not designated as scenic or recreational under the National Wild and Scenic River Act of 1968;

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certain features (such as structures, wells, or irrigation systems), minimize impacts to environmental resources, or facilitate construction in such areas as steep terrain or waterbody crossings."

[2] The SDPUC issued a permit under the Energy Conversion and Transmission Facilities Siting Act on April 12, 2010, and an amended permit on June 29, 2010 (Amended Final Decision and Order; Notice of Entry (Docket HP09-001)). As required by South Dakota law, Keystone certified to the SDPUC that the Project continues to meet the conditions upon which the permit was granted. The SDPUC granted Keystone's Certification on January 21, 2016 (Docket HP14-001).

- Identifying other routing opportunities such as beneficial topography and compatible land uses; and
- Considering co-location opportunities with other existing pipelines, electric transmission lines, railways, roadways, and other utilities to the extent consistent with other routing criteria.

Based on the siting criteria listed above, Keystone identified a Preferred Route[3] and two alternative routes for comparison as required by the PSC regulations (Subsection 023.02A2). Specifically, the two alternative routes identified herein are the Sandhills Alternative Route and Keystone Mainline Alternative Route.

2.1.1 Preferred Route

The Preferred Route, which was evaluated by the NDEQ and approved by the Governor, would start at the Nebraska-South Dakota border in Keya Paha County, Nebraska near pipeline milepost 601 of the proposed Project (see Figure 2.2-1). The Preferred Route would run southeastward across the southwestern corner of Boyd County where it would cross the Keya Paha River and then enter Holt County as it crosses the Niobrara River. The route would continue southeastward and turn to the south in Antelope County where it would cross the Elkhorn River and then pass through Boone County and into Nance County. In Nance County, the route would cross the Loup River and then turn southeast across the northeastern corner of Merrick County. After crossing the Platte River and entering Polk County, the route would turn south through York, Fillmore and Saline counties. The Preferred Route would parallel the existing Keystone Mainline pipeline for 7.3 miles and terminate in Jefferson County at pipeline milepost 876.3 (see Figure 2.2-2). The Preferred Route would be 275.2 miles long and would require five pump stations, including the pump station at Steele City.

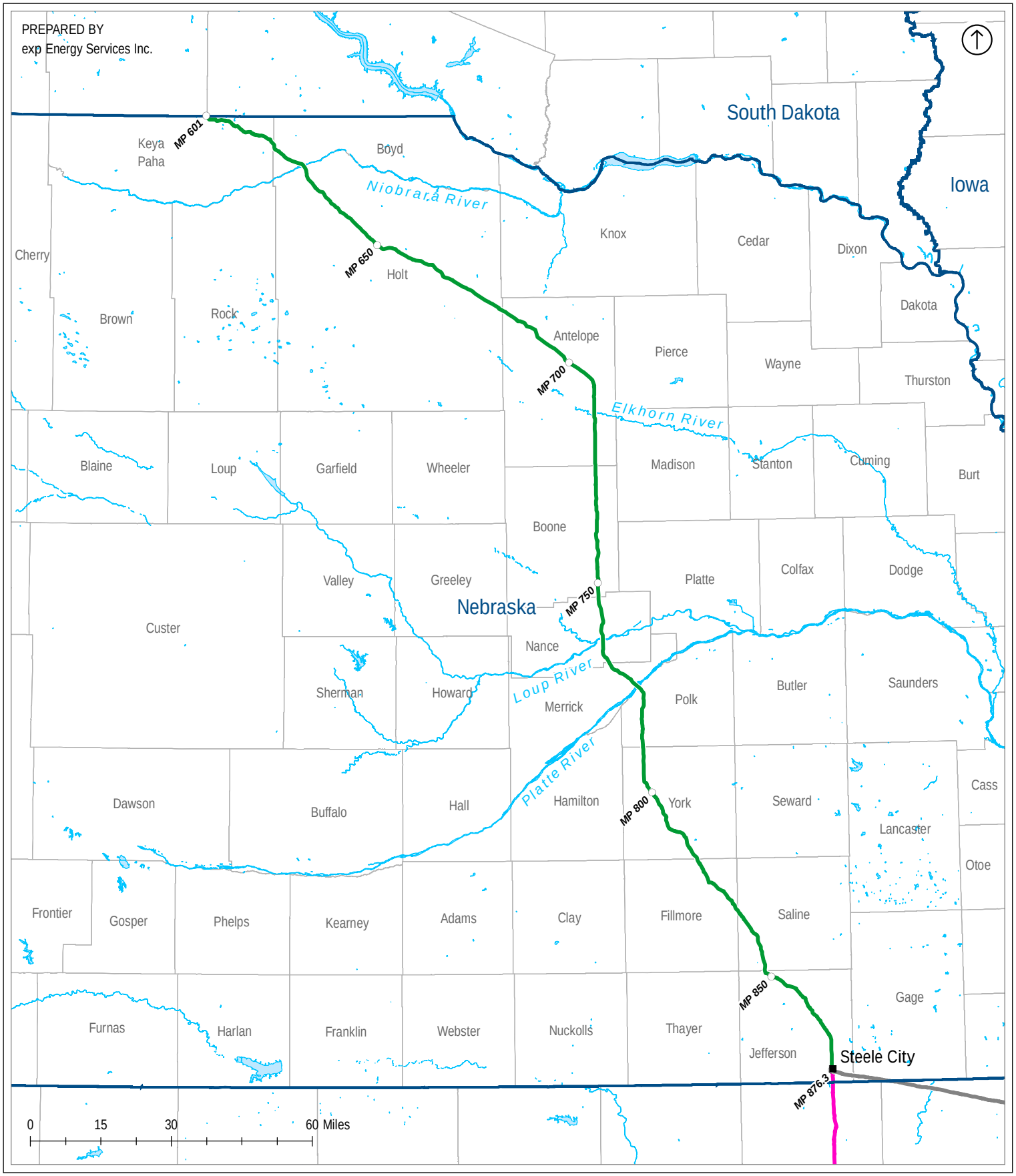
2.1.2 Sandhills Alternative Route

The Sandhills Alternative Route would start at the Nebraska-South Dakota border in Keya Paha County, Nebraska near pipeline milepost 601 of the proposed Project (see Figure 2.2-3). The Sandhills Alternative Route would cross the Keya Paha and Niobrara rivers and continue through Rock, Holt, Garfield, Wheeler, Greeley, and Boone counties, continuing through Nance County where it would cross the Loup River, and then cross the Platte River in Merrick County. The route would continue through Hamilton County and into York County. In York County, the Sandhills Alternative Route would rejoin the Preferred Route for 65.2 miles[4] and pass through Fillmore and Saline counties and terminate in Jefferson County. The Sandhills Alternative Route would parallel the existing Keystone Mainline pipeline for 7.3 miles. The Sandhills Alternative Route would be 254.8 miles long and would require five pump stations, including the pump station at Steele City.

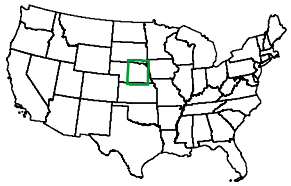
Compared to the Sandhills Alternative Route, the overall footprint of the Preferred Route represents less environmental impact by avoiding the Sandhills region and minimizing impacts to areas with characteristics similar to the Sandhills, including shallow groundwater and fragile soils. In addition, compared to the Sandhills Alternative Route, the Preferred Route reduces impacts to American burying beetle habitat and other federally-listed threatened and endangered species, habitats that may support state-listed threatened and endangered species, grasslands, and reduces potential impacts to WPAs

[3] It should be understood that Keystone may make minor route refinements during the final design and construction process to address landowner concerns and unanticipated construction circumstances.

[4] The 65.2 miles of co-location with the Preferred Route is not contiguous. The Sandhills Alternate Route co-locates with the Preferred Route for 44.8 miles, then deviates for 13.3 miles where the Preferred Route has been revised to avoid the Western Well Head Protection Area, and then rejoins the Preferred Route for 20.4 miles.



VICINITY MAP



LEGEND

- PREFERRED ROUTE
- KEYSTONE MAINLINE (PHASE I)
- KEYSTONE CUSHING EXTENSION (PHASE II)
- WATERBODY
- STATE BOUNDARY
- COUNTY BOUNDARY

KEYSTONE XL PROJECT

FIGURE 2.2-1

PREFERRED ROUTE

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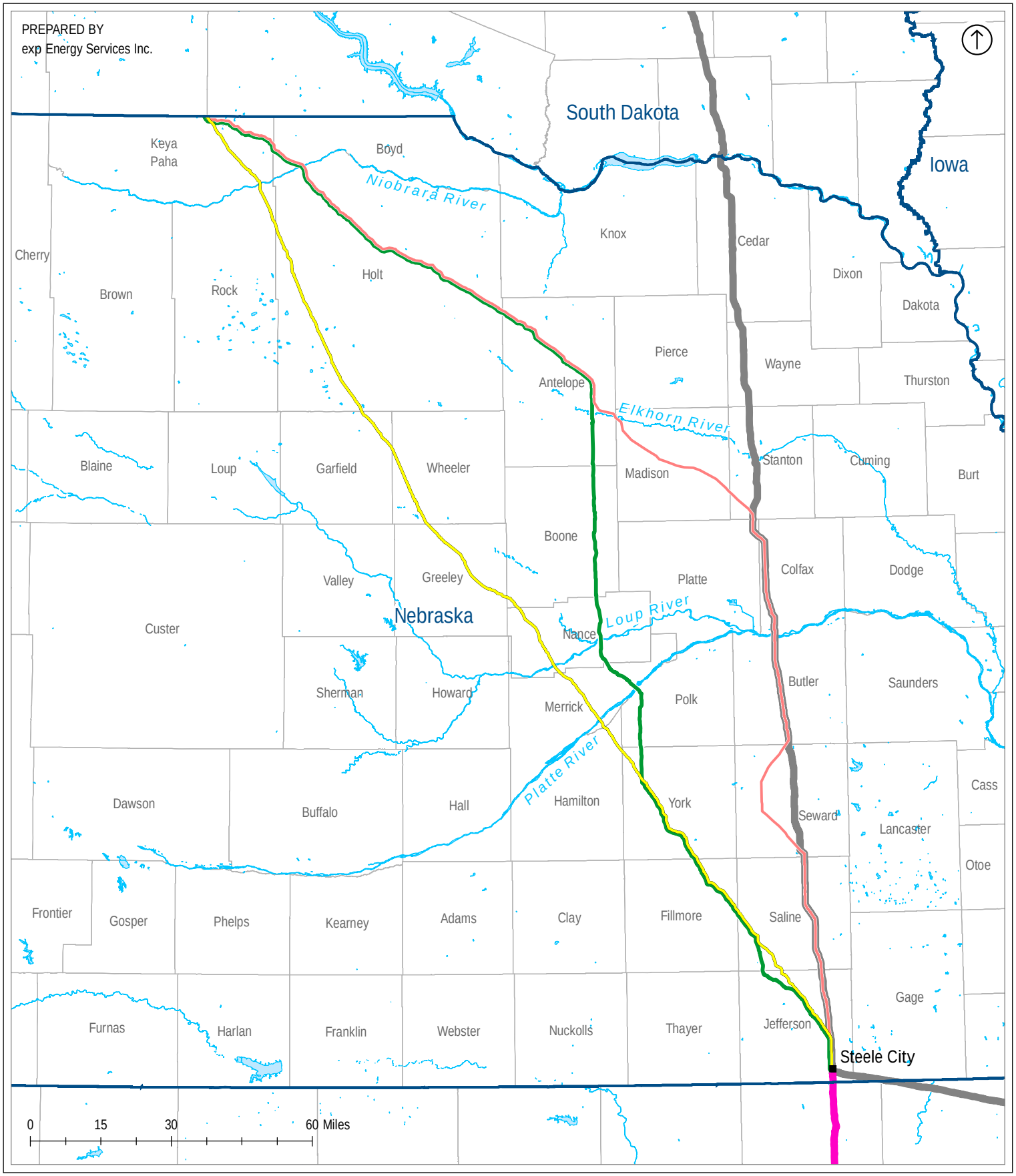
PREPARED BY
exp Energy Services Inc.
South Dakota
Iowa
Nebraska
Keya Paha
Boyd
Niobrara River
Knox
Cedar
Dixon
Dakota
Cherry
Brown
Rock
Holt
Pierce
Wayne
Thurston
Antelope
Elkhorn River
Blaine
Loup
Garfield
Wheeler
Madison
Stanton
Cuming
Burt
Boone
Valley
Greeley
Platte
Colfax
Dodge
Custer
Nance
Loup River
Sherman
Howard
Merrick
Polk
Butler
Saunders
Platte River
Dawson
Buffalo
Hall
Hamilton
York
Seward
Cass
Lancaster
Otoe
Frontier
Gosper
Phelps
Kearney
Adams
Clay
Fillmore
Saline
Gage
Furnas
Harlan
Franklin
Webster
Nuckolls
Thayer
Jefferson
Steele City
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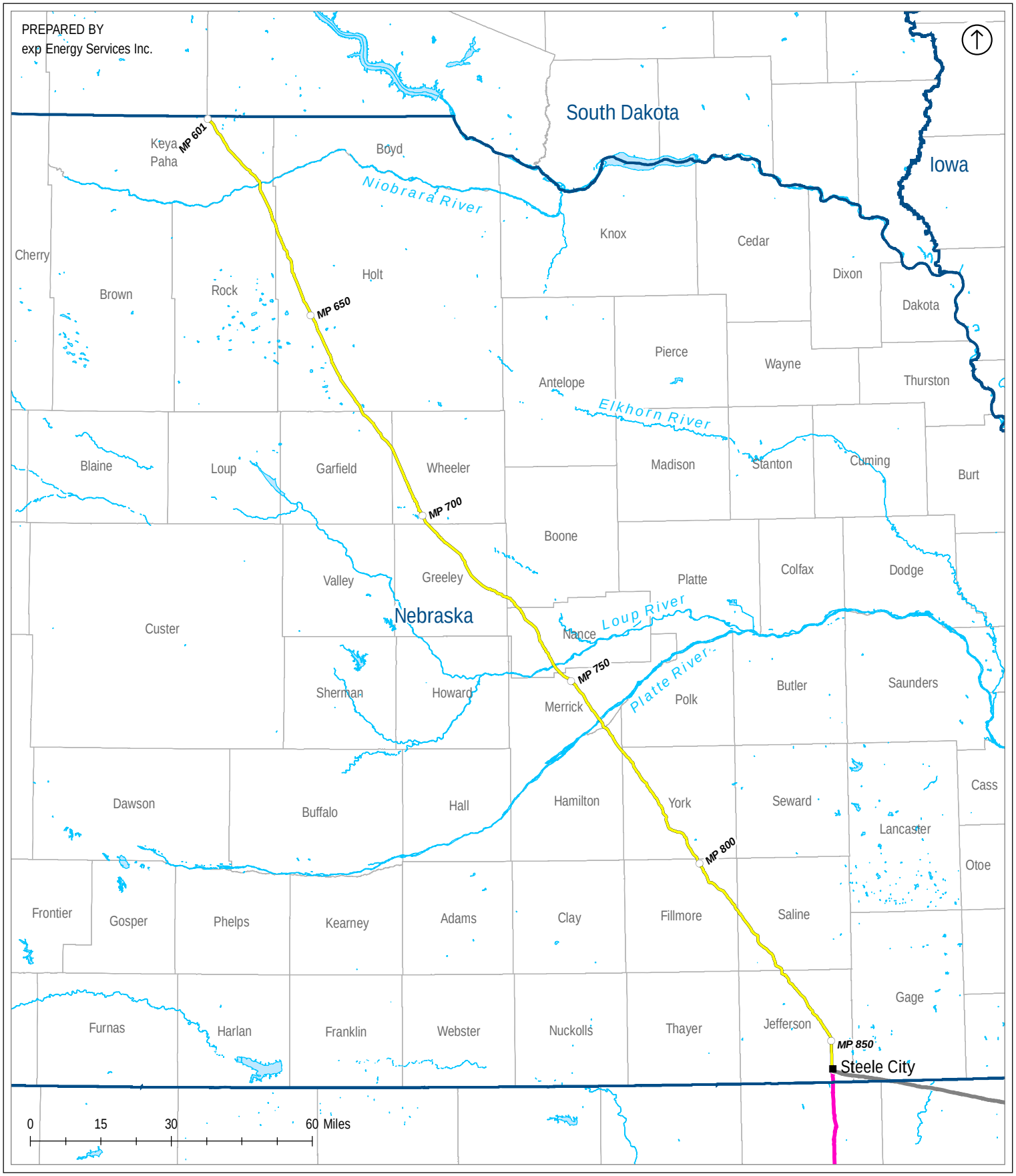
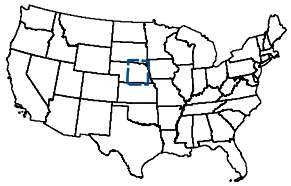
60 Miles
VICINITY MAP
LEGEND
PREFERRED ROUTE
SANDHILLS ALTERNATIVE ROUTE
KEYSTONE MAINLINE ALTERNATIVE ROUTE
KEYSTONE MAINLINE (PHASE I)
KEYSTONE CUSHING EXTENSION (PHASE II)
WATERBODY
STATE BOUNDARY
COUNTY BOUNDARY
KEYSTONE XL PROJECT
FIGURE 2.2-2
PREFERRED ROUTE AND TWO ALTERNATIVE ROUTES
TransCanada
In business to deliver



VICINITY MAP



LEGEND

- SANDHILLS ALTERNATIVE ROUTE
- KEYSTONE MAINLINE (PHASE I)
- KEYSTONE CUSHING EXTENSION (PHASE II)
- WATERBODY
- STATE BOUNDARY
- COUNTY BOUNDARY

KEYSTONE XL PROJECT

FIGURE 2.2-3

SANDHILLS ALTERNATIVE ROUTE

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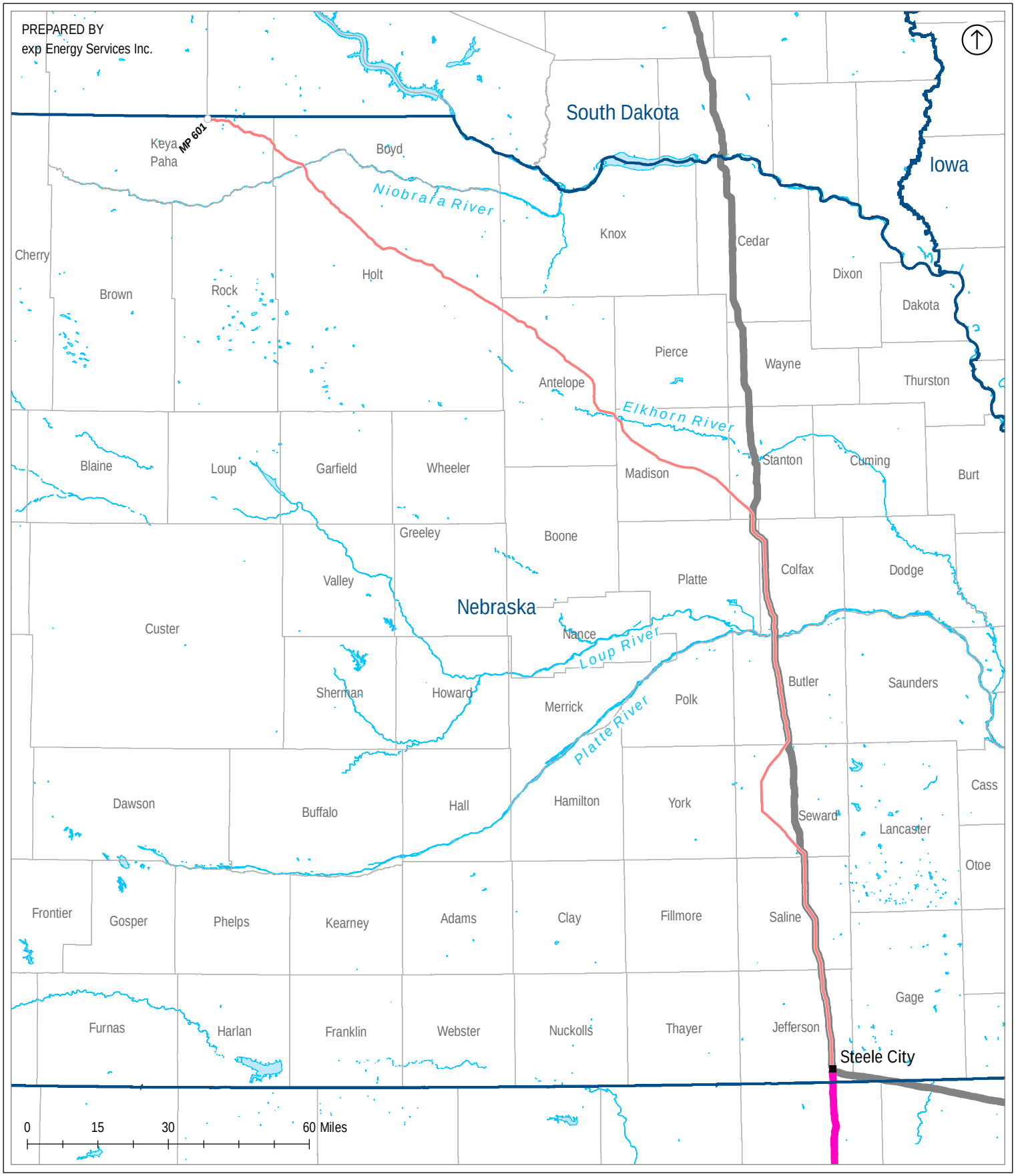
PREPARED BY
exp Energy Services Inc.
South Dakota
Iowa
Nebraska
Keya Paha
MP 601
Boyd
Niobrara River
Knox
Cedar
Dixon
Dakota
Cherry
Brown
Rock
Holt
Pierce
Wayne
Thurston
Antelope
Elkhorn River
Blaine
Loup
Garfield
Wheeler
Madison
Stanton
Cuming
Burt
Greeley
Boone
Valley
Platte
Colfax
Dodge
Custer
Nance
Loup River
Sherman
Howard
Merrick
Polk
Butler
Saunders
Platte River
Dawson
Buffalo
Hall
Hamilton
York
Seward
Lancaster
Cass
Otoe
Frontier
Gosper
Phelps
Kearney
Adams
Clay
Fillmore
Saline
Gage
Furnas
Harlan
Franklin
Webster
Nuckolls
Thayer
Jefferson
Steele City
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15
30
60 Miles
VICINITY MAP
LEGEND
KEYSTONE MAINLINE ALTERNATIVE ROUTE
KEYSTONE MAINLINE (PHASE I)
KEYSTONE CUSHING EXTENSION (PHASE II)
WATERBODY
STATE BOUNDARY
COUNTY BOUNDARY
KEYSTONE XL PROJECT
FIGURE 2.2-4
KEYSTONE MAINLINE ALTERNATIVE ROUTE
TransCanada
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2.1.3 Keystone Mainline Alternative Route

The Keystone Mainline Alternative Route would start at the Nebraska-South Dakota border in Keya Paha County, Nebraska near pipeline milepost 601 of the proposed Project (see Figure 2.2-4). This alternative route would follow the Preferred Route for 110 miles to just south of the Elkhorn River in Antelope County, then head in a southeasterly direction across Madison and Stanton counties for approximately 43 miles to intercept the existing Keystone Mainline pipeline, and then heads south. The Keystone Mainline Alternative Route parallels the existing Keystone Mainline for a total of 97.6 miles, crossing Shell Creek and the Platte River in Colfax County. The route would shift away from this co-location with the existing Keystone Mainline pipeline for 29.8 miles by routing west around the Seward County Wellhead Protection Area (WPA). Keystone made this adjustment to be consistent with NDEQ's recommendation to avoid WPAs. This route would then rejoin the existing Keystone Mainline pipeline route and continue through Saline County and terminate in Jefferson County.

A comparison of the Preferred Route and the two alternative routes with respect to several environmental and non-environmental criteria is provided in Table 2-1. The table presents information from readily available public data sources, which is typically used to screen pipeline route alternatives. Threatened and endangered species information provided in the table includes the range for the species which was obtained from the Nebraska Natural Heritage Program, and which does not reflect the results of field surveys. The results of Keystone's threatened and endangered species field surveys are provided in Sections 16.3 and 17.3.

The Keystone Mainline Alternative Route would be 280.5 miles long—adding in an incremental five miles--and would require an additional pump station, for a total of six pump stations, including the station at Steele City. In addition, as compared to the Preferred Route and as summarized at Section 20.3, the Keystone Mainline Alternative Route would:

- Result in a greater total number of acres disturbed due to the increase in the route length;
- Increase the crossing of the ranges of federally-listed threatened and endangered species;
- Increase the crossing of highly erodible soils;
- Increase the crossing of ecological unusually sensitive areas; and
- Increase the number of crossings of perennial streams, railroads and total road crossings.

2.1.4 Liquid Pipeline Hydraulics Considerations

Keystone uses liquid pipeline hydraulic analyses to determine the facilities necessary to achieve the flow rate (barrels/day or bpd) that meets the pipeline's nominal design capacity. These analyses also determine the necessary locations and required pumping horsepower for pump stations along the pipeline route. The flow rate of a liquid pipeline is sensitive to route length and terrain (slopes and elevation changes) which are critical variables in determining the number of pump stations and the pumping horsepower required at each station to achieve, but not exceed, the maximum operating pressure (MOP) established for the pipeline. The MOP is established in compliance with federal regulatory requirements.

The Preferred Route as presently configured is approaching the limit of hydraulic capability to meet the required flow rate with its current pump station spacing. The additional 5.3 miles required for the Keystone Mainline Alternative Route would require an additional pump station in order to meet the required flow rate.

Table 2-1. Comparison of The Preferred Route to the Two Proposed Alternatives					
FEATURE	**SUB-CATEGORIES**	**ATTRIBUTE**	**SANDHILLS ALTERNATIVE ROUTE**	**PREFERRED ROUTE**	**KEYSTONE MAINLINE ALTERNATIVE ROUTE**
			254.8 Miles	**275.2 Miles**	**280.5 Miles**
Environmental Features					
Federally Listed Species Range (Endangered)[1]	American burying beetle	*CROSSING LENGTH (MILES)*	112.1	100.9	100.9
	Interior least tern		25.6	27.5	18.4
	Pallid sturgeon		0.0	0.0	3.2
	Topeka shiner		0.0	0.0	7.7
	Whooping crane		229.9	250.9	166.3
Federally Listed Species Range (Threatened)[1]	Northern long-eared bat		254.8	275.2	280.5
	Piping plover		25.6	27.5	18.4
	Western prairie fringed orchid		96.4	118.2	145.4
State Listed Species Range (Endangered)[1]	American burying beetle		112.1	100.9	100.9
	Interior least tern		25.6	27.5	18.4
	Pallid sturgeon		0.0	0.0	3.2
	Sturgeon chub		0.0	0.0	3.2
	Topeka shiner		0.0	0.0	7.7
	Whooping crane		229.9	250.9	166.3
State Listed Species Range (Threatened)[1]	Lake sturgeon		0.0	0.0	3.2
	Massasauga rattlesnake		14.4	14.4	13.4
	Northern long-eared bat		254.8	275.2	280.5
	Northern redbelly dace		23.8	16.8	16.8
	Piping plover		25.6	27.5	18.4
	River otter		33.0	26.2	26.1
	Small white lady's slipper		52.8	43.4	39.6
	Western prairie fringed orchid		96.4	118.2	145.4
Highly Water Erodible Soils[2]		*CROSSING LENGTH (MILES)*	38.3	57.4	33.0
Highly Wind Erodible Soils[2]		*CROSSING LENGTH (MILES)*	51.9	47.1	43.5

Table 2-1. Comparison of The Preferred Route to the Two Proposed Alternatives					
FEATURE	**SUB-CATEGORIES**	**ATTRIBUTE**	**SANDHILLS ALTERNATIVE ROUTE**	**PREFERRED ROUTE**	**KEYSTONE MAINLINE ALTERNATIVE ROUTE**
			254.8 Miles	**275.2 Miles**	**280.5 Miles**
High Consequence Area (HCA)[3] - Ecological Unusually Sensitive Areas		*CROSSING LENGTH (MILES)*	3.8	2.2	4.4
Sandhills Terrain Crossed	Major Land Resource Area (MLRA) Sandhills[4]	*CROSSING LENGTH (MILES)*	81.0	0.0	0.0
	Topographic Region Sandhills[5]		68.8	3.9	3.9
	Eco-Region IV Sandhills[6]		91.5	0.0	0.0
Land Use Class[7]	Barren Land (Rock/Sand/Clay)	*CROSSING LENGTH (MILES)*	0.0	0.0	0.0
	Open Water		0.9	0.7	0.7
	Developed, Open Space		5.5	8.4	10.0
	Developed, Low Intensity		0.5	0.3	0.5
	Developed, Medium Intensity		0.0	0.0	0.1
	Deciduous Forest		1.6	1.9	2.9
	Evergreen Forest		0.0	0.0	0.0
	Mixed Forest		0.1	0.1	0.1
	Shrub/Scrub		0.0	0.0	0.0
	Grassland/Herbaceous		136.6	78.3	77.9
	Pasture/Hay		5.3	2.1	2.0
	Cultivated Crops		99.8	180.9	184.6
	Woody Wetlands		1.6	1.7	1.3
	Emergent Herbaceous Wetlands		2.8	0.7	0.6
Hydrology[8]	Artificial Path[8]	*NUMBER OF CROSSINGS*	11	15	11
	Canal/Ditch		1	0	1
	Intermittent Stream/River		195	229	205
	Perennial Stream/River		7	21	31
	SUBTOTAL		215	265	248

Table 2-1. Comparison of The Preferred Route to the Two Proposed Alternatives					
FEATURE	**SUB-CATEGORIES**	**ATTRIBUTE**	**SANDHILLS ALTERNATIVE ROUTE**	**PREFERRED ROUTE**	**KEYSTONE MAINLINE ALTERNATIVE ROUTE**
			254.8 Miles	**275.2 Miles**	**280.5 Miles**
Non-Environmental Features					
Number of Pump Stations		*NUMBER OF PUMP STATIONS*	5	5	6
HCA - Wellhead Protection Areas[9]		*CROSSING LENGTH (MILES)*	3.5	1.4	1.4
Depth to Shallow Groundwater From CSD Well Data[10]	0 - 10 Feet	*CROSSING LENGTH (MILES)*	27.7	6.0	5.1
Ownership[11]	Federal	*CROSSING LENGTH (MILES)*	0.0	0.1	0.3
	State		6.6	5.4	4.8
	Local Government		0.0	0.1	0.2
	Private		248.2	269.7	275.3
Railroad Crossings[12]		*NUMBER OF CROSSINGS*	7	9	12
Road Crossings[12]	Local Road/Vehicular Trail[13]	*NUMBER OF CROSSINGS*	47	63	56
	County Road		24	30	53
	Interstate		2	2	2
	Local Neighborhood Road[13]		169	221	243
	State Highway		16	17	15
	US Highway		8	9	10
Pipeline Crossings[14]	Crude Oil	*NUMBER OF CROSSINGS*	0	0	0
	Miscellaneous		1	1	1
	Natural Gas		30	35	20
	Refined Products		4	4	4

Table 2-1. Comparison of The Preferred Route to the Two Proposed Alternatives					
FEATURE	**SUB-CATEGORIES**	**ATTRIBUTE**	**SANDHILLS ALTERNATIVE ROUTE**	**PREFERRED ROUTE**	**KEYSTONE MAINLINE ALTERNATIVE ROUTE**
			254.8 Miles	**275.2 Miles**	**280.5 Miles**
Water Wells (Active and Inactive)[15]		*NUMBER WITHIN 150 FEET OF CENTERLINE*	26	11	15
		NUMBER WITHIN 300 FEET OF CENTERLINE	66	69	57
		NUMBER WITHIN 500 FEET OF CENTERLINE	134	189	148
Pivot Irrigation Crop Crossings[16]		*NUMBER OF CROSSINGS*	143	326	256
Co-Location[17]	Right-of-Way (Pipeline)	*CO-LOCATION LENGTH (MILES)*	7.8	7.3	95.6
	Utility Corridors		0.3	0.0	3.3
	Roads		1.5	2.4	13.0

[1]Source: Nebraska Natural Heritage Program, Nebraska Game and Parks Commission (NGPC); September 2011.

[2]Source: Natural Resources Conservation Service (NRCS), 2007. Includes soils in wind erodibility group (WEG) of 1 or 2

[3]Source: US Department of Transportation – Pipeline and Hazardous Materials Safety Administration (PHMSA)

[4]Source: US Department of Agriculture (USDA), NRCS, 2006

[5]Source: University of Nebraska-Lincoln, Conservation and Survey Division (CSD)/Institute of Agriculture and Natural Resources

[6]Source: US Environmental Protection Agency (EPA)

[7]Source: National Landcover Data (NLCD), 2011

[8]Source: National Hydrology Dataset

[9]Source: Nebraska Department of Environmental Quality (NDEQ), 2014

[10]Source: University of Nebraska-Lincoln, CSD Average Groundwater Depth

[11]Source: Contract Land Staff; previously UFS; Parcel Data along Mainline Option was digitized based on Plat Books

[12]Source: U.S. Census Bureau (TIGER), 2012

[13]Unnamed roads, including private roads and vehicular trails (as classified by MAF/TIGER Feature Class Code)

[14]Source: PennWell MAPSearch, 2014

[15]Source: Nebraska Department of Natural Resources, 2015

[16]Source: Pivot Irrigation Crops were digitized based on 2012 NAIP Imagery

[17]Source: Co-location mileage is based on features that are within 250 feet of the centerline, any segments less than 0.25 miles long that cross the centerline were removed since they are considered crossings and not co-location

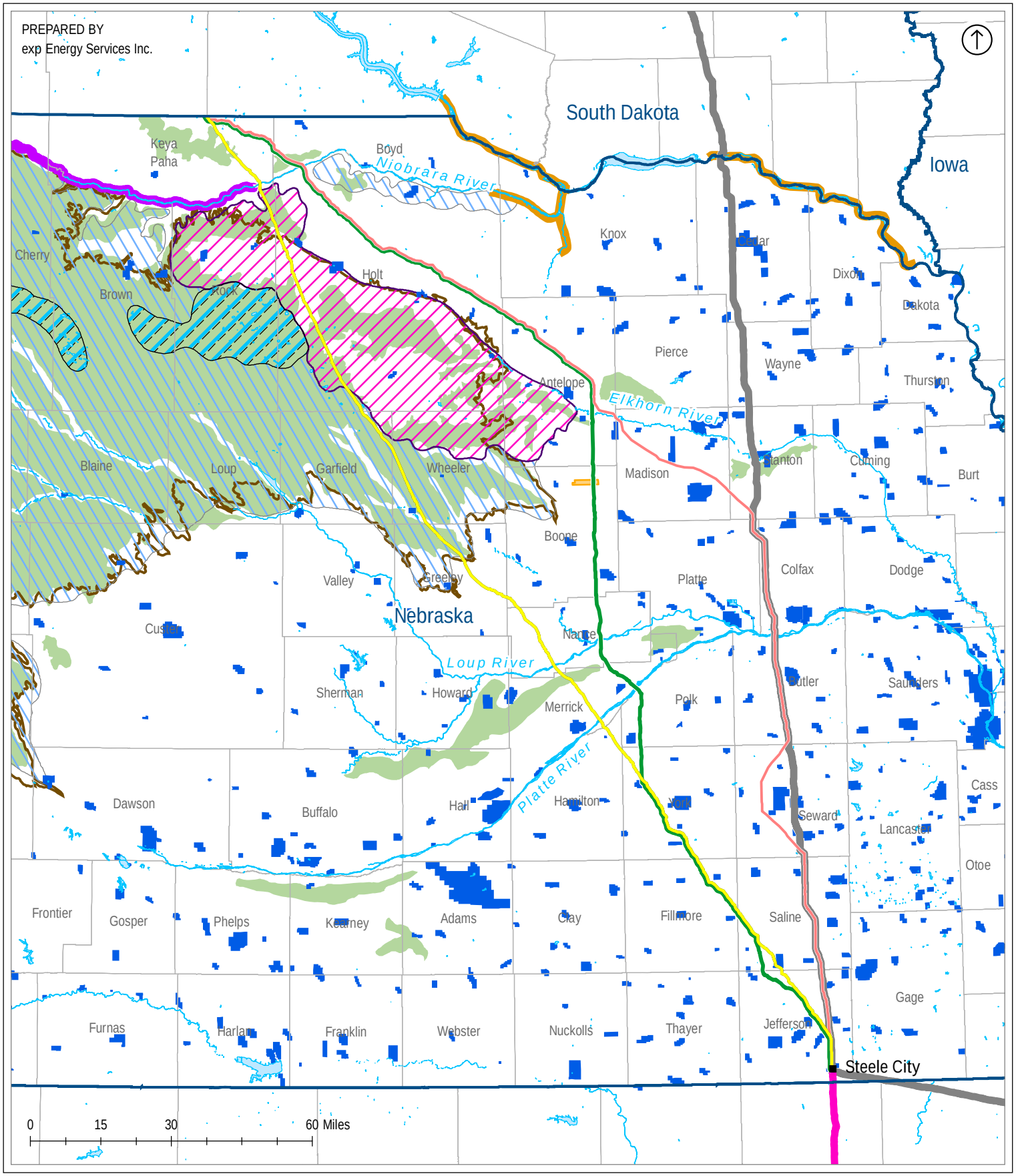
3.0 REASONS FOR THE SELECTION OF THE PROPOSED ROUTE OF THE MAJOR OIL PIPELINE (SUBSECTION 023.02A3)

The characteristics of the Preferred Route were evaluated by the NDEQ over a 10-month public process in 2012. The 10-month long process included a 7-month public comment and testimony period during which feedback was provided on the Preferred Route for incorporation into route adjustments to avoid sensitive and important areas in Nebraska. Among other findings, NDEQ found that the path of the Preferred Route avoids the Nebraska Sandhills region and avoids many areas of fragile soils in northern Nebraska. In January 2013, the Governor advised the President and the Secretary of State that he approved the route reviewed in the 2013 NDEQ Final Evaluation Report.

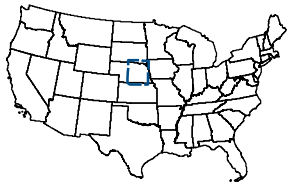
Based on the findings of the 2013 NDEQ Final Evaluation Report and the Governor's approval, Keystone incorporated the Preferred Route through Nebraska into its 2012 Presidential Permit application for the proposed Project. Keystone has continued to work closely with federal, state, county, and local agencies, landowners and other stakeholders to further refine the Preferred Route. Based on this information, Keystone refined the engineering of the Preferred Route to avoid, or minimize to the extent practicable, the potential impact to identified environmental and non-environmental resources (see Figure 3.0-1). In addition to completing the engineering design, Keystone has worked successfully with the landowners and stakeholders along the Preferred Route and has been able to voluntarily acquire necessary easements from approximately 90 percent of landowners along the Preferred Route. Keystone has also purchased the land needed to accommodate the five proposed pump stations.

The following summarizes the environmental and non-environmental rationale that was used by Keystone to select the Preferred Route.

- It is significant that the Preferred Route has been the subject of multiple reviews and evaluations by federal and state agencies, extensive public input, and the Governor's approval. The DOS FSEIS concluded that significant impacts to most resources are not expected along the proposed Project. Further, the voluntary acquisition of easements from 90 percent of landowners along the route represents an indication of wide public acceptance of the Preferred Route.
- Neither the Sandhills Alternative Route nor the Keystone Mainline Alternative Route provide a distinct environmental advantage over the Preferred Route. Compared to the Sandhills Alternative Route, the overall footprint of the Preferred Route represents less environmental impact by avoiding the Sandhills region and minimizing impacts to areas with characteristics similar to the Sandhills, including shallow groundwater and fragile soils. In addition, compared to the Sandhills Alternative Route, the Preferred Route reduces impacts to American burying beetle habitat and other federally-listed threatened and endangered species, habitats that may support state-listed threatened and endangered species, grasslands, and reduces potential impacts to WPAs (see Figure 3.0-1). As detailed in Section 20.3, while the Keystone Mainline Alternative Route has potential environmental benefits due to its co-location with the Keystone Mainline, those potential benefits are outweighed by the need for additional aboveground infrastructure (i.e., pump station and associated electrical transmission lines), the longer length of the route, and other factors. Therefore, the Keystone Mainline Alternative Route is not considered preferable or beneficial in relation to the Preferred Route.



VICINITY MAP



LEGEND

- PREFERRED ROUTE
- SANDHILLS ALTERNATIVE ROUTE
- KEYSTONE MAINLINE ALTERNATIVE ROUTE
- KEYSTONE MAINLINE (PHASE I)
- KEYSTONE CUSHING EXTENSION (PHASE II)
- PETERSBURG WIND FARM
- STATE BOUNDARY
- COUNTY BOUNDARY
- WELLHEAD PROTECTION AREAS
- MAJOR LAND RESOURCE AREA (MLRA) - SANDHILLS
- TOPOGRAPHIC REGIONS SANDHILLS
- MISSOURI NATIONAL RECREATIONAL RIVER
- NIOBRARA NATIONAL SCENIC RIVER

ECOREGION 44

- LAKES AREAS
- SANDHILLS
- WET MEADOW AND MARSH PLAIN

KEYSTONE XL PROJECT

FIGURE 3.0-1

CONSTRAINTS MAP

TransCanada
In business to deliver

4.0 A LIST OF THE GOVERNING BODIES OF THE COUNTIES AND MUNICIPALITIES THROUGH WHICH THE PROPOSED ROUTE OF THE MAJOR OIL PIPELINE WOULD BE LOCATED (SUBSECTION 023.02A4)

A list of Governing bodies of the counties and municipalities along the Preferred Route is provided below in Table 4-1.

Table 4-1. Governing Bodies of Counties and Municipalities Through Which the Preferred Route would be located

County	Municipality Governing Bodies	County Governing Bodies
Keya Paha County	• None Identified	• Keya Paha County Board of Commissioners
Boyd County	• None Identified	• Boyd County Board of Supervisors
Holt County	• None Identified	• Holt County Board of Supervisors
Antelope County	• None Identified	• Antelope County Board of Supervisors
Boone County	• None Identified	• Boone County Board of Commissioners
Nance County	• None Identified	• Nance County Board of Supervisors
Merrick County	• None Identified	• Merrick County Board of Supervisors
Polk County	• None Identified	• Polk County Board of Commissioners
York County	• Board of Trustees of the Village of McCool Junction	• York County Board of Commissioners
Fillmore County	• None Identified	• Fillmore County Board of Supervisors
Saline County	• None Identified	• Saline County Board of Commissioners
Jefferson County	• Steele City Village Board	• Jefferson County Board of Commissioners

5.0 A DESCRIPTION OF THE PRODUCT OR MATERIAL TO BE TRANSPORTED THROUGH THE MAJOR OIL PIPELINE (SUBSECTION 023.02A5)

The proposed Project will transport a range of crude oils as determined by its shippers from time to time, in compliance with its tariff, which will be subject to approval by the Federal Energy Regulatory Commission. The range of products that will be transported through the pipeline is provided in the representative Material Safety Data Sheets (MSDS) found at Appendix C, which satisfy the requirements of Subsection 023.02A5.

6.0 THE PERSON WHO WILL OWN THE MAJOR OIL PIPELINE (SUBSECTION 023.02A6)

TransCanada Keystone Pipeline, L.P.
700 Louisiana Street
Houston, Texas, 77002-2700

7.0 THE PERSON WHO WILL MANAGE THE MAJOR OIL PIPELINE (SUBSECTION 023.02A7)

TC Oil Pipeline Operations Inc.
700 Louisiana Street
Houston, Texas, 77002-2700

8.0 A PLAN TO COMPLY WITH THE OIL PIPELINE RECLAMATION ACT (SUBSECTION 023.02A8)

8.1 RECLAMATION PLAN INTRODUCTION

The sections below provide a summary of Keystone's reclamation and revegetation plan developed to restore equivalent capability to lands disturbed by construction along the Preferred Route and to comply with the PSC regulations and the Nebraska Oil Pipeline Reclamation Act, as amended (Reclamation Act). Reclamation procedures were developed through consultation with local and regional agencies and University of Nebraska scientists regarding preferred reclamation and revegetation procedures in Nebraska.

The majority of procedures described in these sections have been summarized from the proposed Project's Construction, Mitigation, and Reclamation Plan (CMRP) Revision 4, which is attached as Appendix D. The CMRP contains measures that will be used throughout the proposed Project to avoid or minimize environmental impacts. Specific environmental conditions addressed in the CMRP include topsoil management, erosion and sediment control, soil compaction relief, and wetland and waterbody crossing methods. Measures related to reclamation and revegetation, of the right-of-way, including for fragile soils, are described in the CMRP.

The pertinent requirements of the PSC regulations and the Reclamation Act are re-stated below:

- **PSC Regulations**
    - Subsection 023.02A8 - A plan to comply with the Reclamation Act.
- **Oil Pipeline Reclamation Act, as amended**
    - Nebraska Revised Statute Section 76-3301 - The purpose of the Reclamation Act is to ensure that a pipeline carrier which owns, constructs, operates, or manages a pipeline through this state for the transportation of oil is financially responsible for reclamation costs relating to the construction, operation, and management of the pipeline in this state as prescribed in the act.
    - Nebraska Revised Statute Section 76-3303(2) - It is the intent of the Legislature that proper reclamation is accomplished as part of the oil pipeline construction process, including restoration of areas through which a pipeline is constructed as close as reasonably practicable to the condition, contour, and vegetation that existed prior to construction, including stabilizing disturbed areas, establishing a diverse plant environment of native grasses and forbs to create a safe and stable landscape, restoring active cropland to its previous productive capability, mitigating noxious weeds, and managing invasive plants, unless otherwise agreed to by the landowner.
    - Nebraska Revised Statute Section 76-3304(1) - A pipeline carrier owning, operating, or managing a pipeline or part of a pipeline for the transportation of oil in this state shall be responsible for all reclamation costs necessary as a result of constructing the pipeline as well as reclamation costs resulting from operating the pipeline, except to the extent another party is determined to be responsible.
    - Nebraska Revised Statute Section 76-3304(2) - The pipeline carrier shall commence reclamation of the area through which a pipeline is constructed as soon as reasonably practicable after backfill as provided in Sections 76-3307 and 76-3308 of the Reclamation Act.
    - Nebraska Revised Statute Section 76-3304(3) - A pipeline carrier's obligation for reclamation and maintenance of the pipeline right-of-way shall continue until the pipeline is permanently decommissioned or removed.

- Nebraska Revised Statute Section 76-3307 - A pipeline carrier shall complete final grading, topsoil replacement, installation of erosion control structures, seeding, and mulching within thirty days after backfill except when weather conditions, extenuating circumstances, or unforeseen developments do not permit the work to be done within such thirty-day period.
- Nebraska Revised Statute Section 76-3308(1) - A pipeline carrier shall ensure that all reclamation, including, but not limited to, choice of seed mixes, method of reseeding, and weed and erosion control measures and monitoring, is conducted in accordance with the Federal Seed Act, 7 USC. 1551 et seq., the Nebraska Seed Law, and the Noxious Weed Control Act.
- Nebraska Revised Statute Section 76-3308(2) - A pipeline carrier shall ensure that genetically appropriate and locally adapted native plant materials and seeds are used based on site characteristics and surrounding vegetation as determined by a preconstruction site inventory.
- Nebraska Revised Statute Section 76-3308(3) - A pipeline carrier shall ensure that mulch is installed as required by site contours, seeding methods, or weather conditions or when requested by a landowner.

Table 8-1 correlates this section of the Application with the above-referenced sections of PSC Regulations and the Reclamation Act.

Table 8-1. Correlation of Nebraska Regulatory and Legislative Requirements Regarding Reclamation with Keystone's Application.		
Nebraska Regulatory or Legislative Requirement	**Location and Topic in the Application**	
	Application Subsection	**Heading**
PSC Regulations		
Subsection 023.02A8	Sections 8.1 to 8.7	Reclamation Plan Introduction; Reclamation Costs; Reclamation Schedule; Erosion Control; Revegetation; Noxious Weed Management; Reclamation and Maintenance Obligations
Oil Pipeline Reclamation Act		
Nebraska Revised Statute Section 76-3303(2)	Sections 8.1 to 8.7	*See list above*
Nebraska Revised Statute Section 76-3303(1) Nebraska Revised Statute Section 76-3304(1)	Section 8.2	Reclamation Costs
Nebraska Revised Statute Section 76-3304(2)	Section 8.3	Reclamation Schedule
Nebraska Revised Statute Section 76-3304(3)	Section 8.7	Reclamation and Maintenance Obligation
Nebraska Revised Statute Section 76-3307	Section 8.3	Reclamation Schedule
Nebraska Revised Statute Section 76-3308(1)	Section 8.5	Revegetation
Nebraska Revised Statute Section 76-3308(2)	Section 8.5	Revegetation
Nebraska Revised Statute Section 76-3308(4)	Section 8.4	Erosion Control

Section 8.6 of this Application addresses noxious weed control, which is not specifically itemized in a regulatory section as noted above, although it is mentioned in Section 76-3303(2).

8.2 RECLAMATION COSTS

The Reclamation Act (Nebraska Revised Statute Section 76-3303(1)) mandates that a pipeline carrier owning, operating, or managing a pipeline or part of a pipeline for the transportation of oil in Nebraska is responsible for all reclamation costs necessary as a result of constructing and/or operating the pipeline except to the extent that another party is determined to be responsible. Keystone hereby states that it will be responsible for all reclamation costs resulting from the construction and operation of the pipeline except to the extent that another party is determined to be responsible. See testimony of Tony Palmer, included as Exhibit 1.

8.3 RECLAMATION SCHEDULE

The Reclamation Act at Nebraska Revised Statute Sections 76-3304(2) and 76-3307 requires timely commencement and completion of reclamation. Specifically, Nebraska Revised Statute Section 76-3307 describes various phases of construction and reclamation, including final grading, topsoil replacement, installation of erosion control structures, seeding, and mulching, which must be completed within 30 days after backfill unless precluded by extenuating circumstances such as weather or unforeseen developments. Keystone has described the typical sequence of events from backfill to topsoil replacement and final seeding and erosion control in the CMRP (see Sections 4.9 and 4.11; Appendix D). In general, it is Keystone's commitment to complete final grading, topsoil replacement, installation of

erosion control structures, seeding, and mulching within 30 days after backfill unless precluded by extenuating circumstances as described in the following subsections.

The timing of reclamation activities is discussed below. The details of the reclamation activities are discussed in Sections 8.4 through 8.7.

8.3.1 Timing of Final Grading

Unless prevented by wet soil conditions, frozen soil conditions, or unforeseen developments, final grading will be completed within 30 days following backfill to approximate pre-construction contours as close as reasonably practical and to limit erosion and subsidence. Areas of the right-of-way that have been compacted by construction activity and equipment traffic will be decompacted as described in the CMRP (see Section 4.11.1; Appendix D) prior to topsoil replacement to prevent an area of compacted subsoil from creating a barrier to root penetration.

8.3.2 Timing of Topsoil Replacement

Following any necessary subsoil decompaction and the establishment of approximate pre-construction contours, where necessary, topsoil will be spread across the right-of-way to its approximate original depth and contour with allowance for settling.

8.3.3 Timing of Installation of Erosion Control Structures

The CMRP (see Sections 4.5 and 4.11.5; Appendix D) describes a variety of temporary and permanent erosion and sediment control measures that will be implemented. Some erosion control structures, such as trench breakers, temporary slope breakers, or sediment barriers surrounding wetlands or waterbodies will be installed prior to or during construction as necessary and prior to backfill. Other erosion control structures, such as permanent slope breakers or erosion control fabric, will be installed concurrent with or following topsoil replacement. Keystone will also restore existing landowner soil conservation structures to the approximate pre-construction line and grade. The installation of post-backfill erosion control structures will be completed within 30 days of backfill unless prevented by weather, frozen soil conditions, or unforeseen circumstances.

8.3.4 Timing of Seeding

Keystone will seed portions of the right-of-way that are not cropland (e.g., annual crops such as corn, soybeans, or wheat, or perennial crops such as alfalfa). Depending on the season in which backfill is completed, revegetation may be most successful if seeding is delayed until favorable soil or weather conditions are present. Specifically, both the state and the local Natural Resource Conservation Service (NRCS) offices have advised Keystone not to apply many of the permanent seed mixes between approximately late June and mid-October since temperature and soil moisture may not be optimal to establish revegetation without subsequent reseeding. Based on these recommendations and the season in which backfill is completed, seeding may not be completed within 30 days of backfill.

8.3.5 Timing of Mulching

The application of straw mulch or hydromulch following topsoil replacement may be necessary to limit erosion depending on slope and soil type. Although interim mulch may be applied at any time during construction to limit erosion, permanent mulch is not applied until after seeding is completed. If mulch was applied prior to seeding for temporary erosion control, the excess mulch will be removed and disposed of prior to seeding to ensure that seed drills and soil packing equipment do not become plugged with excess mulch and to support an adequate seedbed.

8.4 EROSION CONTROL

Erosion and sediment control measures are installed to ensure the restoration of areas affected by the pipeline and to create a "safe and stable landscape" as described in Nebraska Revised Statute Section 76-3303(2). The following information summarizes the procedures Keystone will implement to limit and manage erosion on the Preferred Route. The CMRP (see Sections 4.5 and 4.11; Appendix D) describes specific installation methods and materials that will be utilized as well as inspection and maintenance procedures.

8.4.1 Sediment Barriers

Sediment barriers will be installed as necessary depending on slope, soil conditions, and adjacent resources (i.e., wetlands) to limit sedimentation from construction to adjacent lands. In general, sediment barriers will be installed in the following types of areas:

- The base of slopes adjacent to road crossings;
- The edge of the right-of-way adjacent to and up-gradient of a roadway, flowing stream, spring, wetland, or impoundment;
- Trench or test water discharge locations where required;
- Where waterbodies or wetlands are adjacent to the right-of-way;
- Across the right-of-way at flowing waterbody crossings;
- Across the right-of-way immediately upslope of the wetland boundary at standard (saturated or standing water) wetland crossings as necessary to prevent sediment flow into the wetland; and
- Along the edge of the right-of-way where saturated or standing water wetlands are present, as necessary to contain spoil and sediment within the right-of-way.

8.4.2 Trench Plugs (Trench Breakers)

Trench plugs (also called trench breakers) will be installed at waterbody and wetland crossings 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 will also be installed immediately upslope and below permanent slope breakers to prevent subsurface water movement and trench subsidence.

8.4.3 Slope Breakers (Water Bars)

Temporary slope breakers will be installed as necessary during construction to limit and manage surface water flow down the right-of-way. Permanent slope breakers will be installed following trench backfill and during topsoil replacement for the same purpose. Temporary slope breakers may be installed on cultivated land, however, permanent slope breakers are not typically installed on cultivated land following backfill unless directed by the landowner. Slope breakers will be installed on slopes greater than five percent at the following recommended spacing:

Slope (%)	Approximate Spacing Between Slope Breakers (feet)
5 - 15	300
>15 - 30	200
>30	100

The outfall of each slope breaker will be to a stable, well-vegetated area or to a constructed energy-dissipating device at the end of the slope breaker. The outfall of each slope breaker shall be installed to prevent sediment discharge into wetlands, waterbodies, or other sensitive resources and shall be constructed to limit the return flow of water to the right-of-way.

8.4.4 Mulching and Cover Crops

Mulch may be required on disturbed areas to limit erosion, depending on soil conditions, slope, seeding method, and landowner preference as noted in Nebraska Revised Statute Section 76-3308(3). Keystone consulted with state and local resources specialists including university and NRCS scientists regarding the use of mulch and seed mixes.

Temporary mulch and/or seed may be applied to disturbed construction work areas that have been inactive for one month or are expected to be inactive for longer than a month. Noxious weed-free straw mulch or hay will be applied on slopes and will be spread uniformly to cover at least 75 percent of the ground surface at an approximate rate of two tons per acre of straw or its equivalent. Mulch application on slopes within 100 feet of waterbodies and wetlands will be increased to an approximate rate of three tons per acre.

Permanent mulch typically will be applied after permanent seeding on areas with high erosion potential (i.e., sandy soils) and on slopes greater than eight percent unless site-specific conditions or circumstances dictate otherwise, such as landowner preference or the use of a cover crop in lieu of mulching. Noxious weed-free mulch will be spread uniformly over the disturbed area to cover at least 75 percent of the ground surface at an approximate rate of two tons per acre of straw or its equivalent. Permanent straw mulch will be anchored into the soil with a crimping tool.

Croplands may be seeded on the right-of-way in inactive construction areas as described above, or following topsoil replacement. Seed will be applied to disturbed surfaces, except cultivated fields (unless requested by the landowner). The final seed mix shall be based on input from the NRCS and the availability of seed. Seed mixes will comply with the Federal Seed Act (FSA), 7 USC 1551 et seq., the Nebraska Seed Law, and the Noxious Weed Control Act.

8.4.5 Tackifier

Topsoil stockpiles or the right-of-way may be sprayed with water to minimize wind erosion and dust. If wetting topsoil piles with water does not prevent wind erosion, biodegradable tackifier, or other similar measures, will be applied to topsoil stockpiles. Tackifier, or other measures, would be reapplied if

construction traffic, cattle grazing, heavy rains, or other related construction activity disturb the tackified topsoil piles and create a potential for wind erosion. No asphalt-based tackifiers would be used.

8.4.6 Erosion Control Matting

Erosion control matting such as biodegradable natural straw or coconut fiber will be utilized to minimize erosion at waterbody banks and on slopes. In areas that are too steep or rocky to safely or effectively operate mechanical mulch-anchoring tools, Keystone may use tackifiers, hydromulch or similar materials for erosion control.

8.5 REVEGETATION

Revegetation is a critical component of reclamation as specified in the Reclamation Act at Nebraska Revised Statute Sections 76-3303(2), 76-3308(1), and 76-3308(2). Consistent with the Reclamation Act, it is Keystone's intent to revegetate the right-of-way as near as practicable to pre-construction conditions to ensure: 1) equivalent land capability following construction, and 2) the establishment of diverse native plant communities where these communities exist along the Project. The Reclamation Act further specifies that Keystone must ensure "genetically appropriate and locally adapted native plant materials and seeds are used based on site characteristics and surrounding vegetation as determined by a preconstruction site inventory" (see Nebraska Revised Statute Section 76-3308(2)) and that seed conforms to the FSA, 7 USC 1551 et seq., the Nebraska Seed Law, and the Noxious Weed Control Act (see Nebraska Revised Statute Section 763308(1)).

Keystone has completed numerous pre-construction vegetation inventories along the Preferred Route to document existing vegetation and to develop compatible seed mixes. These seed mixes have been discussed with local and state resource specialists including University of Nebraska and NRCS scientists, and those discussions are a part of the public record before the DOS. Keystone has also requested, from the NRCS and the Farm Service Agency, specific seed mixes to utilize on Conservation Reserve Program (CRP) lands.

Further, Keystone has worked with landowners who have requested specific seed mixes for their properties either to develop landowner-approved seed mixes or to determine if the prescribed seed mix for a property would be acceptable to the landowner. In the course of university and agency consultation, as well as in discussions with landowners, Keystone has requested and received lists of "genetically appropriate and locally adapted" plant materials and seed. Based on these consultations and discussions, Keystone has developed native seed mixes of diverse species for use in native prairies and environments, as well as, non-native pasture mixes for use in non-native hay and agricultural land. Provided below is a list of native seed mixes that have been developed for different land and vegetation types in Nebraska:

- Mixed Grasslands
- Riparian Forest
- Tall Grasslands
- Sandy Prairie
- Sub-irrigated Pasture

The following non-native seed mixes have been developed for different land and vegetation types in Nebraska:

- Introduced Pasture Mix
- Smooth Brome

All seed utilized in these mixtures will be certified weed-free and will conform to the FSA, 7 USC 1551 et seq. and the Nebraska Seed Law.

Subject to landowner preference, the following procedures will be utilized during seeding and are further detailed in the CMRP (see Section 4.11.4; Appendix D).

- All seed will be certified free of noxious weeds.
- Seed not utilized within twelve months of seed testing will be retested and approved prior to use.
- Mulch applied prior to seeding for temporary erosion control will be removed prior to seedbed preparation, as needed.
- Seeding rates will be based on pounds of pure live seed per acre.
- Weather conditions, construction right-of-way constraints, site access, topography and soil type will influence the seeding method to be used (i.e., drill seeding versus broadcast seeding).
- Seeding will be delayed until the soil is in the appropriate condition for seeding and weather is amenable to revegetation success.
- A rangeland or other appropriate drill seeder that is 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 will be used for placement of the seed.
- All seeders will be operated at an appropriate speed so the specified seeding rate and depth is maintained.
- All seeders will be calibrated so that the specified seeding rate is planted. The row spacing on drill seeders shall not exceed 8 inches.
- Seed will be planted at depths consistent with the local or regional agricultural practices for the seeded species.
- Broadcast or hydro seeding, used in lieu of drilling, shall utilize NRCS-recommended seeding rates. Where seed is broadcast it will be harrowed, raked, or cultipacked following broadcasting to incorporate the seed to the specified depth and to firm the seedbed.
- Broadcast seeding will not be utilized during high wind conditions.
- Areas of broadcast seeding that are too steep or otherwise cannot be safely harrowed or cultipacked will be hand raked in order to incorporate the broadcast seed to the specified depth.
- Hydroseeding 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 hydroseeding, 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 percent ground cover. Tackifier will consist of biodegradable, vegetable-based material and will be applied at the rate recommended by the manufacturer. The seed, mulch, and tackifier slurry will be applied so that it forms a uniform, mat-like covering of the ground.

8.6 NOXIOUS WEED MANAGEMENT

Keystone is committed to managing noxious weeds and invasive plants on the right-of-way. The Reclamation Act also specifies noxious weed mitigation and management and compliance with the Noxious Weed Control Act (Nebraska Revised Statute Sections 76-3303(2) and 76-3308). Keystone has completed pre-construction weed surveys and mapped state- and county-listed noxious weed populations that occur along the Preferred Route. In addition, Keystone has developed a Noxious Weed Management Plan for Nebraska (see Appendix E).

The Nebraska Noxious Weed Management Plan specifies pre-construction, construction, and post-construction management efforts to limit the spread of noxious weeds via the Nebraska portion of the proposed Project. In particular, topsoil from areas infested with noxious weeds will be stored separately from weed-free topsoil to limit the spread of weed seeds or rhizomes via topsoil. Equipment cleaning stations will be utilized in specific areas during construction to limit the movement of weeds to uninfested areas, and weeds will be treated following construction as necessary with EPA-approved herbicides by a licensed applicator or manually removed depending on the degree of infestation and adjacent resources, such as waterbodies.

8.7 RECLAMATION AND MAINTENANCE OBLIGATION

Nebraska Revised Statute Section 76-3304(3) specifies that a "pipeline carrier's obligation for reclamation and maintenance of the pipeline right-of-way shall continue until the pipeline is permanently decommissioned or removed." Keystone will abide by the proposed Project maintenance and reclamation commitments and regulatory requirements, including those prescribed by the Reclamation Act, until the proposed Project is permanently decommissioned or removed. See testimony of Tony Palmer, included as Exhibit 1.

9.0 A LIST OF PLANNED METHODS TO MINIMIZE OR MITIGATE THE POTENTIAL IMPACTS OF THE MAJOR OIL PIPELINE TO LAND AREAS AND CONNECTED NATURAL RESOURCES OTHER THAN WITH RESPECT TO OIL SPILLS (SUBSECTION 023.02A9)

9.1 DESCRIPTION OF CONSTRUCTION

The following is a general description of the typical construction methodology for the Preferred Route. Keystone has proposed the installation of 36-inch diameter pipeline for the entire length of the selected route. Pipeline construction will generally proceed in a linear fashion on each spread (e.g., pre-determined construction segments), with each operation usually separated by a number of miles. Construction typically will occur within a 110-foot-wide construction right-of-way, consisting of a 60-foot temporary construction right-of-way and a 50-foot permanent right-of-way (i.e., permanent easement). Though the typical width of the construction right-of-way would be 110 feet, this width may be decreased or increased based on best management practices to address natural resource or engineering and safety concerns.

In addition to the installation of the pipeline, the Preferred Route will include the construction and operation of the following permanent aboveground structures: five pump stations and 19 intermediate mainline valves (IMLV). The five pump stations will be built on land purchased in fee on sites ranging from approximately seven to 17 acres. Each IMLV will be constructed within a fenced site approximately 50 feet by 50 feet in size and located within the 50-foot-wide permanent right-of-way.

An illustrative depiction of construction activities in provided in Figure 9.1-1. The exact sequence of construction activities may vary depending upon site-specific factors. Construction of the Preferred Route will include the following sequenced major activities along the length of the route:

1. Mobilization, including surveying and staking the work area and preparing access;

2. Mowing and clearing the construction work area;

3. Grading the construction work area, as necessary, and installing temporary erosion and sediment controls, as required;

4. Topsoil stripping;

5. Assembling the pipe (stringing, bending, welding, coating, inspection, etc.);

6. Excavating the pipeline trench;

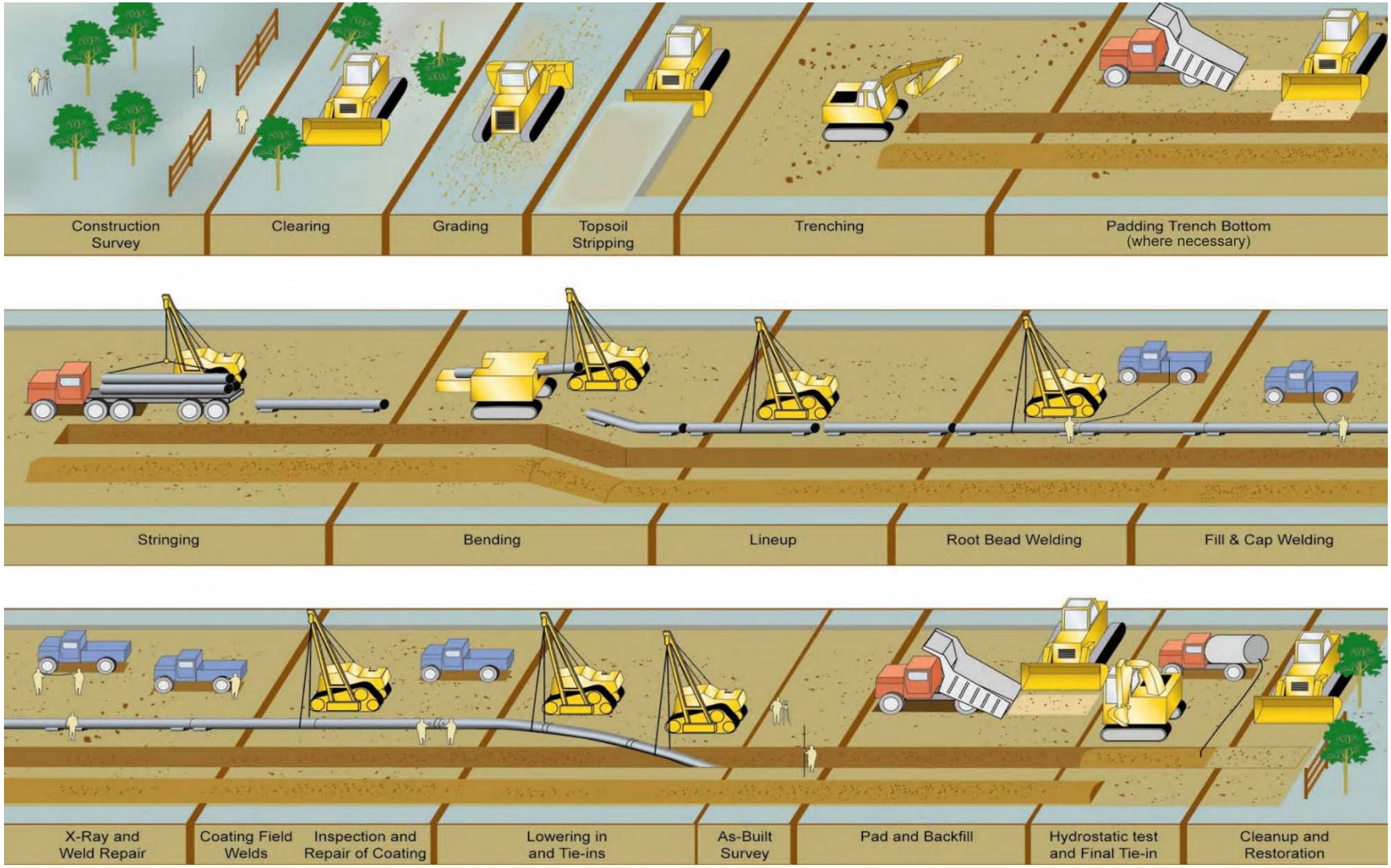
7. Installing (lowering-in) the pipeline and backfilling the trench;

8. Hydrostatically testing the pipeline segments; and

9. Cleaning up and restoring the construction work area, including, but not limited to, removing temporary structures and fill and installing permanent erosion and sediment controls.

In addition, special construction crews may be used for specific site conditions such as, waterbodies, roads, highways, and railroads. Pump stations will be constructed by specialty contractors.

Figure 9.1-1 Diagram of the Typical Construction Sequence of an Oil Pipeline



9.2 PLANNED METHODS

The following subsections outline Keystone's planned methods to minimize or mitigate the potential impacts of the pipeline to land areas and connected natural resources in Nebraska.

9.3 ENVIRONMENTAL TRAINING AND AWARENESS

All environmental training programs will communicate Project requirements and the expectation that each individual is responsible for ensuring compliance with the proposed Project's environmental and regulatory requirements.

Keystone will provide Project personnel with the applicable environmental orientation and awareness training before conducting activities within their area of responsibility.

Each specific environmental training program will identify applicable environmental mitigation, including site-specific measures.

Training programs will be developed and presented to both inspection and contractor staff at various levels of the organization from leadership to pipeline laborers, as appropriate to job responsibilities.

9.4 ENVIRONMENTAL INSPECTION

Environmental Inspectors will undergo training prior to joining the Project team. Training includes project-specific requirements, reporting requirements, site specific environmental issues including management of special status species, erosion control, topsoil and water management, and permit requirements.

Environmental Inspection Program

The objective of the environmental inspection program is to inspect the work, document the inspection results and work with the construction management team to help ensure conformance with:

- Project permits and applicable regulatory requirements;
- Construction, Mitigation and Reclamation Plan (see Section 9.6)
- Keystone's environmental policies; and
- Environmental commitments.

The Environmental Inspector

The Environmental Inspector will provide technical recommendations to the Construction Management Team to ensure that the above requirements are met. The Chief Inspector will have the authority to issue a stop work order and/or order corrective action on the recommendation of the Environmental Inspector in the event that construction activities deviate from the measures outlined in the compliance material identified above and in Section 9.5 below. The Environmental Inspector refers to environmental management plans and tools during construction, such as:

- The Construction, Mitigation, and Reclamation Plan (see Section 9.6);
- The environmental commitments database; and
- Federal, state, local, and other applicable laws, permits and regulatory approvals and requirements.

9.5 COMMITMENT MANAGEMENT

Before and during construction and reclamation, compliance with environmental and landowner commitments will be tracked using a commitment management database. In addition to the environmental commitments identified in Section 9.4, a commitment management system will contain agreements made during the stakeholder consultation process. Individual landowner agreements are managed through a land database and a construction line list.

9.6 CONSTRUCTION MITIGATION AND RECLAMATION PLAN (CMRP)

The CMRP describes construction, operation, and maintenance measures that are designed to reduce the likelihood and severity of impacts along the pipeline construction corridor and during operations. Examples include topsoil removal, storage and replacement, temporary and permanent erosion controls, construction measures at wetland and waterbody crossings, drain tile system mitigation and repairs, noxious weed controls, reclamation and revegetation of the pipeline right-of-way, and hydrostatic testing. These measures would be implemented, as practicable, provided that they do not conflict with the requirements of any applicable federal, state, or local rules and regulations, or other permits and approvals applicable to the proposed Project.

9.7 CONSTRUCTION/RECLAMATION PLANNING

To plan appropriate construction and reclamation procedures for inclusion in the CMRP, surveys were conducted to map Construction and Reclamation (Con/Rec) Units and to obtain data related to depth of topsoil, erosion control measures, and revegetation seed mixtures. Categories of Con/Rec units identified for the Project include:

- Crop - Farmed cropland includes areas of agricultural production that are tilled either annually or occasionally. Agricultural products include wheat, corn, milo, oats, soybeans, and alfalfa.
- Shelterbelt - Planted tree and shrub shelterbelts and windbreaks. Common northern species include: plains cottonwood, Chinese elm, American elm, Austrian pine, Siberian peashrub, and lilac. Common southern species include: Osage orange, eastern red cedar, locust, and hawthorne.
- Sandy Prairie - Native prairie on sandy soils dominated primarily by warm- season grasses such as little bluestem, sand bluestem, prairie sandreed, and switchgrass. Topography is typically flat to gently rolling.
- Forest - Forest areas are dominated by native and introduced trees. Typical species include green ash, boxelder, plains cottonwood, elm, oak, mulberry, and eastern red cedar.
- Tall Grasslands - Tall grasslands are dominated by tall warm-season grass species including big bluestem, switchgrass, Indiangrass, and little bluestem, and shorter warm-season grasses such as blue grama and sideoats grama.
- Improved Pasture and Hayland - Improved pasture and hayland are managed grasslands that have typically been planted with grasses for livestock forage or hay production. Improved pastures and haylands are often dominated by crested wheatgrass, smooth brome and legumes in various combinations, or seeded native tall grasses.
- Conservation Reserve Program - Lands enrolled in the CRP under contract with the USDA Farm Service Agency. Landowners convert erodible or environmentally sensitive acreage to native grasses or introduced grasses and forbs, wildlife plantings, trees, or riparian buffers per the terms of a multiyear contract.
- Mixed Grassland - Mixed grasslands are dominated by native perennial grasses such as western wheatgrass, needle-and-thread, blue grama, Sandberg bluegrass, prairie junegrass, little bluestem, prairie sandreed, green needlegrass and bluebunch wheatgrass.

- Riparian - Riparian woodlands include forested and shrub dominated areas around streams and rivers. Common trees and shrubs include plains cottonwood, green ash, box elder, Russian olive, sandbar willow, Wood's rose, snowberry, and silver sagebrush. Herbaceous understories are often dominated by Kentucky bluegrass, western wheatgrass, and redtop.
- Subirrigated Pasture - The Subirrigated Pasture type includes subirrigated plains and hay meadows. Soils are typically fine sands, with narrow clay bands in some areas. Topography is typically flat. The water table within this Con/Rec unit is often within six feet of the surface. Native grasses include big bluestem, switchgrass, and little bluestem; introduced grasses include timothy, orchardgrass, and Kentucky bluegrass. Wetlands may occur adjacent to, but not part of, this reclamation unit.

Appendix F provides further descriptions of the Con/Rec units identified in the Project area along with the appropriate construction and reclamation procedures for each.

The surveys also identified vegetation cover, characterized existing land uses, and recorded native plant distribution in the Project area to aid planning. Agency recommendations for each specific land use/vegetative cover were also incorporated into construction and reclamation planning. Extensive consultation with federal, state, and county agencies and universities was also conducted in developing the Project CMRP.

The Con/Rec units will be placed on the final construction alignment drawings. The Project will be constructed in accordance with the final construction alignment drawings.

9.8 PERMIT COMPLIANCE

Keystone will comply with the terms and conditions stipulated in applicable federal, state, and local permits and will comply with applicable laws and regulations. See testimony of Tony Palmer, included as Exhibit 1. Compliance will be managed through the commitment management measures described above.

9.9 HORIZONTAL DIRECTIONAL DRILL (HDD)

Keystone currently plans to use the HDD method of construction to avoid impacts to five waterbody crossings along the Preferred Route. The HDD method involves drilling a pilot hole under the waterbody and adjacent areas, then enlarging the hole through successive reaming until the hole is large enough to accommodate a prefabricated segment of pipe. Throughout the process of drilling and enlarging the hole, slurry consisting of water and bentonite clay will be circulated to lubricate the drilling tools, remove drill cuttings, and provide stability to the drilled holes. Pipe sections long enough to span the entire crossing will be staged and welded along the construction work area and then pulled through the drilled hole. The use of the HDD method would generally result in no impacts to the banks, bed, or water quality of the waterbody being crossed. Locations considered for HDD techniques included commercially navigable waterbodies, waterbodies wider than 100 feet, waterbodies with terrain features that prohibit open crossing methods, waterbodies adjacent to features such as roads or railroads that would complicate construction using the open crossing method, and sensitive environmental resource areas.

9.10 HYDROSTATIC TEST PLAN

The pipeline will be hydrostatically tested in sections of varying lengths averaging approximately 29 miles to ensure the pipeline system is capable of withstanding the operating pressure for which it is designed. Hydrostatic testing involves filing a section of the pipe with water and pressurizing the pipe for a fixed period of time and then discharging the water. Generally, the pipeline will be hydrostatically tested after backfilling and construction work that could directly affect the pipe is completed. Pump station piping will be hydrostatically tested separate from the mainline pipeline. Hydrostatic testing will be conducted in accordance with 49 CFR 195 Subpart E.

Water for hydrostatic testing will generally be obtained from rivers, streams, groundwater, or municipal sources in close proximity to the pipeline and in accordance with federal, state, and local regulations. The temporary water withdrawal from either surface water and groundwater sources for hydrostatic testing will be permitted through the process required by the Nebraska Department of Natural Resources. As part of the permitting process, the requested water withdrawal will only be permitted if it is determined that the temporary withdrawal will not negatively impact the existing water level of the surface water or groundwater source. No chemicals will be added to the test water prior to filling the hydrostatic test sections.

After hydrostatic testing, the water will be tested to ensure compliance with the National Pollutant Discharge Elimination System (NPDES) discharge permit requirements, treated if necessary, and discharged at either the source waterbody within the same water basin or to a suitable upland area near the test discharge in accordance with the NPDES permit. To reduce the velocity of the discharge to upland areas, energy dissipating devices will be employed. Energy dissipation devices are described in the CRMP (Section 8.4).

Hydrostatic test water will not be discharged 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, or local permitting agencies grant authorization. To avoid impacts from invasive species that could be in the water column, no inter-basin transfers (discharge) of hydrostatic test water will occur without specific permitting approval to discharge into an alternative water basin.

9.11 SPILL PREVENTION CONTROL AND COUNTERMEASURE

A Project specific Spill Prevention, Control, and Countermeasure (SPCC) Plan will be implemented to avoid or minimize the potential for spills and leaks from equipment during construction. The SPCC Plan will be finalized when construction contractors are engaged and will describe spill prevention practices, emergency response procedures, emergency and personnel protection equipment, release notification procedures, and cleanup procedures.

9.12 NOXIOUS AND INVASIVE WEEDS

When intact soils and vegetative communities are disturbed, there is a greater potential for noxious and invasive weeds to spread into the area. Keystone has completed the majority of pre-construction noxious weed surveys and mapped state- and county-listed noxious weed populations that occur along the Preferred Route and has developed a Noxious Weed Management Plan for Nebraska (see Appendix E) that would be implemented for the Project. Prior to construction, noxious weed surveys will be completed and any additional recorded occurrences will be added to Project mapping.

9.13 RECREATION AND SPECIAL INTEREST AREAS

The Preferred Route in Nebraska does not impact any known recreation areas, Wetland Reserve Program land, or Nebraska Land Trust tracts. Approximately 54 acres of land owned by the State of Nebraska Board of Educational Lands and Funds, and approximately 3.9 non-contiguous miles of land included in the CRP will be crossed by the Preferred Route. Keystone will acquire easements along the Preferred Route from the State of Nebraska Board of Educational Lands and Funds in accordance with Nebraska Revised Statute Section 72-222.01 and the related regulations. While CRP lands will undergo temporary and permanent impacts, pipeline construction and operation should have no effect on landowners' participation in the CRP. The Farm Service Agency will require that affected landowners, prior to pipeline construction, notify it of the planned construction activities. Keystone will commit to restoring these lands to their pre-construction condition. In doing so, it would not be expected that landowners will lose their eligibility for participation in the CRP. However, should CRP participants be required to leave the program because of the Project construction, Keystone will compensate the landowner for any lost CRP payments, including any retroactive forfeited payments. In addition, Keystone

will work with seed corn producers to minimize impacts to seed corn production. Keystone will compensate producers for lost seed corn production.

9.14 CONTAMINATED SOILS UNANTICIPATED DISCOVERY PLAN

A contaminated soils unanticipated discovery plan that covers response, cleanup and reporting procedures will be developed.

10.0 FOR INFORMATIONAL PURPOSES ONLY, A DESCRIPTION OF THE METHOD FOR STATE AGENCIES AND EMERGENCY RESPONSE PERSONNEL TO OBTAIN CURRENT SAFETY DATA SHEET(S) FOR THE PRODUCT(S) OR MATERIAL(S) BEING TRANSPORTED THROUGH THE PIPELINE IN THE EVENT OF AN INCIDENT (SUBSECTION 023.02A10)

In November 2012, Keystone conducted an emergency response exercise for the proposed Project. The exercise was conducted at the request of the NDEQ to test Keystone's ability to provide the specific applicable MSDS to State and local authorities in the case of a spill from the pipeline. NDEQ randomly selected the simulated spill location and provided it at the start of the exercise.

The exercise facilitator began the exercise by calling the TransCanada Operations Control Center (OCC) in Calgary, Canada, and reporting third-party excavation damage to the pipeline. The controller at the OCC stated that he had observed indications of a product release and that he was shutting down the line and contacting the nearest Keystone on-scene responder to drive to the location of the spill. The Regional Emergency Operations Center (EOC) in Omaha, Nebraska was activated, along with the Corporate EOC in Calgary. The Regional EOC Manager requested that the OCC email an MSDS for the batch of crude oil in the pipeline at the point of the third-party strike. The OCC controller stated that the location of the strike was near the interface of two batches of oil and sent an MSDS for each batch to the Regional EOC Manager.

Seventeen minutes after the exercise began, the Regional EOC Manager emailed the two safety data sheets to Nebraska Emergency Management Agency, the Wayne County Sheriff, the Wayne County Local Emergency Planning Committee, and the public safety answering point (PSAP), or 911, successfully completing the exercise. In the Final Evaluation Report[5], NDEQ concluded that the exercise demonstrated that Keystone could provide an MSDS for the exact material being transported in the pipeline at the time of a spill in a reasonable amount of time.

The steps taken during the emergency response exercise described above would be the method Keystone would use to provide MSDS in the event of an incident.

11.0 BURDEN OF PROOF (SUBSECTION 023.07)

In enacting MOPSA, the Nebraska Legislature conclusively found that, due to the increasing need for energy, the construction of major oil pipelines is in the public interest of Nebraska and the US. Nebraska Revised Statute Section 57-1403. MOPSA expressly provides that nothing in the Act shall be construed to regulate any safety issue with respect to any aspect of any interstate oil pipeline. MOPSA is intended to deal solely with the issue of siting or choosing the location of the route aside and apart from safety considerations. In enacting MOPSA, the Legislature acknowledged the exclusive federal authority over safety issues established by federal law. MOPSA is intended to exercise only the remaining sovereign powers and purposes of Nebraska which are not included in the category of safety regulation, Nebraska Revised Statute Section 57-1402(2).

Sections 12.0 through 19.0 of this Application demonstrate that Keystone has met its burden of proof by selecting a route that is in the public interest. The potential impacts to natural resources from the

[5] Nebraska Department of Environmental Quality's Final Evaluation Report for the Keystone XL Pipeline is available at http://deq.ne.gov/PipeMeet.nsf/MenuFinal?OpenPage.

construction, operation and maintenance of the Preferred Route have been thoroughly evaluated by federal and state agencies. As part of this evaluation, best management practices and mitigation measures have been adopted. The Preferred Route has been designed to minimize and mitigate impacts to natural resources during construction, operation and maintenance of the pipeline in Nebraska.

12.0 WHETHER THE PIPELINE CARRIER HAS DEMONSTRATED COMPLIANCE WITH ALL APPLICABLE STATE STATUTES, RULES, AND REGULATIONS AND LOCAL ORDINANCES (SUBSECTION 023.07A)

Keystone will comply with all applicable state statutes, rules, regulations, and local ordinances. In some instances, compliance may not be complete at this time because:

(i) the requirement has not yet been triggered;
(ii) the term of the permit would expire before construction is underway or completed if obtained too far in advance; or
(iii) Keystone is still in the process of compliance.

Keystone's compliance with the applicable state statutes, rules, regulations, and local ordinances is evident throughout this Application. Notably, Keystone has demonstrated compliance, or a plan to comply with the primary Nebraska statutes applicable to oil pipelines and which govern siting of the pipeline and reclamation of areas through which a pipeline is constructed. As explained in Sections 2.0 and 3.0 of this Application, the Preferred Route was initially developed through the oil pipeline siting process found at Nebraska Revised Statute Section 57-1501 et. seq., which includes a review by the NDEQ and public input. As explained in Section 8.0, Keystone has also developed a plan that ensures the Preferred Route will comply with the Oil Pipeline Reclamation Act.

As appropriate, Keystone has obtained, or will obtain, all required permits to comply with state laws, floodplain regulations, and local ordinances such as applicable zoning requirements. Keystone will work with the Nebraska Department of Roads to obtain state road-crossing permits and driveway approach permits where necessary. Keystone will similarly work local officials to obtain right-of-way crossing and driveway approach permits where necessary. In some counties, the permits have already been acquired for the Preferred Route.

Finally, Keystone will obtain any required construction, environmental, conditional use, permitted use, or building permits from state, county, and local jurisdictions for the pipeline including pump stations, contractor yards, pipe yards, valve sites, and any permanent driveways. Keystone has been in contact with the appropriate authorities but has not secured all required permits at this time because either the request for a permit is premature or Keystone is still in the process of compliance. Some permits have already been obtained for the Preferred Route, however, due to sunset provisions in some applicable regulations, some permits have expired or will expire before this Application receives a ruling from the PSC. Keystone will renew any expired permits prior to construction.

13.0 AN ENVIRONMENTAL IMPACT STUDY (SUBSECTION 023.007B1)

Table 13-1 provides a summary of the potential impacts that may occur along the Preferred Route (e.g., the construction and operation right-of-way, pump stations, mainline valve sites) during both construction and operation. Mitigation measures and best management practices that will be implemented to minimize or mitigate the impacts are discussed in the Sections 9.0 and 18.0 of this Application.

Additional environmental impact studies were performed for the Preferred Route by the NDEQ and the DOS. See the NDEQ Final Evaluation Report (2013)[6] and the DOS FSEIS (2014)[7]. The NDEQ Final Evaluation Report concluded that construction and operation of the proposed pipeline, with the mitigation and commitments from Keystone, as described in the Final Evaluation Report, could have minimal environmental impacts in Nebraska. The DOS FSEIS concluded that construction and normal operation of the proposed Project is not expected to have significant impacts to most resources along the Preferred Route.

[6] NDEQ's Final Evaluation Report (2013) for the Keystone XL Pipeline is available at http://deq.ne.gov/PipeMeet.nsf/MenuFinal?OpenPage.

[7] DOS Final Supplemental Environmental Impact Statement (2014) for the Keystone XL Pipeline is available at https://keystonepipeline-xl.state.gov/2012/finalseis/index.htm

Table 13-1. Description of Impacts to Natural Resources as a Result of the Construction and Operation of the Preferred Route.		
Resource	**Construction Impacts**	**Operations Impacts**
Geology	Due to depth of bedrock, there will be minimal impacts to bedrock along the Preferred Route. There are minimal areas where bedrock is located within eight feet of the surface and the typical trench depth is generally seven feet below surface. Minimal breakup and removal of rock material will occur over 0.3 miles[1] of potential ripping locations (shallow bedrock) along the Preferred Route.	During the operational phase of the proposed Project, maintenance and repair of the pipeline is not expected to impact physiography or surface or bedrock geology.
Soils and Sediments	Potential impacts to soil and sediment during construction activities will include: • Temporary and short-term soil erosion; • Short-term to long-term loss of topsoil; • Short-term to long-term soil compaction; • Temporary increases in the proportion of large rocks in the topsoil; • Soil mixing; and • Short-term to permanent soil contamination. The Preferred Route crosses the following types of soils: • 47.1 miles of highly wind erodible soils[2] • 57.4 miles of highly water erodible soils[2] • 5.4 miles of low revegetation potential soils[3] • 182.2 miles of prime farmland soils[4] • 9.6 miles of hydric soils[5]	During the operational phase of the proposed Project, impacts to soil and sediment will be limited to possible impact in small areas where maintenance and repair activities occur.
Water Resources: Groundwater	Potential impacts to groundwater during construction activities will include: • Temporary increases in total suspended solids (TSS) concentrations where the water table is disturbed during trenching and excavation activities (temporary, localized drawdown of the aquifer is possible where dewatering of the trench is necessary); • Degradation of groundwater quality due to potential blasting; • Degradation of groundwater quality due to potential fuel spills from construction equipment; and • Minor, temporary impacts from water withdrawals for hydrostatic testing.	During the operational phase of the proposed Project impacts to groundwater will be limited to possible impact in small areas where maintenance and repair activities occur.

Table 13-1. Description of Impacts to Natural Resources as a Result of the Construction and Operation of the Preferred Route.		
Resource	**Construction Impacts**	**Operations Impacts**
Water Resources: Surface Water	Potential impacts to surface water resources during construction activities will include: • Temporary increases in TSS concentrations and increased sedimentation during stream crossings or from stormwater runoff; • Temporary to short-term degradation of aquatic habitat from in-stream construction activities; • Potential changes in channel morphology and stability caused by channel and bank modifications; • Temporary to long-term decrease in bank stability and resultant increase in TSS concentrations from bank erosion until vegetation removed from banks during construction is reestablished; • Localized degradation of surface water due to potential fuel spills from construction equipment; and • Short-term impact to surface waters from water withdrawals for HDD, hydrostatic testing, and dust control. There will be 162 individual crossings[6] of waterbodies: • 33 individual crossings of perennial waterbodies; • 59 individual crossings of intermittent waterbodies; • 67 individual crossings of ephemeral waterbodies; and • 3 individual crossings of constructed ditches. The Preferred Route will have temporary impacts to mapped floodplains at 78 identified crossings. Impacts will be temporary and the original elevation of the floodplain will be restored following construction.	During the operational phase of the proposed Project, impacts to surface water resources will be limited to possible impact in small areas where maintenance and repair activities occur. There will be a permanent, but insignificant, impact to the mapped floodplain within the boundary of the Fillmore County Pump Station due to the construction of permanent aboveground structures within the mapped floodplain.
Wetlands	The width of the construction right-of–way will be reduced from 110-feet to 85-feet for the crossing of wetlands. Potential impacts to wetlands during construction activities will include: • Short-term to long-term degradation of wetland habitat from construction activities; • Short-term changes in wetland hydrology; and • Localized degradation of the wetland due to potential fuel spills from construction equipment Construction will cross approximately 0.6 miles of wetlands[7]: • 0.4 miles of palustrine emergent wetlands • 0.2 miles of palustrine forested wetlands	During the operational phase of the proposed Project, impacts to wetlands will be limited to possible impact in small areas where maintenance and repair activities occur. Due to regular mowing and clearing, palustrine forested wetlands within the 50-foot-wide permanent right-of-way would be converted to and managed as herbaceous emergent wetland vegetation.

Table 13-1. Description of Impacts to Natural Resources as a Result of the Construction and Operation of the Preferred Route.		
Resource	**Construction Impacts**	**Operations Impacts**
Terrestrial Vegetation	Most of the vegetation impacts within the Preferred Route will be temporary and short-term since the majority of the Preferred Route crosses agricultural land. Potential impacts to terrestrial vegetation during construction activities could include: • Impacts to annually tilled croplands which will be short-term and limited to the current growing season if topsoil is segregated and topsoils are not compacted during construction; • Impacts to pastures, rotated croplands, and open grassland range which, generally, will be short to long-term, with vegetation typically reestablishing within 1 to 5 years after construction; and • Impacts to upland and riparian forest communities which will result in long-term impacts on these vegetation communities. Herbaceous vegetation will reestablish within 5 years, but up to 50 years will be needed for trees to mature to pre-construction conditions. Trees will not be allowed to re-establish within the permanent easement. The Preferred Route will cross the following vegetation communities[8]: • 212.0 miles of agriculture/cropland • 4.6 miles of developed lands • 52.0 miles of grassland/ rangeland • 3.9 miles of forest land • 1.4 miles of riverine/open water • 0.6 miles of palustrine forested wetlands • 0.7 miles of palustrine emergent/scrub-shrub wetlands The Preferred Route will cross 44.3 miles of vegetation communities[9] of conservation concern: • 3.6 miles of deciduous forests and woods • 41.5 miles of native grasslands • 1.4 miles of riparian woodlands. Construction of the Preferred Route has the potential to introduce or expand the growth of noxious weeds. The introduction or expansion of noxious weeds could result in short-term impacts during construction and reclamation by inhibiting or prolonging restoration success.	During the operational phase of the proposed Project, impacts to terrestrial vegetation will be limited to small areas where maintenance and repair activities occur. Keystone does not anticipate any significant overall effect to crops and vegetation associated with heat generated by the operating pipeline (See Appendix S to the 2014 DOS FSEIS). Due to regular mowing and clearing, forested land within the 50-foot-wide permanent right-of-way would be converted to and managed as herbaceous vegetation.

Table 13-1. Description of Impacts to Natural Resources as a Result of the Construction and Operation of the Preferred Route.		
Resource	**Construction Impacts**	**Operations Impacts**
Wildlife	For big game species, small game species, and nongame species (small mammals, migratory birds, and reptiles and amphibians) impacts will be temporary in nature due to the short-term nature of construction activities. Potential temporary impacts to wildlife during construction activities could include: • Habitat loss, alteration, and fragmentation; • Direct mortality during construction activities; • Indirect mortality because of stress or avoidance of feeding due to exposure to construction noise and increased human activity; • Reduced breeding success from exposure to construction noise and increased human activity; and • Reduced survival or reproduction due to decreased abundance of forage species or reduced cover. • Reduced travel corridors	During the operational phase of the proposed Project, impacts to wildlife species will be limited to possible impact in small areas where maintenance and repair activities occur, operations noise, and occasional low-level helicopter or airplane monitoring overflights
Fisheries	Potential impacts associated with open-cut stream crossings and water withdrawal for hydrostatic testing, horizontal directional drilling, and dust control will be temporary due to the short-term nature of construction activities. Potential temporary impacts to fisheries during construction activities could include: • Short-term changes in the benthic invertebrate community; • Direct mortality during construction activities; • Short-term feeding disruption; • Temperature fluctuations around stream crossings, especially in low flow situations; and • Reduced productivity and spawning due to increased suspended sediments, temperature changes, physical disturbance of streambeds, and changes in oxygen content.	During the operational phase of the proposed Project, impacts to fisheries will be limited to possible impact in small areas where maintenance and repair activities occur.

Table 13-1. Description of Impacts to Natural Resources as a Result of the Construction and Operation of the Preferred Route.		
Resource	**Construction Impacts**	**Operations Impacts**
Threatened and Endangered Species	Potential impacts to threatened and endangered species will be similar to those impacts described for terrestrial vegetation, wildlife, and fisheries. Federally listed or candidate species that could be affected, as identified by the 2013 Biological Opinion issued by USFWS: • American burying beetle • Whooping crane • Interior least tern • Pallid sturgeon • Piping plover • Western prairie fringed orchid The Biological Opinion concluded that the American burying beetle is the only federally-listed species that is likely to be adversely affected. USFWS concluded that the other species considered may be affected, but are not likely to be adversely affected. Subsequent to USFWS issuance of the Biological Opinion, two additional species that may be present in the Project area were listed as threatened: the northern long eared bat and the red knot. Six state-listed species could potentially be affected (in addition to the federally-listed species): • River otter • Massasauga rattlesnake • Northern redbelly dace • Blacknose Shiner • Finescale Dace • Small white lady's slipper Keystone will implement conservation measures to avoid or minimize potential impacts on state-listed species. Conservation measures have been developed based on discussions with the NGPC.	During the operational phase of the proposed Project, impacts to threatened and endangered species will be similar to those described for terrestrial vegetation, wildlife, and fisheries. Maintenance and repair of the pipeline could affect the American burying beetle depending on the location of the activity.

Table 13-1. Description of Impacts to Natural Resources as a Result of the Construction and Operation of the Preferred Route.		
Resource	**Construction Impacts**	**Operations Impacts**
Land Use, Recreation, and Visual Resources	Potential impacts include a short-term and temporary change of land use, recreation, and visual resources within the construction right-of-way of the Preferred Route. The Preferred Route will cross the following land ownerships[10]: • 269.6 miles of private land • 0.1 miles of federal land • 4.6 miles of state land • 0.1 miles of local government land	During the operational phase of the proposed Project, impacts to land use, recreation, and visual resources will be limited to possible impact in small areas where maintenance and repair activities occur.

[1] Source: NRCS, 2007. Includes soils that have lithic bedrock within 60 inches of the soil surface.

[2] Source: NRCS, 2007. Includes soils in WEG of 1 or 2.

[3] Source: NRCS, 2007. Includes soil components listed as saline (EC>=4 & SAR<13), sodic (EC<4 & SAR>=13), or saline-sodic (EC>=4 & SAR>=13), in addition to components containing horizons with a pH less than 3.5 (very acidic) or greater than 9 (very alkaline).

[4] Source: NRCS, 2007. Includes land listed by the NRCS (2007) as potential prime farmland if adequate protection from flooding and adequate drainage are provided.

[5] Source: NRCS, 2007. As designated by the NRCS (2007).

[6] Source: Number of stream crossings is based on field survey data

[7] Source: Number is based on project survey data. Impacts shown are for permanent & temporary easement along preferred route.

[8] Source: Based on project data for land use/land cover. Project data consists of desktop analysis results (2010/2012 NAIP, Bing) and field verified data (approx. 55.0 Miles were field verified). Note, wetland values reflect base land use/land cover data, field verified numbers are listed in the "Wetlands" row.

[9] Source: Westech, 2013

[10] Source: Based on project parcel data. Parcel data was digitized from plat books or downloaded from county websites. Ownership information was then verified by Universal Field Services (UFS) and later Contract Land Staff (CLS).

14.0 A COMPREHENSIVE SOIL PERMEABILITY SURVEY (SUBSECTION 023.007B2)

A comprehensive soil permeability survey was completed for the Preferred Route and the results are presented as Appendix G; Soil Permeability Study and Distance-To-Groundwater Survey report. Soil permeability is specifically addressed in Section 2.0, Table SA-1 and Figures SA-01 through SA-11 of the report.

15.0 A DISTANCE-TO-GROUNDWATER SURVEY (SUBSECTION 023.007B3)

A comprehensive distance-to-groundwater survey was completed for the Preferred Route and the results are presented as Appendix G; Soil Permeability Study and Distance-To-Groundwater Survey report. Distance-to-groundwater is specifically addressed in Section 3.0, Tables GW-1 and GW-2, and Figures GW-01 through GW-05 of the report.

16.0 EVIDENCE REGARDING THE IMPACT OF THE MAJOR OIL PIPELINE ON WILDLIFE (SUBSECTION 023.007B4)

16.1 TERRESTRIAL WILDLIFE SPECIES

The Preferred Route crosses habitat that supports a variety of wildlife, including big game species, small game species and furbearers, waterfowl and game birds, and nongame species. Wildlife habitats along the Preferred Route include grasslands/rangelands (mixed-grass prairie, tall-grass prairie, and non-native pasture), upland forests, riverine habitats, and wetlands. These vegetation communities provide foraging, cover and roosting, and breeding habitats for wildlife. This section addresses common big game species, small game species, nongame species, and federally- and state-listed species along the Preferred Route.

16.1.1 Big Game Species

Mule deer, white-tailed deer, and antelope are the principal big game species occurring along the Preferred Route. Elk may also be present in the vicinity of the Niobrara River crossing, though they are not expected to commonly occur along the Preferred Route.

Construction and Operations Impacts

Construction activities could result in temporary loss of potential foraging, cover, and breeding habitats, increased fragmentation of habitats, temporary increase in noise and human activity, and the temporary loss of preferred travel corridors. For big game species, these short-term impacts related to construction activities could result in temporary agitation, physiological stress, temporary displacement from home ranges, and the temporary use of sub-optimal habitat (Lutz et al. 2011).

The operation of the permanent aboveground facilities (e.g., pump stations and mainline valve sites) will result in the permanent loss of approximately 64 acres of undeveloped habitat for big game animals. This lost habitat will constitute a very small percentage of available habitat within Nebraska and will not likely affect big game populations that may overlap the Preferred Route.

During the operational phase of the proposed Project, further impacts to big game species will be limited to possible impacts in small areas where maintenance and repair activities occur, operations noise, and occasional low-level helicopter or airplane monitoring overflights.

16.1.2 Small Game Species

Small game species that may occur along the Preferred Route include upland gamebirds, waterfowl, furbearers, and small mammals. Specific species could include mourning dove, northern bobwhite, ring-necked pheasant, gray partridge, wild turkey, eastern fox squirrel, eastern gray squirrel, eastern red squirrel, eastern cottontail, sandhill crane, and migratory waterfowl. Furbearers include American beaver, bobcat, coyote, red fox, gray fox, raccoon, American badger, least weasel, long-tailed weasel, and mink.

Construction and Operations Impacts

Potential temporary construction impacts to small game species include nest or burrow destruction or abandonment and loss of young, loss of foraging habitat, loss of breeding habitat, and the loss of cover and roosting habitat. Small mammals could fall into and become trapped in the open trench during pipeline construction, potentially resulting in injury or mortality. Displacement of small game species from disturbance areas will be short-term, as individuals will be expected to return following completion of construction and reclamation activities. Burrowing animals will be expected to return and recolonize the right-of-way after construction.

Most waterfowl and game birds nest on the ground, although a few notable species such as wood ducks, mergansers, and mourning doves nest in trees. Direct impacts to small game bird species could include nest disturbance, loss of eggs or young, or mortality if construction takes place during the nesting season. Indirect short-term impacts such as habitat loss, alteration, and fragmentation could occur until vegetation is re-established and could result in avoidance behavior and increased predation.

Impacts from construction and operation of the pipeline would be small on a landscape level because the permanent corridor will be narrow, disturbed habitats will be reclaimed, and the majority of the affected habitats will be range- and cropland. For species that use tree and shrub habitats for cover and roosting, forage, and nesting, losses of these habitats will be long-term because trees and shrubs will require five years or more to reestablish and the permanent right-of-way will be maintained free of trees and large shrubs during operations. An estimated 49 acres of forested habitats (upland forested and woody wetlands) will be affected by construction of the proposed Preferred Route, of which an estimated 15.5 acres will be maintained in an herbaceous state during operations.

Those areas falling within the temporary construction right-of-way will be cleared of trees and brush to provide access for construction equipment, but allowed to reestablish after construction is complete. Trees and brush within the permanent right-of-way would be prevented from reestablishment due to periodic mowing and brush clearing of the easement so that the pipeline can be inspected by aerial surveillance in accordance with PHMSA regulations. Differences in vegetation cover between the right-of-way and the surrounding landscape could act as a travel barrier for some animals, such as the North American porcupine and tree squirrels, while acting as a travel corridor for others, such as coyotes and raccoons. Migratory waterfowl could be attracted to the pipeline corridor during early spring if it becomes snow-free earlier than surrounding habitats.

The construction of the permanent aboveground facilities (e.g., pump stations) will result in the permanent loss of approximately 64 acres of undeveloped habitat for small game species. This lost habitat will constitute a very small percentage of available habitat within Nebraska and will not likely affect small game populations that may overlap the Preferred Route.

16.1.3 Nongame Species

The Preferred Route crosses regions which are inhabited by a variety of nongame species that includes mammals, raptors, songbirds, amphibians, and reptiles.

16.1.3.1 Nongame Mammals

The Preferred Route will cross habitats that have the potential to support a diverse assemblage of nongame mammal species. Examples of nongame mammals that may occur along the Preferred Route include multiple bat species (e.g., big brown bat, eastern red bat, and hoary bat), multiple mice species (e.g., deer mouse, hispid pocket mouse, and plains harvest mouse), multiple shrew species (e.g., masked shrew and least shrew), hispid cotton rat, eastern mole, nine-banded armadillo, and woodchuck.

Construction and Operations Impacts

Potential impacts to nongame mammals resulting from construction and operation of the Preferred Route will be similar to those impacts described for big game and small game species.

16.1.3.2 Reptiles and Amphibians

The Preferred Route will cross a variety of habitats that have the potential to support a diverse assemblage of reptile and amphibian species. Examples of reptile and amphibian species that may occur along the Preferred Route include multiple snake species (e.g., milk snake, prairie king snake, western rat snake, prairie rattlesnake, plains garter snake, and northern water snake), multiple lizard species (e.g., prairie lizard, northern prairie skink, and five-lined skink), multiple turtle species (e.g., common snapping turtle, slider, and northern painted turtle), multiple frog species (e.g., cricket frog species, Great Plains narrow mouth toad, northern leopard frog, and bullfrog), and multiple toad species (e.g., Great Plains toad, Central Plains spadefoot toad, and American toad).

Construction and Operations Impacts

Potential construction impacts to reptiles and amphibians include direct mortality and loss of young, burrow destruction or abandonment, a loss of foraging habitat, loss of cover habitat, and loss of breeding habitat. If timing of the open trench coincides with migration of species to hibernation sites or breeding sites, large numbers of reptiles or amphibians could become trapped in the open trench. Trapped individuals that may not be noticed by construction crews will likely not survive. Displacement of reptiles and amphibians from disturbance areas will be short-term, as they will be expected to return and recolonize the right-of-way after construction. Erosion control blankets, especially those supported by fine, non-biodegradable, monofilament meshes could entangle and entrap reptiles or amphibians. Ripping for construction through rock outcrops that may provide hibernacula (winter hibernation locations) for snakes could destroy portions of these habitats.

During operations, reptiles and amphibians may be attracted by the heat that radiates from the pipeline, especially during fall, winter, and spring months. Changes in vegetation cover and structure over the maintained right-of-way could inhibit or increase movements of reptiles and amphibians. Reduction in riparian shrubs and trees could reduce riparian habitat or function as a movement corridor for reptiles and amphibians. Differences in vegetation cover between the right-of-way and the surrounding landscape could act as a barrier for reptiles or amphibians, while acting as a movement corridor for their predators. Indirect impacts such as soil compaction and vegetation cover/height that may make habitat less suitable for several years after construction may occur. Operational impacts may also occur in small areas where maintenance and repair activities occur.

16.1.3.3 Migratory Birds

Literature indicates that the presence of nongame birds along the Preferred Route is associated with open, grassland habitat, although woodland species are also represented along woodland riparian corridors and in upland forests along the Preferred Route. Possible raptors present in open habitats associated with the Project include turkey vulture, burrowing owl, bald and golden eagle, red-tailed hawk, Swainson's hawk, northern harrier, American kestrel, short-eared owl, and great horned owl. The woodland-associated raptor species likely to be present along the Preferred Route include the Cooper's hawk, sharp-shinned hawk, long-eared owl, and eastern screech owl. The burrowing owl, northern harrier, and short-eared owl are the only raptor ground nesters that may breed within the Preferred Route. Aerial survey by helicopter conducted in April 2013 along the Preferred Route identified seven active raptor nests within 0.5 miles of the centerline: one sharp-shinned hawk nest, one bald eagle nest, and five red-tailed hawk nests. The aerial survey also identified eight non-active raptor nests with 0.5 miles of the centerline. Ground surveys were completed in 2013 for burrowing owls at one prairie dog town north of the Keya Paha River. No burrowing owls were observed.

Open country species encountered during surveys included eastern kingbird, American crow, western and eastern meadowlark, horned lark, and sparrow species. Woodpecker species, blue jay, black-capped chickadee, wren species, vireo species, warbler species, and northern cardinal are typical

summer or year-long residents of woodlands along the Preferred Route. The April 2013 aerial surveys identified the location of two inactive great blue heron rookeries within approximately one mile of the centerline.

Construction and Operations Impacts

Construction could cause direct and indirect impacts to raptors and migratory birds if construction overlaps with nesting seasons. Construction activity near active nests during incubation or brood rearing could result in nest abandonment, overheating, chilling, or desiccation of unattended eggs or young, causing nestling mortality or premature fledging. Indirect impacts could be associated with increased human presence and noise from construction activity close enough to disturb nesting birds. However, raptor surveys in the spring prior to construction will identify nest locations for avoidance. Keystone will develop and implement a conservation plan consistent with the MBTA and the Bald and Golden Eagle Protection Act and consistent with provisions of Executive Order 13186. Survey protocols and other appropriate actions, as agreed upon by USFWS and NGPC will be included in the Migratory Bird Conservation Plan.

Loss of grassland habitats used by migratory birds for cover, forage, and nesting will be short-term because revegetation is expected to occur within one to five years after restoration efforts. Losses of tree and woodland habitats used by migratory birds for cover, forage, and nesting will be long-term because five years or more would be required to re-establish trees and shrubs. The permanent operations right-of-way will be maintained free of trees and large shrubs in upland areas.

The operation of the permanent aboveground facilities (e.g., pump stations and mainline valve sites) will result in the permanent loss of approximately 64 acres of undeveloped habitat for migratory bird species. This lost habitat will constitute a very small percentage of available habitat within Nebraska and will not likely affect migratory bird populations that may overlap the Preferred Route.

16.2 AQUATIC RESOURCES

Aquatic resources include the perennial streams, rivers, ponds and lakes that will be crossed by the Preferred Route. Important fisheries, which are defined as species with recreational or commercial value or threatened, endangered, or sensitive status, may be found along the Preferred Route

The Preferred Route will cross 11 Class A warmwater fisheries, seven Class B warmwater fisheries, and 12 Class B coldwater fisheries in Nebraska (Table 16-1). Common game fish include rainbow trout, northern pike, yellow perch, large- and smallmouth bass, catfish, sturgeon, and carp. See Section 16.3.2 for a discussion of state-listed fish species.

Construction and Operations Impacts

Construction through streams during spawning periods could result in short-term disruption of spawning and loss of eggs and young. Additionally, construction methods that lead to increased siltation and turbidity (cloudiness in the water) could temporarily displace fish. However, most species are acclimated to excessive turbidity from spring runoff and heavy rain events. Water withdrawals for use during HDD crossings or for hydrostatic test purposes could lead to fish entrainment. Water withdrawal will be performed consistent with permit requirements, and intake hoses will be screened to prevent entrainment of fish. Construction timing considerations and best management practices for maintaining water quality and flow will reduce potential impacts to aquatic resources.

Operation of the Project will likely have minimal impacts to aquatic resources located along the Preferred Route. If operational activities are required within or directly adjacent to rivers, streams, or wetlands, there is potential for a short-term increase in siltation and turbidity that could temporarily displace fish.

Table 16-1. Game Fishery Classification Along the Preferred Route			
Waterbody	**County**	**Approximate Milepost**	**Fishery Class[1]**
Unnamed Creek - Nebraska-South Dakota border to Buffalo Creek (Sec 26-35N-19W)	Keya Paha	602.2	Warmwater B
Wolf Creek	Keya Paha	610.8	Coldwater B
Spotted Tail Creek	Keya Paha	613.8	Coldwater B
Alkali Creek	Keya Paha	617.2	Warmwater B
Keya Paha River - Nebraska-South Dakota border (Sec 23-35N-20W) to Niobrara River	Boyd	618.3	Warmwater A
Niobrara River - Plum Creek to Keya Paha River	Boyd	626.3	Warmwater A
Niobrara River - Plum Creek to Keya Paha River	Boyd	626.3	Warmwater A
Niobrara River - Plum Creek to Keya Paha River	Holt	626.4	Warmwater A
Niobrara River - Plum Creek to Keya Paha River	Holt	626.4	Warmwater A
Niobrara River - Plum Creek to Keya Paha River	Holt	626.5	Warmwater A
Beaver Creek	Holt	627.1	Coldwater B
Big Sandy Creek - Spring Creek to Niobrara River	Holt	633.0	Warmwater B
Unnamed Creek (Sec 33-32N-14W)	Holt	640.3	Coldwater B
Unnamed Creek (Sec 24-32N-14W)	Holt	640.6	Coldwater B
Brush Creek - Headwaters to Unnamed Creek (Sec 24-32N-14W)	Holt	642.8	Coldwater B
North Branch Eagle Creek	Holt	647.2	Coldwater B
Middle Branch Eagle Creek	Holt	649.6	Coldwater B
East Branch Eagle Creek	Holt	653.4	Coldwater B
Redbird Creek - Headwaters to Blackbird Creek	Holt	663.4	Coldwater B
South Branch Verdigre Creek - Headwaters to East Branch Verdigre Creek (Sec 33-29N-7W)	Holt	680.4	Coldwater B
Big Springs Creek	Antelope	683.5	Coldwater B
Elkhorn River - Cedar Creek to North Fork Elkhorn River	Antelope	713.8	Warmwater A
Beaver Creek - Rae Creek (Sec 11-21N-7W) to Bogus Creek	Boone	744.3	Warmwater A
Plum Creek	Nance	760.1	Warmwater B
Loup River - Confluence of North and Middle Loup Rivers to Loup River Canal Division (Sec 6-16N-4W)	Nance	762.2	Warmwater A
Prairie Creek	Nance	767.2	Warmwater B
Platte River - Wood River to Loup Power Canal (Sec 35-17N-1E)	Merrick	775.7	Warmwater A
Beaver Creek - Headwaters to Unnamed Creek (Sec. 12-10N-2W)	York	804.0	Warmwater B
West Fork Big Blue River - School Creek to Beaver Creek	York	813.5	Warmwater A
Turkey Creek - Unnamed Creek (Sec 27-7N-2W) to Spring Creek	Fillmore	832.5	Warmwater B

[1]Nebraska Stream Classification Using Fish, Macroinvertebrates, Habitat and Chemistry Evaluation from Regional Environmental Monitoring and Assessment Program (R-EMAP) Data, 1997-2001. 2005. Bazata, K. Surface Water Section. Nebraska Department of Environmental Quality. Lincoln, NE.

[^]Nebraska Stream Biological Monitoring Program 2004-2008. 2011. Bazata, K. Surface Water Section. Nebraska Department of Environmental Quality. Lincoln, NE.

Table 16-2 provides information on how the surface water fisheries are identified for the State of Nebraska with a brief description of the definition on each classification.

Table 16-2. Surface Water Classification for 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.
Class B - Coldwater	Waters which provide or could provide a habitat capable of maintaining year-round populations of a variety of coldwater fish and associated vertebrate and invertebrate organisms and plants or which supports the seasonal migration of salmonids. These waters do not support natural reproduction of salmonid populations due to limitations of flow, substrate composition, or other habitat conditions, but salmonid population may be maintained year-round if periodically stocked.

16.3 FEDERAL AND STATE PROTECTED WILDLIFE SPECIES

Numerous surveys for federally- and state-listed threatened and endangered species have been conducted between 2008 and 2013, along those portions of the Preferred Route for which survey access permission has been granted. For those portions of the Preferred Route for which land access has not been granted, the potential occurrence of threatened and endangered species and suitable habitat for these species has been evaluated from a review of aerial photography, species occurrence locations supplied by the Nebraska Heritage Program, and habitat requirements for each species. Species specific presence and absence surveys will be conducted as required by federal and state agencies within the suitable habitats along the Preferred Route prior to ground disturbance activities.

The USFWS's 2013 Biological Opinion evaluated federally-listed wildlife species that occur in Nebraska: American burying beetle, interior least tern, piping plover, whooping crane, and pallid sturgeon. The Biological Opinion concluded that the construction and operation of the proposed Project may affect, and is likely to adversely affect the American burying beetle. The USFWS concluded that the proposed Project may affect, but is not likely to adversely affect the other species considered in the Biological Opinion. The Topeka shiner is also listed as a federally endangered species but was not included in the Biological Opinion as the USFWS acknowledged the no effect determination provided in the December 12, 2012 Biological Assessment submitted to the USFWS by the DOS.

16.3.1 Federally-Listed Species

16.3.1.1 American Burying Beetle

The American burying beetle is a type of carrion beetle that is federally-listed as endangered. Surveys for the American burying beetle occurred in suitable habitat along the Preferred Route in Antelope, Holt, Keya Paha, and Boyd counties in Nebraska during the summer of 2012. The surveys identified low numbers of American burying beetles in Holt and Keya Paha counties, and none in Antelope and Boyd counties. Although data from the NGPC indicates that approximately 101 miles of the Preferred Route crosses through the range for the American burying beetle, field surveys identified approximately 58 miles of potential beetle habitat along the route. The 58 miles of potential habitat includes prime, good, and fair habitat quality categories and excludes potential habitat that was classified as marginal or poor. The USFWS's 2013 Biological Opinion estimated that there are approximately 47 miles of suitable habitat (habitat rankings of prime, good or fair) where American burying beetles may occur in Nebraska. The small discrepancy between the current calculation of potential suitable American burying beetle habitat and the impact calculation of the Biological Opinion is due to minor route adjustments that have been made since the issuance of the Biological Opinion and the subsequent evaluation and ground trothing of the potential American burying beetle habitat along the Preferred Route.

In the Biological Opinion, the USFWS concurred with the determination that the Project may affect and is likely to adversely affect the American Burying Beetle.

Construction and Operations Impacts

Construction activities will result in a variety of temporary and permanent effects to the American burying beetle and its habitat. If construction occurs during periods when American burying beetles are active, movement of vehicles, especially heavy equipment, and other human activities in the right-of-way could cause mortality or injury of adult beetles and larvae through soil compaction. Construction activities such as clearing and grubbing of trees and shrubs, vegetation removal, grading, removal and stockpiling of topsoil, trenching, pipe laying, soil backfilling and compaction, and final grading and reclamation activities will occur in the pipeline right-of-way. These construction activities will result in temporary habitat loss, temporary habitat fragmentation, and/or alteration of suitable American burying beetle habitat. The extent of habitat loss will depend on the time necessary to successfully restore affected grassland habitats after project construction. Construction activities will also likely cause direct injury or mortality of American burying beetle adults, larvae, and eggs by crushing or exposure during soil excavation that would lead to desiccation.

Artificial lighting has the potential to disrupt foraging and increase predation on the American burying beetle. Most construction activities will take place during daylight hours and construction areas will not generally use artificial lighting. However, activities that could potentially require lighting could include pipeline tie-ins, HDD crossings, and certain work required after sunset due to weather, safety or other project requirements. HDD crossings will require 24-hour operation until the crossing is completed. Localized fuel spills from construction equipment may occur and could cause direct beetle mortality or the short term contamination of suitable habitat. Keystone's planned methods to minimize or mitigate potential impacts of the pipeline to land areas and connected natural resources in Nebraska are described in Section 9.0, and include the SPCC Plan which will be implemented to avoid or minimize the potential for spills and leaks from equipment during construction.

Routine operation potentially could affect American burying beetles and their habitat. Modeled heat dissipation from the pipeline indicates potential seasonal thermal effects on soil freezing rendering an area within about eleven feet from the pipeline unsuitable to serve as wintering habitat for the American burying beetle and will be considered a permanent habitat loss. It is possible that the impact extends beyond the 22-foot width, but eleven feet from the pipeline center was the maximum modeled distance that could be compared to background temperatures. Therefore, permanent impacts to American burying beetle habitat from operation of the pipeline include the central 22-foot width affected by the heat generated during pipeline operation within suitable habitat along the Preferred Route in Keya Paha, Boyd, and Holt counties. Lights associated with operation and security of pump stations may have an adverse effect to American burying beetles. However, minimal lighting will be used at pump stations and those lights will be sodium vapor-type and down-shielded in areas within the range of American burying beetles.

The construction of the O'Neil pump station will result in the permanent loss of approximately 15 acres of marginal habitat for the American burying beetle. This lost habitat will constitute a very small percentage of available habitat within Nebraska and will be mitigated by the terms of the 2013 USFWS Biological Opinion for the proposed Project.

16.3.1.2 Interior Least Tern and Piping Plover

The Interior least tern is a federally-listed endangered migratory shorebird species and the piping plover is a federally-listed threatened migratory shorebird species. Surveys for the interior least tern and piping plover were conducted along the Preferred Route during the spring and summer of 2012. The surveys identified approximately one mile of suitable habitat near the Platte River. The two species are known to nest within or near the Preferred Route at the crossings of the Platte, Loup, and Niobrara rivers. The USFWS's 2013 Biological Opinion determined that the Project may affect, but is not likely to adversely affect the interior least tern and piping plover.

Construction and Operations Impacts

The construction of the Preferred Route could result in similar impacts to the interior least tern and piping plover. No direct impacts to breeding habitat of either species are anticipated at the river crossing location, since pipeline placement across the rivers will be completed by the HDD method. Minimal hand clearing of vegetation and limited human access will be required within the riparian areas of these rivers in association with the drilling equipment movement and in order for equipment to access the rivers to potentially withdraw water for the Project's HDD and hydrostatic tests. Any vegetation disturbance adjacent to suitable riverine habitat will be allowed to completely revegetate following construction. Temporary indirect impacts could result from increased noise and human presence at work site locations if breeding terns or plovers are located within 0.25 miles of the proposed Project construction.

If operation activities (e.g., maintenance or repair) are required within or directly adjacent to the Preferred Route's crossing of the Platte, Loup, or Niobrara rivers, then short-term impacts similar to those describe for construction could occur to the interior least tern or piping plover if they were present.

16.3.1.3 Whooping Crane

The whooping crane is a federally-listed endangered migratory bird species that may occur along the Preferred Route during its spring or fall migration. Based on the current migration pathway of this species, potential occurrence within or near the project area could occur but will be extremely rare and will be limited to a few individuals or small groups of migrant birds (CWS and USFWS 2007). The USFWS's 2013 Biological Opinion determined that the proposed Project may affect, but is not likely to adversely affect the whooping crane.

Construction and Operation Impacts

No direct impacts to the whooping crane are anticipated from the construction of the Preferred Route. Suitable roosting and/or foraging habitats occur within the Preferred Route at major river crossings including the Niobrara River, Loup River, and Platte River. Habitats at these rivers will be crossed by HDD, so potential habitat loss, alteration, or fragmentation will be negligible. Minimal hand clearing of vegetation and limited human access will be required within the riparian areas of these rivers in association with the drilling equipment and in order for equipment to access these rivers to potentially withdraw water for the Preferred Route's HDD and hydrostatic tests. Any vegetation disturbance adjacent to suitable riverine habitat will be allowed to completely revegetate following construction and will therefore only be a short-term loss of migratory habitat.

Temporary indirect impacts could result from migrating individuals being disturbed and displaced due to noise and human presence during construction, if construction occurs during spring or fall migration.

Normal operation of the pipeline is not expected to affect the whooping crane or habitats used during migration. Pipeline right-of-way inspections will involve routine low-level aerial over-flights 26 times per year at intervals not to exceed every three weeks and/or ground based inspections once per year. Over-flights during migration periods will have the potential to disturb migrating whooping cranes. Over-flights will normally occur during late-morning or mid-day at an altitude of approximately 1,000 feet, although over-flights could occur at any time of day, and will be unlikely to disturb roosting or foraging cranes. Maintenance inspections that will require external examination of the pipeline will be unlikely to coincide with crane roosting or foraging habitats but will have the potential to disturb migrant cranes.

16.3.1.4 Pallid Sturgeon

The pallid sturgeon is a federally-listed endangered species that is known to occur in the lower Platte River. No habitat for the pallid sturgeon exists at the Preferred Route's crossing of the Platte River. The USFWS's 2013 Biological Opinion did not specifically assess the potential indirect effects of the proposed Project on the pallid sturgeon in the Platte River system; however, it did conclude that the proposed Project may affect, but is not likely to adversely affect the pallid sturgeon.

Construction and Operation Impacts

No direct impacts to the pallid sturgeon are anticipated from the construction of the proposed Project because the Preferred Route would not cross any waterbodies at locations with known habitat for the sturgeon. Though the pallid sturgeon is known to exist in the lower Platte River downstream of the Preferred Route, it is unlikely that the proposed Project would have adverse indirect affects since the Platte River will be crossed via HDD and measures would be implemented to ensure that water withdrawals from the river for hydrostatic testing would be at a rate less than ten percent the daily flow and returned to the source within 30 days of the withdrawal. It is not anticipated that operations would have adverse impacts to the pallid sturgeon.

16.3.1.5 Northern Long-eared Bat

The northern long-eared bat occurs in eastern Nebraska along the Preferred Route (Bat Conservation International 2012). Surveys for the northern long-eared bat were conducted along the Preferred Route during the spring and summer of 2012. Although data from the NGPC indicates that the entire Preferred Route crosses through the range of the northern long-eared bat, field surveys identified only approximately 5.6 miles of suitable habitat.

Construction and Operations Impacts

The northern long-eared bat may be impacted by construction or operations of the Preferred Route. Summer or winter roosts may occur in the proposed Project area. Bats flying over the pipeline route are expected to avoid the ground-based construction and operation activities. Keystone will use the HDD method to cross major and sensitive rivers, thereby avoiding most riparian vegetation used by the northern long-eared bat. Operational impacts, if any, would be limited to the small areas where maintenance and repair activities that overlap with suitable habitat for the northern long-eared bat species.

16.3.1.6 Red Knot

The red knot was listed by the USFWS as federally threatened on December 11, 2014.

Construction and Operation Impacts

There is no breeding or wintering habitat for the red knot along any portion of the proposed Project. Most red knot migrate along the eastern shoreline of the US, feeding on mollusks and softer invertebrate prey. The primary locations for these types of food sources are coastal marine and estuarine habitats with exposed intertidal sediment, sand, gravel, or cobble beaches, tidal mudflats, salt marshes, shallow coastal impoundments and lagoons.

Coastal shoreline stop-over habitat does not occur on any portion of the proposed Project, consequently there are relatively few records of red knot in states associated with the proposed Project. The Central Flyway Council (CFC) summarized sightings of red knot in Montana, North Dakota, South Dakota, Nebraska, and Kansas in a letter to the USFWS in November of 2013 (CFC 2013). Based on that summary, there are only 15 records of occurrence of red knot in Nebraska over approximately the last 100 years (CFC 2013).

The lack of consistent records of red knot along the proposed Project is due to the paucity of suitable stop-over habitat (e.g., lack of beaches, mudflats, or shallow impoundments where mollusks may be consistently available). Based on this assessment as well as the USFWS' description of red knot migratory habitat and locations (USFWS 2013), it is unlikely that inland stop-over habitat is common along the Preferred Route.

16.3.2 State-listed Species

The federally-listed threatened or endangered species described in the previous sections are also listed as either state threatened or endangered species and are not further discussed below. In addition to these species, there are five other state-listed threatened or endangered species that have been identified as potentially occurring along the Preferred Route: river otter, massasauga rattlesnake, northern redbelly dace, blacknose shiner, and finescale dace.

16.3.2.1 River Otter

There is the potential for river otters to occur at the major river crossings in Nebraska, Niobrara River, Loup River, Cedar River and the Platte River. During June 2013, surveys were conducted at the crossing of the Elkhorn River and the Platte River for river otter and their denning habitat. No river otters were observed during the survey, but approximately 1.5 total miles of suitable habitat was determined to be present at both crossings.

Construction and Operations Impacts

The use of HDD and additional conservation measures from the NGPC will minimize potential impacts to the river otter during construction. Construction-related noise could disturb denning otters; however, noise impacts would be temporary, ceasing once construction and reclamation are complete. Hydrostatic testing of the pipeline could cause short-term indirect impacts on this species. Decreased flows could limit individual ability to seek and find still-accessible deeper water or alternative tributaries, streams, or rivers. Operational impacts will be limited to the small areas where maintenance and repair activities will overlap with suitable habitat for the river otter.

16.3.2.2 Massasauga Rattlesnake

Suitable habitat for the massasauga rattlesnake, or pygmy rattlesnake, occurs along waterbody shorelines along the Preferred Route within Jefferson County.

Construction and Operations Impacts

Potential impacts to the massasauga rattlesnake resulting from construction and operation will be the same as those described in Section 16.1.5 for reptiles and amphibians. Operational impacts will be limited to the small areas where maintenance and repair activities occur that overlap with suitable habitat for the massasauga rattlesnake.

16.3.2.3 State-listed Minnow Species

The northern redbelly dace, blacknose shiner, and finescale dace are state protected minnow species that have the potential to occur within the tributaries of the Niobrara River and main stem of the Elkhorn River in Nebraska. During May 2013, fish surveys were conducted at a total of three streams, which are tributaries of either the Keya Paha or Niobrara River. The three streams were Wolf Creek, Spotted Tail Creek, and Big Creek (Big Creek was dry at the time of the survey). There were no observations of the any of the state-listed minnow species during the surveys, and it was concluded that the sampling locations did not provide suitable habitat to support any of the state-listed minnow species. Due to the lack of survey access permission, the potential habitat at the crossings of Alkali, Beaver, and Big Sandy creeks was not evaluated in the field but will be surveyed prior to the initiation of construction.

Construction and Operations Impacts

Potential impacts to the three state-listed minnow species resulting from construction will be similar to those described in Section 16.2 for aquatic resources.

Operation of the proposed Project will likely have minimal to no impacts to the three minnow species along the Preferred Route. If operations activities (e.g., maintenance and repairs) are required within or

directly adjacent to suitable habitat for the three minnow species, there is potential for increased siltation and turbidity that could temporarily displace these fish.

16.3.3 References

Bat Conservation International. 2014. BCI Species Profiles –*Myotis septentrionalis*. Website: http://www.batcon.org/index.php/all-about-bats/species-profiles.html?task=detail&species=2306&country=43&state=all&family=all&start=20. Accessed April 3, 2014.

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USFWS. 2007. National Bald Eagle Management Guidelines. May 2007. 25 pp.

17.0 EVIDENCE REGARDING THE IMPACT OF THE PIPELINE ON PLANTS LOCATED WITHIN AND SURROUNDING THE PROPOSED ROUTE (SUBSECTION 023.007B5)

17.1 VEGETATION TYPES

The types of vegetation that occur along the Preferred Route have been identified and delineated through the combination of a literature review, internet database resources, aerial photography interpretation, general observations made during field reconnaissance, habitat surveys, and during wetland delineation activities. The vegetation community types crossed by the Preferred Route include cropland (agriculture), previously disturbed, grassland/rangeland, upland forest, and wetland/riparian areas. The grasslands/rangelands vegetation community type in the Preferred Route can be sub-divided into tall grass prairie and mixed grass prairie. A summary of the vegetation communities crossed is presented in Table 17-1, and a summary of vegetation communities of conservation concern crossed is provided in Table 17-2.

Table 17-1. Miles of Vegetation Communities Crossed by the Preferred Route									
Nebraska	Vegetation Communities Crossed (miles)								
	Agriculture	Previously Disturbed	Grassland/ Rangeland	Upland Forest	Riverine/Open Water	Palustrine Forested Wetlands	Palustrine Emergent Wetlands	Scrub-Shrub Wetlands	Route Total
Total	212.0	4.6	52.0	3.9	1.4	0.6	0.7	0.05	275.2

Table 17-2. Estimated Impacts to Vegetation Communities of Conservation Concern Occurring Along the Preferred Route		
Community Type	**Length (miles)[1]**	**Number of Locations Crossed**
Deciduous forests and woods	3.6	73
Native grasslands	41.5	84
Riparian woodlands	1.4	4
[1]Approximate mileage. Note that community types may overlap. Source: Westech, 2013		

Construction and Operations Impacts

Clearing and grading activities will remove the existing vegetation within the 110-foot construction right-of-way.

Most of the vegetation impacts within the Preferred Route during construction will be temporary and short-term since the majority of the route crosses agricultural land. There will be approximately 2,650 acres of agricultural land disturbed along the construction right-of-way for the Preferred Route. Impacts to annually tilled croplands generally will be short term and limited to the current growing season if topsoil is segregated and not compacted during construction. Impacts to pastures, rotated croplands, and open grassland range generally will be short term, with vegetation typically reestablishing within one to five years after construction.

Typically, shortgrass prairie and mixed-grass prairie areas may take five years or more to reestablish if there are poor soil conditions and low moisture levels. Construction through native grasslands could expose the fragile soils to erosion by wind and water which could contribute to the extended duration of restoration efforts. There will be approximately 1,161 acres of grassland/herbaceous vegetation disturbed along the construction right-of-way for the Preferred Route. Of the 1,161, acres, 486 will be permanently lost with the installation of the above-ground facilities.

Clearing trees within upland and riparian forest communities will result in long-term impacts to these vegetation communities: five years or more are needed for the community to mature to pre-construction conditions. Permanent impacts will occur within the 50-foot-wide permanent (operations) easement centered on the pipeline. There will be approximately 49 acres of upland and riparian forest disturbed along the construction right-of-way for the Preferred Route.

After removal of vegetation cover and disturbance to the soil, reestablishment of native vegetation communities could be delayed or prevented by infestations of noxious weeds and invasive plants. Vegetation removal and soil disturbance during construction could create optimal conditions for the establishment of noxious weeds. Construction equipment traveling from weed-infested areas into weed-free areas could disperse noxious weed seeds or propagules (such as buds or spores); resulting in the establishment of noxious weeds in previously weed-free areas. To limit the potential for the spread of noxious weeds, construction equipment will be cleaned upon completion of work in weed-infested areas.

When construction is complete, the construction right-of-way will be restored and returned to equivalent productive capability. The objectives of reclamation and revegetation are to return the disturbed areas to approximate pre-construction vegetation, use, and capability. However, approximately 23 acres of woodland and forested habitat within the 50-foot-wide permanent easement will not be allowed to reestablish due to periodic mowing and brush clearing during pipeline operation. Mowing and brush clearing over the pipeline would be conducted so that the pipeline can be inspected by aerial surveillance in accordance with PHMSA regulations. During operations, temporary habitat loss may occur in the small areas where maintenance and repair activities occur.

Additionally, construction of the permanent aboveground facilities (e.g., pump stations and mainline valve sites) will result in the permanent loss of approximately 64 acres of undeveloped habitat, predominantly agricultural land.

Ground disturbance activities as a result of operational maintenance activities may impact the vegetation communities through the introduction or spreading of noxious weeds similar to those impacts described for construction.

17.2 BIOLOGICALLY UNIQUE LANDSCAPES OR ECOREGIONS

17.2.1 Rainwater Basin

The Rainwater Basin Complex (RWBC) is scattered throughout a 21-county area in south central Nebraska (see Figure 17.2-1). Originally this complex covered a much larger area, but now only about ten percent (about 4,200 square miles) of the originally mapped RWBC has not been drained or filled for farmland. Most of the RWBC is now privately owned farmland. The NGPC and the USFWS administer the remainder of the RWBC for public use.

The topography in this basin is flat to gently rolling with a poorly developed surface water drainage system that allows many of the watersheds to drain into low lying wetlands (NGPC 2014). The wetlands are shallow, ephemeral depressions that flood quickly during heavy rainstorms and snow melts due to a relatively impervious clay layer lining the depression (USDOI 2005).

A desktop analysis of the Preferred Route in the RWBC of Nebraska was conducted to determine if any wetlands along the Preferred Route will qualify as traditional, historic Rainwater Basin wetlands. Using guidance provided by the NDEQ, Keystone studied the soil types crossed by the Preferred Route in the RWBC to determine whether hydric (wetland) soils and hydrophytic vegetation (wetland vegetation), the hallmarks of traditional, historic Rainwater Basin wetlands, were present. The desk top study determined that the Preferred Route crosses several small areas of hydric soils but that all but one had been converted to agricultural use and no longer exhibited hydrophytic vegetation. The single wetland exhibiting hydrophytic vegetation appears to have been highly altered and modified by past agricultural activities such that it currently resembles a large pond rather than a natural, historic rainwater basin

wetland. Results of the analysis concluded that the Preferred Route does not cross any intact traditional, historic rainwater basin wetlands.

Construction and Operations Impacts

There will be no impacts to RWBC wetlands resulting from construction or operation due to the absence of any RWBC wetlands along the Preferred Route.

17.2.2 Native Grasslands

The Preferred Route would cross through the unique Verdigris-Bazile landscape in northeastern Nebraska. This area consists primarily of a mosaic of cropland, restored native grasslands, native tallgrass and mixed-grass prairie, and exotic cool season grasslands (Nebraska Natural Legacy Project 2012). Native grassland types identified along the Preferred Route are included in Table17-3.

Table 17-3. Native Grassland Types Along the Preferred Route

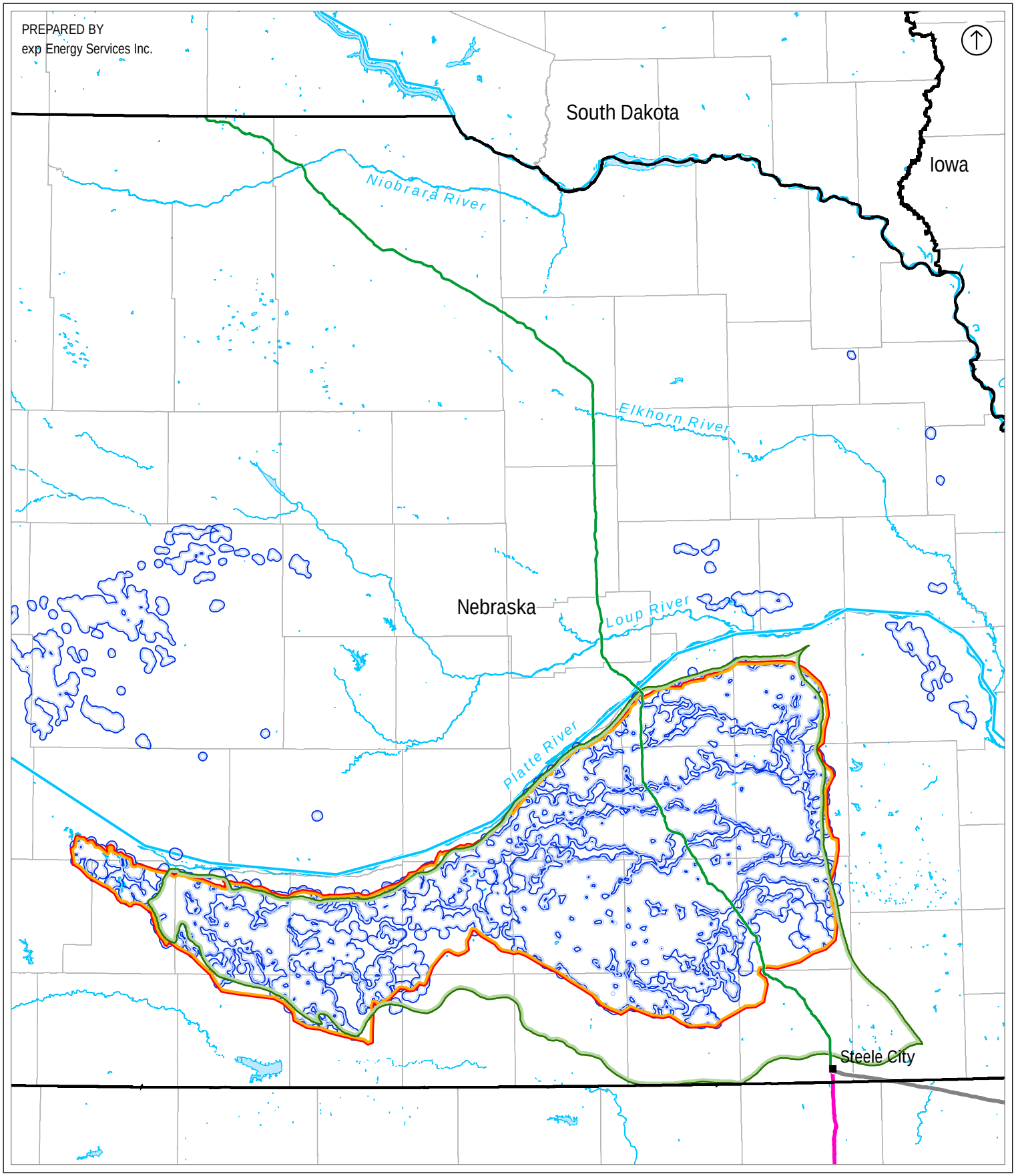
Grassland Type	Miles Crossed
Mixed Grassland	20.2
Sandy Prairie	17.9
Tall Grassland	3.4

Source: Westech, 2013

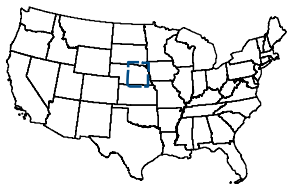
Construction and Operations Impacts

Construction effects on previously untilled native grasslands could be long term, since soils that support native grasses would not regenerate quickly. However, permanent impacts are not anticipated. To promote the recovery of native grasslands, the existing seed-bank and propagules would be conserved in the separated topsoil which would be handled in a manner that would minimize admixing and loss of organic matter. Topsoil would be restored to pre-existing depths and contours following construction. Areas of native grasslands along the construction right-of-way will be restored using construction and reclamation practices specifically designed for native grasslands in Nebraska.

During operations, the permanent right-of-way would be mowed periodically as part of easement maintenance. Clearing of the permanent right-of-way would be conducted so that the pipeline can be inspected by aerial surveillance in accordance with PHMSA regulations.



VICINITY MAP



LEGEND

- PREFERRED ROUTE
- KEYSTONE MAINLINE (PHASE I)
- KEYSTONE CUSHING EXTENSION (PHASE II)
- NE PLAYA - RAINWATER BASIN / CLUSTERS
- USFWS - RAINWATER BASIN
- EPA - RAINWATER BASIN
- STATE BOUNDARY
- COUNTY BOUNDARY

0 15 30 60 Miles

KEYSTONE XL PROJECT

FIGURE 17.2-1

RAINWATER BASIN

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17.3 SENSITIVE, RARE, THREATENED, AND ENDANGERED PLANT SPECIES

Two special status plant species were identified as having the potential to occur along the Preferred Route. The two species are the western prairie fringed orchid, a federally-listed threatened species, and the small white lady's slipper, a state-listed threatened species.

As part of the ESA Section 7 consultation with USFWS, Keystone engaged with NGPC regarding federal and state special status species that may be impacted by the proposed Project. Though NGPC does not permit "take" of a state-listed threatened or endangered species, the NGPC has acknowledged that the National Environmental Policy Act (NEPA) review and the formal Section 7 consultation process accommodates the State consultation process (Section 37-807(3) of the Nebraska Revised Statue) and the mitigation measures mandated by the USFWS's 2013 Biological Opinion and the 2014 DOS FSEIS for the proposed Project are sufficient to minimize the potential impacts to the two plant species.

17.3.1 Western Prairie Fringed Orchid

The western prairie fringed orchid is a federally-listed threatened species and its potential range along the Preferred Route includes Holt, Antelope, and Boone counties. No western prairie fringed orchids were identified during the 2012 field surveys for the species, although 0.4 miles of suitable habitat was present. Other areas of potentially suitable habitat were not surveyed due to lack of survey access permission. Prior to the initiation of ground disturbance activities, presence/absence surveys will be conducted within suitable habitat along the Preferred Route.

Construction and Operations Impacts

The USFWS's 2013 Biological Opinion regarding potential impacts to the western prairie fringed orchid by the proposed Project concluded that the construction and operation of the Preferred Route may affect, but is not likely to adversely affect, the species. Construction could potentially disturb western prairie fringed orchids when vegetation is cleared and graded. Revegetation of the proposed pipeline right-of-way could introduce or expand invasive species, especially leafy spurge, Kentucky bluegrass, and Canada thistle into the disturbed areas along the Preferred Route, potentially contributing to the decline of western prairie fringed orchid. The species could be impacted through disturbance to its habitat. Additional measures to mitigate potential impacts are identified in the USFWS's 2013 Biological Opinion. Potential operational impacts to the western prairie fringed orchid will be limited to only those areas of suitable habitat where maintenance and repair activities occur.

17.3.2 Small White Lady's Slipper

The small white lady's slipper is a state-listed threatened species that could be present in the major drainage crossings/floodplains along the Preferred Route. Surveys will be conducted for presence/absence within suitable habitat prior to the proposed Project construction in Antelope, Boyd, Holt, Keya Paha, Nance, and Merrick counties in Nebraska.

Construction and Operations Impacts

If this plant is present during construction within the proposed Project construction right-of-way in Nebraska, appropriate mitigation measures would be developed and implemented in consultation with the NGPC. Potential operational impacts to the small white lady's slipper will be limited to only those areas of suitable habitat where maintenance and repair activities occur.

17.4 NOXIOUS AND INVASIVE WEEDS

When intact soils and vegetation communities are disturbed, there is a greater potential for noxious and invasive weeds to spread into the area. The presence or introduction of noxious weeds could result in short-term impacts during construction and operation activities similar to those impacts previously described in Subsections 17.1 through 17.3.

Keystone has completed the majority of pre-construction noxious weed surveys and mapped state- and county-listed noxious weed populations that occur along the Preferred Route. Prior to construction, noxious weed surveys will be completed, and any additional recorded occurrences will be added to Attachment B of the Noxious Weed Management Plan and included in Project mapping. Table 17-4 provides a list of the noxious weeds identified to date along the Preferred Route.

Table 17-4. Noxious Weeds Found Along the Preferred Route.

Common Names	Crossing Length (miles)
Canada thistle	0.10
Leafy spurge	0.62
Leafy spurge/Spotted knapweed	0.05
Musk thistle	2.14
Musk thistle/Canada thistle	0.42
Musk thistle/Leafy spurge	0.25
Purple Loosestrife	0.02
Spotted knapweed	0.51
Spotted knapweed/Musk thistle	0.23

Source: Westech, 2013

17.5 REFERENCES

NGPC. 2014. Nebraska's Rainwater Basin. Website: http://outdoornebraska.ne.gov/conservation/wildlife-viewing/Birds/basin.asp. Accessed on April 17, 2014.

US Department of the Interior. 2014. Chapter 19: The Rainwater Basin of Nebraska. Website: http://www.doi.gov/pmb/oepc/wetlands2/v2ch19.cfm. Accessed on April 17, 2014.

18.0 EVIDENCE OF METHODS TO MINIMIZE OR MITIGATE THE POTENTIAL IMPACTS OF THE MAJOR OIL PIPELINE TO NATURAL RESOURCES (SUBSECTION 023.007C)

The following list of planned methods and environmental documents contain specific best management practices and mitigation measures that minimize or mitigate the potential impacts to the wildlife and plant resources that are discussed in Sections 16.0 and 17.0.

Planned Methods

- Environmental Training and Awareness (Section 9.3)
- Environmental Inspector Training (Section 9.4)
- Commitment Management (Section 9.5)
- Construction Mitigation, and Reclamation Plan (Section 9.6)
- Construction/Reclamation (Con/Rec) Planning (Section 9.7)
- Permit Compliance (Section 9.8)
- Horizontal Directional Drill (HDD; Section 9.9)
- Hydrostatic Test Plan (Section 9.10)

- Spill Prevention Control and Countermeasure Plan (Section 9.11)
- Noxious and Invasive Weeds (Section 9.12)
- 2013 Biological Opinion (discussed below)
- 2014 DOS FSEIS (discussed below)

The following two environmental documents (Biological Opinion and FSEIS) include mitigation measures that address the potential impacts that may occur to wildlife and plant resources.

18.1 BIOLOGICAL OPINION

On May 15, 2013, USFWS issued a Biological Opinion addressing the effects to threatened and endangered wildlife and plant species from the construction, operation, and maintenance of the proposed Project. The development of the Biological Opinion was a collaborative process that included input from local, state, and federal agencies, subject matter experts, and Keystone. In the document, the USFWS provides mitigation measures to be implemented that will minimize and mitigate potential impacts to federally-listed threatened and endangered species under the ESA of 1973, as amended. Mitigation measures include best management practices, species specific timing restrictions or buffer distances during construction activities, avoidance measures, project design constraints, and compensatory mitigation requirements.

USFWS's 2013 Biological Opinion concluded that the construction and operation of the proposed Project may affect, and is likely to adversely affect the American burying beetle and that the proposed Project may affect, but is not likely to adversely affect the other federally-listed species including the interior least tern, piping plover, whooping crane, pallid sturgeon, or western prairie fringed orchid. As part of the formal consultation process with USFWS under Section 7 of the ESA, the USFWS issued an incidental take statement authorizing the 'take' of the federally-listed American burying beetle. The statement also includes reasonable and prudent measures to minimize the take.

The Topeka shiner is also listed as a federally endangered species in Nebraska. In the Biological Opinion, the USFWS acknowledged the no effect determination provided in the December 12, 2012 Biological Assessment submitted to the USFWS by the DOS.

Subsequent to the USFWS issuance of the Biological Opinion, two additional species were listed as federally threatened that may be in the proposed Project area: the northern long-eared bat and the red knot.

Final Supplemental Environmental Impact Statement

The DOS issued the 2014 FSEIS for the proposed Project, which evaluated the potential impacts of the construction, operation, and maintenance of the proposed Project on the wildlife and plant species along the Preferred Route. During the development of the FSEIS, the DOS engaged pertinent federal, state, and local agencies, non-government organizations, subject matter experts, and the general public to develop a comprehensive evaluation of the potential impacts to wildlife and plant resources along the Preferred Route.

As part of the evaluation, the FSEIS presented measures that will minimize and mitigate the potential impacts to wildlife and plant species that occur or have the potential to occur along the Preferred Route. The mitigation measures include best management practices, species specific timing restrictions or buffer distances during construction activities, avoidance measures, project design constraints, and compensatory mitigation requirements. Within the FSEIS, mitigation measures for wildlife species were addressed in Sections 4.6, 4.7, 4.8, as well as in Section 7.0, 8.0, and 9.0 of Appendix Z of the FSEIS. Mitigation measures for plant species were addressed in Section 4.5 and Section 6.0 of Appendix Z of the FSEIS.

19.0 EVIDENCE REGARDING THE ECONOMIC AND SOCIAL IMPACTS OF THE MAJOR OIL PIPELINE (SUB-SUBSECTION 023.07D)

The socio-economic impact of the Project along the Preferred Route has been studied extensively. In addition to the analyses reflected in the FSEIS, Dr. Ernie Goss, the Jack McAllister Chair in Regional Economics and Professor of Economics at Creighton University, has specifically examined the impacts of the Project along the Preferred Route in Nebraska. A report containing results of that analysis is attached at Appendix H.

The conclusion of Dr. Goss' analysis is that, based upon spending data anticipated by Keystone, the construction of the Project along the Preferred Route will have a positive socio-economic impact on the State, including a positive impact on employment and tax revenue within the State. The following is a summary of the impact on the State from the report:

As reflected in Table 19-1, the positive impacts include state and local tax revenue in an amount estimated to exceed $260 million during the period of construction and the first 15 years of operations, which will positively affect Nebraska including counties along the Preferred Route. Additionally, Keystone's estimated spending as a result of construction and operations will have a very significant positive impact on overall economic activity in the State. This is reflected in increased spending for locally-supplied goods and services, which leads to further spending throughout the local economies. The Project, including the Preferred Route, is, therefore, clearly a positive to the State's economy and is in the public interest.

Table 19-1. Summary of the Impacts of Keystone XL on Nebraska, 2018-2034

	Construction	Operations	2018-34
Sales/output	$890,995,940	$1,236,688,436	$2,127,684,376
Jobs (average per year)	3,397.2	371.7	727.6
Labor income	$326,558,356	$415,471,634	$742,029,990
State & local taxes	$43,538,660	$221,240,614	$264,779,274

Source: IMPLAN Multiplier System

20.0 WHETHER ANY OTHER UTILITY CORRIDOR EXISTS THAT COULD FEASIBLY AND BENEFICIALLY BE USED FOR THE ROUTE OF THE MAJOR OIL PIPELINE (SUBSECTION 023.07E)

As part of the routing process Keystone evaluated co-location opportunities including other utility corridors that could feasibly and beneficially be used for the routing of the Project between the fixed start and end points identified in Subsection 2.2. Table 20-1 summarizes the types and lengths of co-location opportunities utilized in the development of the Preferred Route and the two proposed alternatives.

Table 20-1. Identification of Co-location Opportunities For the Preferred Route and the Two Proposed Alternatives.	
Co-location Feature	**Length of Co-location (miles)**
Sandhills Alternative Route	
ROW (Pipeline)	7.8
Utility Corridors	0.3
Roads	1.5
Preferred Route	
ROW (Pipeline)	7.3
Utility Corridors	0.0
Roads	2.4
Keystone Mainline Alternative Route	
ROW (Pipeline)	95.6
Utility Corridors	3.3
Roads	13.0

The Preferred Route takes advantage of co-location with the existing Keystone Mainline pipeline for the final 7.3 miles on its approach to the Steele City pump station as well as other limited opportunities to co-locate with roads where feasible. No existing utility corridors are available for beneficial co-location.

The following discussion describes other major co-location options that were considered in the development of the Preferred Route and the Keystone Mainline Alternative Route but were determined not to be feasible or beneficial. These major co-location options are identified on Figure 20.0-1.

20.1 CO-LOCATION WITH THE ENTIRE EXISTING KEYSTONE MAINLINE

As part of the DOS analysis of Major Pipeline Route Alternatives described in the 2014 FSEIS, co-location with the entire existing Keystone Mainline pipeline system that enters Nebraska in Cedar County and runs through eastern Nebraska to Steele City, Jefferson County was considered.

Consideration of co-location with the entire Keystone Mainline as an alternative in this Application is not possible because the Mainline's point of entry into Nebraska is situated over 100 miles to the east of, and for practical purposes too far removed from, the existing fixed starting point of the Project: the approved pipeline entry location at the South Dakota–Nebraska border in Keya Paha County, Nebraska, north of Mills, Nebraska.

20.2 PREFERRED ROUTE

In developing the Preferred Route other major co-location opportunities were evaluated as follows:

i) Nebraska Public Power District (NPPD) transmission line (Knox and Antelope counties):

Co-location options between the Niobrara and Elkhorn Rivers up to 22.5 miles in length were evaluated along this NPPD 345 KV transmission line in Knox and Antelope Counties.

A significant portion of the segment considered for co-location in Knox County was found to be less preferable from a constructability standpoint due to large hills, side slopes and unstable soils which would require routing away from the existing transmission line infrastructure. The segment considered for co-location in Antelope County was found to present a reasonable option for pipeline construction.

However, the cross country pipeline route options approaching this transmission line from the northwest via Holt County were found to be less preferable from a constructability standpoint due to their proximity to the Niobrara River to the north resulting in:

- Areas with predominantly steep slopes and unstable soils; and
- Increased waterbody crossing widths, head cutting potential[8], and number of drainage crossings.

To avoid these conditions, the transmission line co-location alternatives and their associated cross country routes were rejected in favor of the Preferred Route located to the southwest of the transmission line.

ii) Cowboy Trail (Rock, Holt and Antelope counties):

The Cowboy Trail is a former rail line that has been converted to a recreational trail along a 195-mile path passing through 20 communities of varying sizes from west of Norfolk to Valentine, Nebraska. The trail was gifted to the State of Nebraska by the Rails to Trails Conservancy and accepted under state legislation. The Cowboy Trail is under the care of the NGPC in accordance with federal rail-banking statutes.

Keystone examined the use of the Cowboy Trail in Rock, Holt, and Antelope counties as a potential pipeline corridor and found it to be incompatible with the Keystone's goals and objectives for reasons including the following:

- The trail is located in the NDEQ Sandhills;
- The trail is required to be maintained in a state such that a rail line could be reactivated (National Trails System Act, 16 USC 1247(d));
- The trail is not contiguous; and
- The trail would need to be taken out of service during pipeline construction, and then disturbed periodically over the life of the pipeline for maintenance work.

20.3 KEYSTONE MAINLINE ALTERNATIVE ROUTE

The Keystone Mainline Alternative Route was developed to maximize the length of co-location with the existing Keystone Mainline pipeline system that runs through eastern Nebraska to the fixed end point at the Steele City pump station while at the same time maintaining the existing Project fixed starting point: the approved pipeline entry location at the South Dakota – Nebraska border in Keya Paha County as described in Section 2.1.

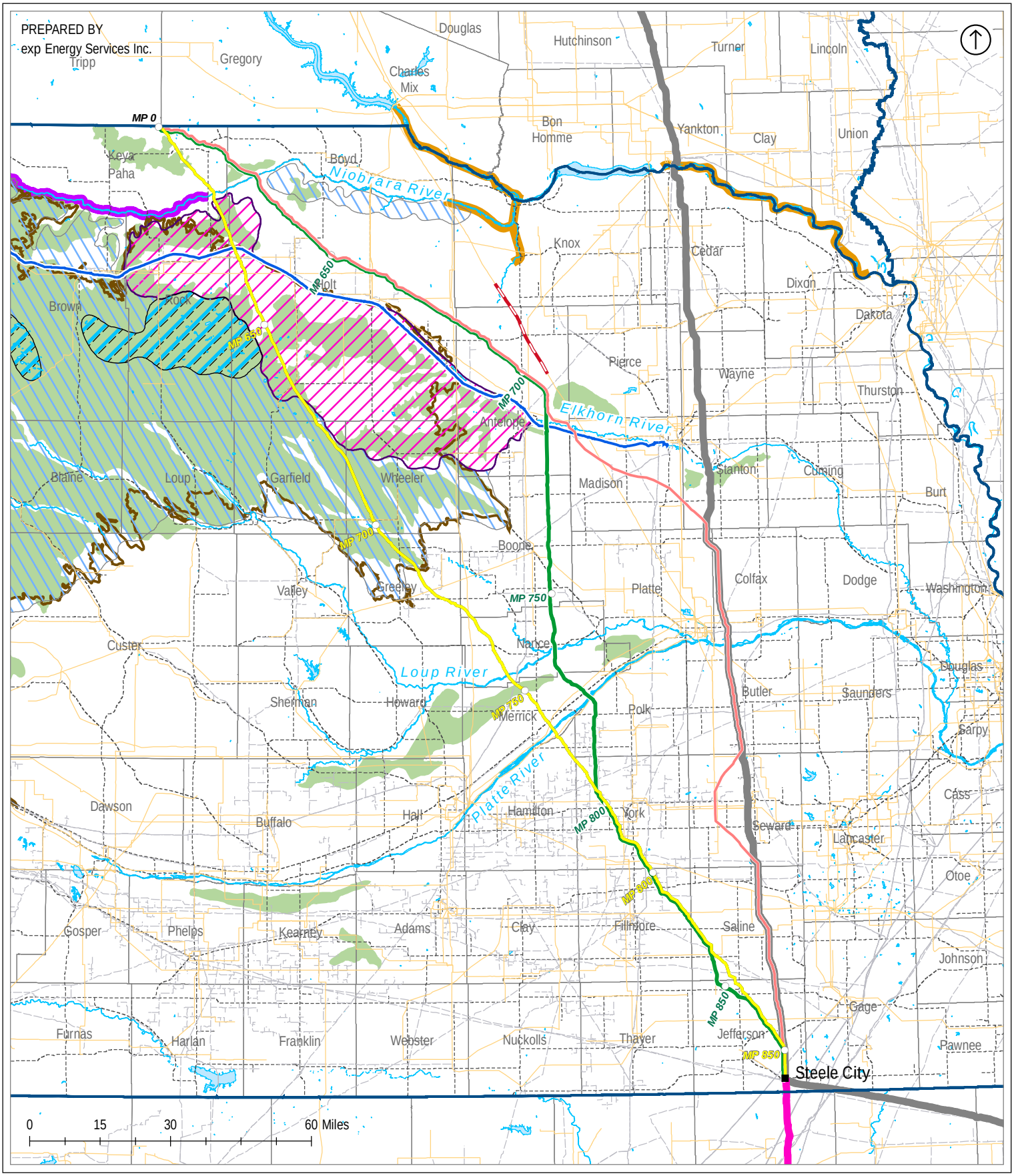
The Keystone Mainline Alternative Route is described in Section 2.1.3. As opposed to co-locating with utility corridors that could potentially be used as described below, the route of the approximate 43 mile cross-over between the Preferred Route and the Keystone Mainline, while not being co-located itself, enables the amount of co-location with the existing Keystone Mainline to be maximized. However, the benefits of co-locating with the Keystone Mainline are diminished due to the need for deviations described in subsection 2.1.3 where the potential length of co-location is reduced to 95.6 miles from 127.2 miles.

[8] Head cutting is an erosion condition where intermittent and perennial streams have an abrupt vertical drop in the streambed. Head cuts resemble small waterfalls or when not flowing, the head cut will resemble a very short cliff or bluff. A small plunge pool may be present at the base of the head cut due to high energy erosion at the base of the falls. Ground seeps and springs are sometimes found along the face, sides, or base of a head cut.

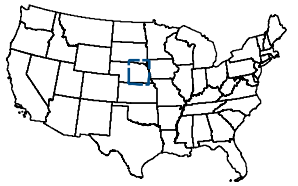
As compared to the Preferred Route, the Keystone Mainline Alternative Route would:

- Result in the need for an additional pump station and associated electric transmission lines as discussed in Section 2.1.4 due to the increase in the route length;
- Result in a greater total number of acres disturbed due to the increase in the route length;
- Increase the crossing of the ranges of federally-listed threatened and endangered species;
- Increase the crossing of highly erodible soils;
- Increase the crossing of ecological unusually sensitive areas; and
- Increase the number of crossings of perennial streams, railroads and total road crossings.

Potential benefits that may be afforded by co-locating with the Keystone Mainline are outweighed by the impacts associated with the necessary additional aboveground infrastructure (i.e., pump station and associated electrical transmission lines) and the additional considerations identified above. For these reasons, the Keystone Mainline Alternative Route is not considered beneficial nor is it preferable to the Preferred Route.



VICINITY MAP



LEGEND

- MISSOURI NATIONAL RECREATIONAL RIVER
- NIOBRARA NATIONAL SCENIC RIVER
- COWBOY TRAIL
- PIPELINE
- TRANSMISSION LINE
- TRANSMISSION LINE CONSIDERED FOR CO-LOCATION
- PREFERRED ROUTE
- SANDHILLS ALTERNATIVE ROUTE
- KEYSTONE MAINLINE ALTERNATIVE ROUTE
- KEYSTONE MAINLINE (PHASE I)
- KEYSTONE CUSHING EXTENSION (PHASE II)
- NDOR ROADS
- STATE BOUNDARY
- COUNTY BOUNDARY
- NEBRASKA SANDHILLS
- MAJOR LAND RESOURCE AREA - SANDHILLS
- TOPOGRAPHIC REGIONS SANDHILLS

ECOREGION 44

- LAKES AREAS
- SANDHILLS
- WET MEADOW AND MARSH PLAIN

KEYSTONE XL PROJECT

FIGURE 20.0-1

CO-LOCATION MAP

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21.0 THE IMPACT OF THE MAJOR OIL PIPELINE ON THE ORDERLY DEVELOPMENT OF THE AREA AROUND THE PROPOSED ROUTE OF THE MAJOR OIL PIPELINE (SUBSECTION 023.07F)

The construction and operation of the pipeline along the Preferred Route will be compatible with the predominant land use, which is rural agriculture. The pipeline will be buried to a depth of four feet in agricultural fields and will not interfere with normal agricultural operations, except during construction or pipeline maintenance activities. Keystone is working with landowners to identify individual irrigation system impacts prior to construction. Potential irrigation system impacts will be minor and will be managed in agreement with individual landowners regarding the details of both temporary and permanent system modifications and appropriate down times. Keystone has already come to agreement with the majority of the current land owners along the route regarding irrigation system considerations during and following construction.

The only aboveground facilities will be pump stations and IMLV sites located at intervals along the Preferred Route. The Preferred Route has been located away from existing rural residences and farmsteads to the extent possible, reducing the likelihood of interference with construction of future structures and installation of buried utilities.

Pump stations will be located in rural agricultural or pastureland/rangeland areas. The sites for the five pump stations have been purchased. Each pump station will consist of five pumps driven by approximately 6,500-horsepower electric motors. The pipe entering and exiting the pump station sites would be below grade. The manifold connecting the pipeline to the equipment at each pump station would be aboveground and located entirely within the pump station boundaries. The pump station site will be enclosed by a perimeter chain link fence approximately six feet high. The pump stations and IMLV will be located near existing county roads, which will minimize interference with agricultural operations on adjacent land and facilitate access by Keystone maintenance crews as needed.

The pump stations and IMLV will require electrical service provided by power lines constructed and operated by local power providers. Although the specific locations of electrical transmission lines will be determined by the local power providers, it is anticipated that these facilities will be located along county roads and along section lines to the extent practicable to minimize interference with existing farming operations. The routing of the electrical transmission lines will follow the routing criteria established by the NPPD. The poles and conductors will be similar to existing electrical service distribution lines of similar capacity that already parallel many section lines and township and county roads along the Preferred Route.

To minimize the potential impacts to neighboring properties from an increase in noise levels from the operation of the pump stations, Keystone will meet the Environmental Protection Agency (EPA) standard of 55 decibels on the A-weighted scale (dBA) day-night sound level measured at the nearest sensitive receptor.

Typically, existing utilities, including water lines, are crossed during pipeline construction. A minimum of twelve inches of separation will be maintained between the existing utility and the proposed pipeline while maintaining depth of cover requirements, as required by federal regulation, while the existing utility typically remains in operation.

The Preferred Route will be in proximity to five wind farm facilities (within 5 miles) that are either existing or under development:

- The Grand Prairie Wind Farm owned by Berkshire Hathaway Renewables in Holt County.
- The Prairie Breeze Wind Farm in Antelope, Boone and Madison Counties, owned by Invenergy LLC.
- The Petersburg Wind Farm operated by Gestamp Wind N.A. in Boone County.

- The Steele Flats Wind Farm in Jefferson and Gage counties owned by Next Era Energy Resources.

- The Laredo Ridge Wind Farm owned by NRG Energy Inc. in Boone County.

Keystone has entered into crossing agreements with the Prairie Breeze Wind Farm and the Petersburg Wind Farm to ensure the integrity of each facility is maintained. Keystone will work with the other wind farm facilities to enter into similar agreements.

The construction and operation of the pipeline along the Preferred Route will not unduly interfere with the orderly development of the region. Keystone has obtained extensive public and agency feedback on the Preferred Route and has worked with numerous stakeholders to adjust the route to ensure minimal impacts to development such as wind projects and areas of future potential population growth. Keystone has voluntarily acquired the necessary easements from approximately 90 percent of the landowners along the Preferred Route and has purchased the pump station sites in fee. This is indicative of the consistency of the Preferred Route with the orderly development of the area.

WHEREFORE, TransCanada Keystone Pipeline, LP requests an order from the PSC that the Preferred Route is in the public interest and that TransCanada Keystone Pipeline, LP is authorized to act pursuant to Neb. Rev. Stat. § 57-1101.

TransCanada Keystone Pipeline, LP

By: _____

James G. Powers, #17780
Patrick D. Pepper, #23228
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APPENDIX A – Governor's Letter, January 22, 2013

Dave Heineman
Governor

STATE OF NEBRASKA
OFFICE OF THE GOVERNOR
P.O. Box 94848 • Lincoln, Nebraska 68509-4848
Phone: (402) 471-2244 • dave.heineman@nebraska.gov

January 22, 2013

President Barack Obama
The White House
1600 Pennsylvania Avenue, NW
Washington, D.C. 20500

Secretary Hillary Rodham Clinton
U.S. Department of State
2201 C Street, NW
Washington, D.C. 20520

Dear President Obama and Secretary Clinton:

I am writing to you today to inform you that the State of Nebraska has completed its evaluation process of a proposed reroute of TransCanada's Keystone XL Pipeline project through the State of Nebraska. As you are aware, in 2011, I called the Nebraska Legislature into a special session to address the siting of a proposed pipeline. On November 22, 2011, I signed LB 1 and LB 4 into law. LB 1 adopted the Major Oil Pipeline Siting Act. LB 4 provided for state participation in a federal supplemental environmental impact statement review process for oil pipelines.

On January 18, 2012, TransCanada's Presidential Permit application was denied. The process established by LB 4 was on hold while we reviewed in detail what that meant for Nebraska. During the 2012 legislative session, the Legislature passed, and I signed into law, LB 1161, which allowed the Nebraska Department of Environmental Quality (NDEQ) to continue evaluating a proposed pipeline route. On April 18, 2012 TransCanada submitted proposed alternative routes to the NDEQ, and on May 24, 2012 the NDEQ entered into a Memorandum of Understanding with the U.S. Department of State to provide a framework for a timely collaborative environmental analysis of routes within Nebraska consistent with National Environmental Policy Act (NEPA), the National Historical Preservation Act, and all other relevant laws and regulations. On January 3, 2013, the NDEQ submitted the Final Evaluation Report on the proposed pipeline reroute to me for my review.

Pursuant to Neb. Rev. Stat. §57-1501, *et. seq.*, the NDEQ has evaluated a route for an oil pipeline within, through, or across the State of Nebraska submitted by a pipeline carrier for the stated purpose of being included in a federal agency's or agencies' NEPA review process; collaborated with a federal agency or agencies in a review under NEPA involving a supplemental environmental impact statement for oil pipeline projects within, through, or across the state;

contracted with HDR, inc. to assist in evaluating a proposed alternative route; solicited public comments over a seven month period, held five public information meetings, and one public hearing; and analyzed the environmental, economic, social, and other impacts associated with the proposed route and route alternatives in Nebraska.

The NDEQ's evaluation of the 194.5-mile-long proposed pipeline reroute has resulted in multiple findings. The following are major determinations from the Final Evaluation Report:

- The proposed Nebraska Reroute avoids the Sand Hills but would cross the High Plains Aquifer, including the Ogallala Group. Impacts on aquifers from a release should be localized and Keystone would be responsible for any cleanup.
- The proposed Nebraska Reroute avoids many areas of fragile soils in Northern Nebraska.
- The proposed Nebraska Reroute avoids a shallow groundwater area upgradient (west) of the boundary of the Clarks Wellhead Protection Area, where the aquifer is thin, wells are shallow, and bedrock is close to the surface.
- Affected agricultural operations could resume the season after the completion of construction.
- Construction of the pipeline would result in $418.1 million in economic benefits.
- The project would generate $16.5 million in use taxes from pipeline construction materials.
- Annual local property tax revenues, for the first full year of valuation, would be between $11 million and $13 million.
- Construction and operation of the proposed Keystone XL Pipeline, with the mitigation and commitments from Keystone would have minimal environmental impacts in Nebraska.
- Throughout NDEQ's evaluation process, the concerns of Nebraskans have had a major influence on the pipeline route, the mitigation commitments, and this evaluation.
- Keystone would be responsible for developing an Emergency Response Plan for a product release associated with the operation of the proposed Keystone XL Pipeline and ancillary facilities. In the event of a spill, appropriate authorities would have timely access to product characteristics.
- Keystone would have financial and regulatory responsibility for any spill associated with the proposed Keystone XL Pipeline.

As stated in the Final Evaluation Report, TransCanada has provided assurances to the State of Nebraska that the company would implement the following mitigation measures. These measures would include: developing an Emergency Response Plan for a crude oil release associated with the operation of the Keystone XL Pipeline and ancillary facilities; providing fast access to the product's Material Safety Data Sheet in the event of a release; providing, at landowner request, baseline water well testing prior to construction for domestic and livestock wells within 300 feet of the centerline of the route; providing for an independent public employee to act as a liaison

between Keystone and landowners, local communities, and residents to facilitate an open exchange of information; adhering to 57 special safety conditions, including more rigorous pipeline design, manufacturing, construction, records and reporting, testing, operational, and maintenance standards developed in coordination with the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration; and in the event of a release, Keystone would be responsible for all costs associated with state and federal cleanup requirements; and Keystone would provide evidence that it is carrying $200 million in third party liability insurance to cover cleanup costs for incidents in Nebraska.

I hereby, in accordance with Neb. Rev. Stat. §57-1503(4), approve the route reviewed in the Final Evaluation Report conducted pursuant to Neb. Rev. Stat. §57-1503(1). I request that Nebraska's evaluation be included in the Department of State's Supplemental Environmental Impact Statement. I appreciate your attention to this matter.

Sincerely,

Dave Heineman

Dave Heineman
Governor

Enclosure: Final Evaluation Report (disc)

APPENDIX B – NDEQ Press Release, December 29, 2011

PRESS RELEASE

from the Nebraska Department of Environmental Quality

For more information, contact
Brian McManus (402) 471-4223, or
Jim Bunstock (402) 471-4243

For Immediate Release
December 29, 2011

NDEQ Identifies Sandhills Regions to be Avoided in Alternative Pipeline Route

The Nebraska Department of Environmental Quality today announced the areas that it considers to be Nebraska Sandhills, based on an analysis of a variety of existing data. This information will be conveyed to TransCanada for their reference as the company develops a proposed new route for the Nebraska portion of the Keystone XL pipeline.

NDEQ Director Mike Linder said this was an important step resulting from legislation which was passed in November relating to the development of an alternative route that avoids the Nebraska Sandhills.

"Obviously, the applicant cannot propose the route without knowing the area to be avoided," Linder said. "NDEQ has been reviewing available information and has selected a map of ecoregions which was finalized in 2001 as best depicting the Sandhills region."

This map, titled "Ecoregions of Nebraska and Kansas" was a multi-year project involving numerous state and federal agencies, including: the U.S. Environmental Protection Agency, NDEQ, the U.S. Geological Survey, Nebraska Game and Parks Commission, and the U.S. Forest Service.

Attached is a map from NDEQ that shows an outline of the Sandhills region in Nebraska. The more comprehensive map that delineates a variety of ecoregions in both Nebraska and Kansas can be found on EPA's web site, at: ftp://ftp.epa.gov/wed/ecoregions/ks/ksne_eco_pg.pdf

This information is being conveyed to TransCanada today. TransCanada will consider this information as it develops an alternative route for the pipeline. When TransCanada submits alternative route information, NDEQ will move forward in the development of a Supplemental Environmental Impact Statement, which will consider a variety of potential environmental impacts.

NDEQ will provide opportunities for public participation during the process. Early in the process, the agency will conduct a series of information sessions to discuss what is being proposed and solicit public input. Later, when a draft Supplemental Environmental Impact Statement is developed, a formal public comment period will be held.

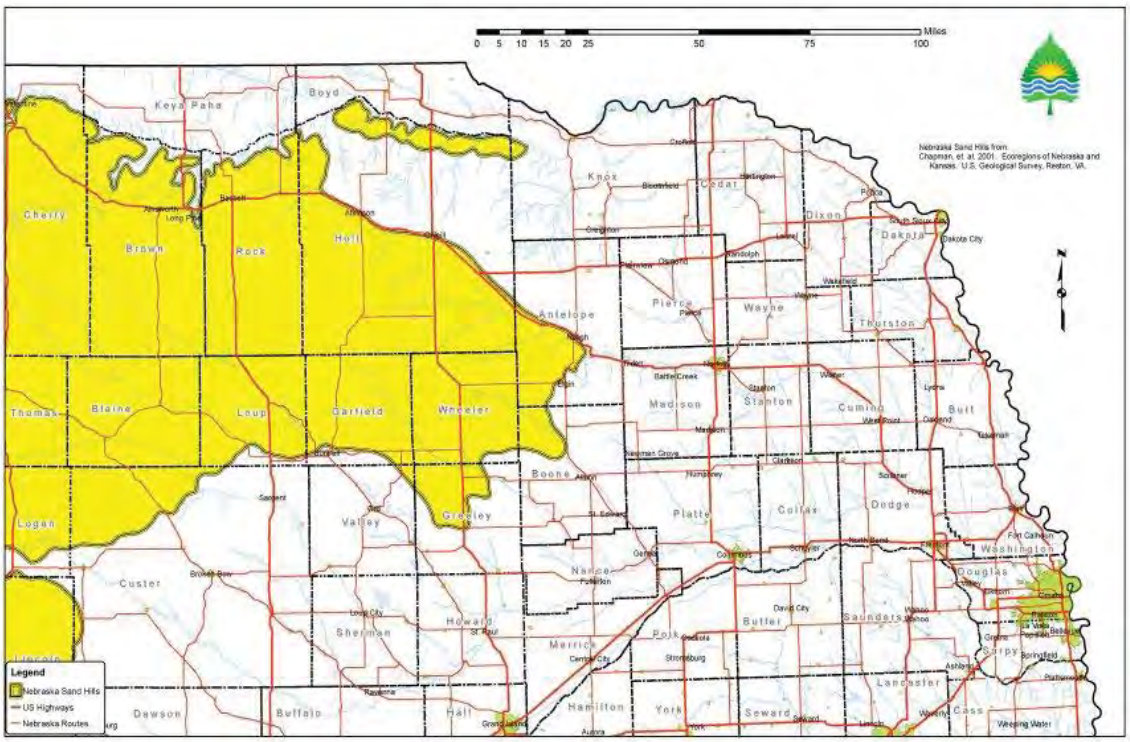
Information will continue to be updated on the agency web site. Go to www.deq.state.ne.us and select "NDEQ's Role in Pipeline Review" or follow the direct URL to: www.deq.state.ne.us/gen.nsf/Pages/Pipeline.

Questions and comments can be sent to a new NDEQ e-mail address: NDEQ.SEISpubliccomment@Nebraska.gov. An NDEQ pipeline telephone comment line has also been established at 1 (800) 295-8912.

Background on NDEQ's New Responsibilities

On November 22, 2011, Gov. Dave Heineman signed LB4 into law, which provides new responsibilities to NDEQ relating to supplemental environmental impact statements involving oil pipelines. The first application of the new law is the development of a supplemental environmental impact statement for the proposed TransCanada Keystone XL pipeline.

The legislation assigns NDEQ to work with the U.S. Department of State throughout the review. Negotiations continue with the U.S. Department of State to finalize a Memorandum of Understanding detailing how NDEQ's environmental review process will fit into the federal review process.



Maps of Sandhills Delineation	
Close-up perspective	Statewide perspective
FinalBase1M (2).pdf PDF Map File Size 1896 KB	FinalBase2M.PDF PDF Map File Size 1536 KB

Nebraska Department of Environmental Quality
1200 "N" Street, Suite 400
P.O. Box 98922
Lincoln, Nebraska 68509
(402) 471-2186

Miles
0 5 10 15 20 25 50 75 100

Nebraska Sand Hills from:
Chapman, et. al. 2001. Ecoregions of Nebraska and Kansas. U.S. Geological Survey, Reston, VA.

N

Valentine
Keya Paha
Boyd
Cherry
Ainsworth
Long Pine
Bassett
Atkinson
O'Neill
Brown
Rock
Holt
Crofton
Knox
Bloomfield
Cedar
Hartington
Ponca
Dixon
South Sioux City
Dakota
Dakota City
Creighton
Laurel
Randolph
Plainview
Osmond
Wakefield
Wayne
Pierce
Pierce
Antelope
Thurston
Neligh
Tilden
Norfolk
Battle Creek
Wisner
Elgin
Stanton
Lyons
Madison
Stanton
Cuming
Burt
West Point
Oakland
Madison
Tekamah
Thomas
Blaine
Loup
Garfield
Wheeler
Burwell
Newman Grove
Clarkson
Boone
Albion
Humphrey
Scribner
Hooper
Sargent
Ord
Valley
Greeley
St. Edward
Platte
Colfax
Dodge
Blair
Logan
Fort Calhoun
North Bend
Schuyler
Fremont
Washington
Genoa
Columbus
Nance
Fullerton
Douglas
Valley
Elkhorn
Omaha
Custer
Broken Bow
David City
Wahoo
Wahoo
Saunders
Ralston
La Vista
Papillion
Bellevue
Howard
Loup City
Sherman
St. Paul
Butler
Polk
Osceola
Gretna
Merrick
Central City
Stromsburg
Sarpy
Springfield
Lincoln
Ashland
Plattsmouth
Lancaster
Ravenna
Dawson
Buffalo
Hall
Hamilton
York
Seward
Waverly
Cass
Grand Island
Aurora
York
Seward
Lincoln
Weeping Water

Legend
- Nebraska Sand Hills
- US Highways
- Nebraska Routes

0 10 20 30 40 50 100 150 200 Miles

Nebraska Sand Hills from:
Chapman, et. al. 2001. Ecoregions of Nebraska and Kansas. U.S. Geological Survey, Reston, VA.

Dawes
Sioux
Sheridan
Cherry
Keya Paha
Boyd
Knox
Cedar
Dixon
Dakota
Box Butte
Brown
Rock
Holt
Antelope
Pierce
Wayne
Thurston
Cuming
Grant
Hooker
Thomas
Blaine
Loup
Garfield
Wheeler
Madison
Stanton
Burt
Scotts Bluff
Morrill
Boone
Washington
Garden
Banner
Arthur
McPherson
Logan
Valley
Greeley
Platte
Colfax
Dodge
Nance
Saunders
Douglas
Custer
Kimball
Cheyenne
Deuel
Keith
Sherman
Howard
Merrick
Polk
Butler
Sarpy
Lincoln
Cass
Buffalo
Perkins
Dawson
Hall
Hamilton
York
Seward
Lancaster
Otoe
Chase
Hayes
Frontier
Gosper
Phelps
Kearney
Adams
Clay
Fillmore
Saline
Johnson
Nemaha
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Webster
Nuckolls
Thayer
Jefferson
Gage
Pawnee
Richardson

Legend

Nebraska Sand Hills

APPENDIX C – MSDS Sheets

TransCanada Keystone Pipeline LP

Heavy Oil MSDS

TransCanada
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1. Product and Company Identification

Product Name: Typical Heavy Oil

Synonyms: Not Available

Intended Use: Chemical feedstock

Chemical Family: Blend of Heavy Petroleum Crude, Medium Crude and Synthetic Crude

Supplier: TransCanada Keystone Pipeline LP
450 – First Street S.W.,
P.O. Box 1000, Station M Calgary, Alberta, CANADA, T2P 4K6

Emergency Phone: **1-800-982-7222 (24 Hour)**

2. Composition/Information on Ingredients

Hazardous Ingredients:

Name	CAS#	TWA (ppm)	TWA (Mg/M³)	Exposure Limits STEL (ppm)	STEL (Mg/M³)	CEIL (ppm)	CEIL (Mg/M³)	% by Weight
Crude Oil (Hydrocarbon C5 and C6 Rich)	8002-05-09	100	n/av	n/av	n/av	n/av	n/av	100
Hydrogen Sulfide	7783-06-04	10	14	15	21	20	28	<0.5
Benzene	71-43-2		3.2		16			0.05-1.0
Toluene	108-88-3	50	188					1-5
Xylene	1330-20-7							0.1-1.5

Toxicity values of the hazardous ingredients

Crude oil (Hydrocarbons C5 and C6 Rich) LD50:4,300 mg/Kg (Rat). LC50: Not available.

Hydrogen Sulphide (H_2S) LC50 Inhalation Mouse = 673 ppm 1 hour. LC50 Inhalation Rat = 444 ppm for 4 hours

Benzene. LD50 Oral rat = 930-5600 mg/Kg. LC50 Inhalation rat = 13,700 ppm for 4 hrs.

Xylene. LD50 Oral rat = 4300 mg/Kg. LC50 Inhalation rat = 6700 ppm for 4 hrs. LD50 Dermal rabbit >2000 mg/Kg.

Toluene. LD50 Oral rat = 5000 mg/Kg. LC50 Inhalation rat = 8000 ppm for n4 hrs. LD50 Dermal rabbit = 14000 mg/Kg.

3. First Aid Measures

Eye: Flush eyes for at least 15 minutes with clean water. Patch lightly, allowing drainage. Seek medical attention.

Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water. Seek medical attention ifirritation develops.

Inhalation (Breathing): Protect rescuer. Move exposed person to fresh air. If breathing has stopped apply artificial respiration. Seek medical attention.

Ingestion (Swallowing): If swallowed, do not induce vomiting or give liquids. Seek immediate medical attention.

4. Protective Clothing

Respiratory: Respiratory protection may be required in poorly ventilated areas. Properly fitted air purifying masks equipped with organic vapour filters will provide protection at low concentrations. Air supplied respirators or positive pressure self contained breathing apparatus is required when atmospheric concentrations of hydrocarbon vapours are likely to exceed 10X the occupational exposure limit or when high concentrations of H2S may be present.

Skin: Impervious gloves and clothing should be worn as appropriate to protect against skin contact. Neoprene or nitrile material is suggested.

Eye: Non-vented chemical goggles to prevent eye irritation from the solvent vapours.

Other: As required by the situation according to your companies policies and procedures. Contact your supervisor for direction.

5. Physical Data

Appearance:	Black Brown
Physical State:	Liquid
Odour:	Petroleum Odor
Vapor Pressure (mm Hg):	155 - 520
Vapor Density:	2.5 - 5.0
Boiling Point/Range:	10^{o}C - 1000^{o}C
Freezing/Melting Point:	Not Available
Solubility in Water:	Not Available
Specific Gravity:	0.92-0.94 (Water =1)
Percent Volatile:	100 vol.%
pH (1% soln/water)	Not Applicable
Odor Threshold	0.13 ppm H2S
Freezing Point	Not Available
Molecular Weight	Not Applicable
Melting Point	Not available
Density (kg/m^3)	920-940

Evaporation Rate (nButAc=1): Not Available

6. Stability and Reactivity

Stability: This product is stable

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide and irritant fumes and gases including sulphur oxides, nitrogen oxides and aldehydes.

Hazardous Polymerization: Will not occur

Materials to Avoid (Incompatible Materials): Strong acids, strong oxidizers, chlorine.

7. Toxicological Information

Routes of entry: Ingestion, inhalation, eye contact, skin contact.

TLV: TLV-TWA 100 PPM (525 mg/m3) for stoddard solvent from ACGIH.
Hydrogen Sulfide:
TWA: 10ppm, 14 mg/m3 ACGIH
STEL: 2.5 ppm STEL ACGIH
CEILING: 20 ppm, 28 mg/m3 Alberta OEL
Consult local authorities for acceptable exposure limits. Consult local authorities for acceptable exposure limits.
Benzene. TWA: (1ppm 3.2 mg/m3) STEL: 5.0 ppm (16 mg/m)3) from Alberta OEL's SKIN
ACGIH (TLV) (United States) TWA 0.5 ppm. STEL 2.5 ppm (SKIN)

Toxicity to animals: Hydrocarbons C5 and C6 Rich
LD50: Not available
LC50: Not available
Hydrogen Sulphide (H2S)
LC50 Inhalation Mouse = 673 ppm 1 hour
LC50 Inhalation RAT = 444ppm for 4 hours
Remark: No additional remark

Chronic effects: This product may contain benzene. Benzene has been classified by the international agency for research on cancer as a group 1 product indicating sufficient evidence of carcinogenicity. Studies exist which report a link to crude oil and reproductive effects including fetal tumors and menstrual disorders. This product contains small quantities of xylene. High exposure to xylene has fetotoxic effects in animal studies. This product contains small quantities of polycylic aromatic hydrocarbons. Prolonged contact with these compounds has been associated with the induction of skin and lung tumours.
Remark: No additional remark

Acute effects: Sensitizing Capability: No effects known. Irritancy: Skin, eye and upper respiratory tract irritant.

Ingestion: Pulmonary aspiration hazard if swallowed and vomiting occurs.

Skin: Prolonged skin contact can cause defatting of the skin resulting in dry cracked skin and dermatitis.

Eyes: Eye contact with product or product vapours may result in eye irritation.

Inhalation: May cause headache, dizziness, loss of appetite and loss of consciousness. Product vapours are irritating to the respiratory tract.
Remark: This product contains small quantities of hydrogen sulphide (H2S) gas which may collect in confined spaces. Acute effects vary with concentration of H2S released from mild eye, nose and throat irritation at approximately 100 ppm to sudden unconsciousness or death at 500 ppm.

Synergistic: Not available

8. Fire and Explosion

Auto-ignition temperature: Not available

Flash points: CLOSED CUP: -40°C (-40°F)

Flammable Limits: Not available

Extinguishing Media: Use DRY chemicals, CO_2, or foam to extinguish fire. Water may not be an effective medium to extinguish fire. Cool contained vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special fire fighting procedures: Use supplied air or self contained breathing apparatus (SCBA) for large fires or for fires in enclosed areas.

Flammability: Highly flammable liquid. Released vapours may form flammable/explosive mixtures at or above the flash point. Vapours may travel considerable distances to ignition sources and cause a flash fire. All storage containers and pumping equipment must be grounded.

Risks of explosion: This material is sensitive to static discharge. This product is not sensitive to mechanical impact.

9. Preventative Measures

Waste Disposal: Dispose of in accordance with all federal, provincial and local regulations.

Storage: Keep away from all ignition sources. Maintain temperature below the flash point. Head spaces in storage containers may contain hydrocarbon vapours and toxic hydrogen sulphide gas.

Ventilation: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Spill and Leak: Evacuate unecessary personnel. Eliminate all ignition sources. Be alert to the potential for the presence of hydrogen sulphide gas and don appropriate protective equipment. Stop leak if safe to do so. Contain spill and absorb with inert absorbent. Large spills should be removed with explosion proof vacuum equipment. Large pools may be covered with foam to prevent vapour evolution. Comply with federal, provincial, and local requirements for spill notification.

10. Classification/Regulatory Information

TDG road/rail: TDG CLASS 3: Flammable liquid with a flash point less than or equal to 60.5°C (140.9°F). Closed cup tes method.

PIN: 1267 - PETROLEUM CRUDE OIL

WHMIS: WHMIS CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
WHMIS CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
WHMIS CLASS D-2B: Material causing other toxic effects (TOXIC).

Other: This product is on the Domestic Substances List (DSL). TSCA (Toxic Substance Control Act): This product is listed on the TSCA Inventory.

Refer to federal, state, and local legislation for further requirements.

TransCanada Keystone Pipeline LP

Light Oil MSDS

TransCanada
In business to deliver

1. Product and Company Identification

Product Name: Typical Light Oil

Synonyms: Not Available

Intended Use: Chemical feedstock

Chemical Family: Blend of Medium Crude and Synthetic Crude

Supplier: TransCanada Keystone Pipeline LP
450 – First Street S.W.,
P.O. Box 1000, Station M Calgary, Alberta, CANADA, T2P 4K6

Emergency Phone: **1-800-982-7222 (24 Hour)**

2. Composition/Information on Ingredients

Hazardous Ingredients:

Name	CAS#	TWA (ppm)	TWA (Mg/M³)	Exposure Limits STEL (ppm)	STEL (Mg/M³)	CEIL (ppm)	CEIL (Mg/M³)	% by Weight
Crude Oil (Hydrocarbon C5 and C6 Rich)	8002-05-09	100	n/av	n/av	n/av	n/av	n/av	100
Hydrogen Sulfide	7783-06-04	10	14	15	21	20	28	<0.5
Benzene	71-43-2		3.2		16			0.1-1.0
Toluene	108-88-3	50	188					1-5
Xylene	1330-20-7							0.1-1.5

Toxicity values of the hazardous ingredients

Crude oil (Hydrocarbons C5 and C6 Rich) LD50:4,300 mg/Kg (Rat). LC50: Not available.

Hydrogen Sulphide (H_2S) LC50 Inhalation Mouse = 673 ppm 1 hour. LC50 Inhalation Rat = 444 ppm for 4 hours

Benzene. LD50 Oral rat = 930-5600 mg/Kg. LC50 Inhalation rat = 13,700 ppm for 4 hrs.

Xylene. LD50 Oral rat = 4300 mg/Kg. LC50 Inhalation rat = 6700 ppm for 4 hrs. LD50 Dermal rabbit >2000 mg/Kg.

Toluene. LD50 Oral rat = 5000 mg/Kg. LC50 Inhalation rat = 8000 ppm for n4 hrs. LD50 Dermal rabbit = 14000 mg/Kg.

3. First Aid Measures

Eye: Flush eyes for at least 15 minutes with clean water. Patch lightly, allowing drainage. Seek medical attention.

Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water. Seek medical attention ifirritation develops.

Inhalation (Breathing): Protect rescuer. Move exposed person to fresh air. If breathing has stopped apply artificial respiration. Seek medical attention.

Ingestion (Swallowing): If swallowed, do not induce vomiting or give liquids. Seek immediate medical attention.

4. Protective Clothing

Respiratory: Respiratory protection may be required in poorly ventilated areas. Properly fitted air purifying masks equipped with organic vapour filters will provide protection at low concentrations. Air supplied respirators or positive pressure self contained breathing apparatus is required when atmospheric concentrations of hydrocarbon vapours are likely to exceed 10X the occupational exposure limit or when high concentrations of H2S may be present.

Skin: Impervious gloves and clothing should be worn as appropriate to protect against skin contact. Neoprene or nitrile material is suggested.

Eye: Non-vented chemical goggles to prevent eye irritation from the solvent vapours.

Other: As required by the situation according to your companies policies and procedures. Contact your supervisor for direction.

5. Physical Data

Appearance:	Amber to Black
Physical State:	Liquid
Odour:	Petroleum Odor
Vapor Pressure (mm Hg):	155 - 620
Vapor Density:	>1
Boiling Point/Range:	-90°C - 1100°C
Freezing/Melting Point:	Not Available
Solubility in Water:	Not Available
Specific Gravity:	0.82-0.90 (Water =1)
Percent Volatile:	100 vol.%
pH (1% soln/water)	Not Applicable
Odor Threshold	0.13 ppm H2S
Freezing Point	Not Available
Molecular Weight	Not Applicable
Melting Point	Not available
Density (kg/m^3)	820-900

Evaporation Rate (nButAc=1): Not Available

6. Stability and Reactivity

Stability: This product is stable

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide and irritant fumes and gases including sulphur oxides, nitrogen oxides and aldehydes.

Hazardous Polymerization: Will not occur

Materials to Avoid (Incompatible Materials): Strong acids, strong oxidizers, chlorine.

7. Toxicological Information

Routes of entry: Ingestion, inhalation, eye contact, skin contact.

TLV: TLV-TWA 100 PPM (525 mg/m3) for stoddard solvent from ACGIH.
Hydrogen Sulfide:
TWA: 10ppm, 14 mg/m3 ACGIH
STEL: 2.5 ppm STEL ACGIH
CEILING: 20 ppm, 28 mg/m3 Alberta OEL
Consult local authorities for acceptable exposure limits. Consult local authorities for acceptable exposure limits.
Benzene. TWA: (1ppm 3.2 mg/m3) STEL: 5.0 ppm (16 mg/m)3) from Alberta OEL's SKIN
ACGIH (TLV) (United States) TWA 0.5 ppm. STEL 2.5 ppm (SKIN)

Toxicity to animals: Hydrocarbons C5 and C6 Rich
LD50: Not available
LC50: Not available
Hydrogen Sulphide (H2S)
LC50 Inhalation Mouse = 673 ppm 1 hour
LC50 Inhalation RAT = 444ppm for 4 hours
Remark: No additional remark

Chronic effects: This product may contain benzene. Benzene has been classified by the international agency for research on cancer as a group 1 product indicating sufficient evidence of carcinogenicity. Studies exist which report a link to crude oil and reproductive effects including fetal tumors and menstrual disorders. This product contains small quantities of xylene. High exposure to xylene has fetotoxic effects in animal studies. This product contains small quantities of polycylic aromatic hydrocarbons. Prolonged contact with these compounds has been associated with the induction of skin and lung tumours.
Remark: No additional remark

Acute effects: Sensitizing Capability: No effects known. Irritancy: Skin, eye and upper respiratory tract irritant.

Ingestion: Pulmonary aspiration hazard if swallowed and vomiting occurs.

Skin: Prolonged skin contact can cause defatting of the skin resulting in dry cracked skin and dermatitis.

Eyes: Eye contact with product or product vapours may result in eye irritation.

Inhalation: May cause headache, dizziness, loss of appetite and loss of consciousness. Product vapours are irritating to the respiratory tract.
Remark: This product contains small quantities of hydrogen sulphide (H2S) gas which may collect in confined spaces. Acute effects vary with concentration of H2S released from mild eye, nose and throat irritation at approximately 100 ppm to sudden unconsciousness or death at 500 ppm.

Synergistic: Not available

8. Fire and Explosion

Auto-ignition temperature: Not available

Flash points: CLOSED CUP: -40°C (-40°F)

Flammable Limits: Not available

Extinguishing Media: Use DRY chemicals, CO_2, or foam to extinguish fire. Water may not be an effective medium to extinguish fire. Cool contained vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special fire fighting procedures: Use supplied air or self contained breathing apparatus (SCBA) for large fires or for fires in enclosed areas.

Flammability: Highly flammable liquid. Released vapours may form flammable/explosive mixtures at or above the flash point. Vapours may travel considerable distances to ignition sources and cause a flash fire. All storage containers and pumping equipment must be grounded.

Risks of explosion: This material is sensitive to static discharge. This product is not sensitive to mechanical impact.

9. Preventative Measures

Waste Disposal: Dispose of in accordance with all federal, provincial and local regulations.

Storage: Keep away from all ignition sources. Maintain temperature below the flash point. Head spaces in storage containers may contain hydrocarbon vapours and toxic hydrogen sulphide gas.

Ventilation: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Spill and Leak: Evacuate unecessary personnel. Eliminate all ignition sources. Be alert to the potential for the presence of hydrogen sulphide gas and don appropriate protective equipment. Stop leak if safe to do so. Contain spill and absorb with inert absorbent. Large spills should be removed with explosion proof vacuum equipment. Large pools may be covered with foam to prevent vapour evolution. Comply with federal, provincial, and local requirements for spill notification.

10. Classification/Regulatory Information

TDG road/rail: TDG CLASS 3: Flammable liquid with a flash point less than or equal to 60.5°C (140.9°F). Closed cup tes method.

PIN: 1267 - PETROLEUM CRUDE OIL

WHMIS: WHMIS CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
WHMIS CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
WHMIS CLASS D-2B: Material causing other toxic effects (TOXIC).

Other: This product is on the Domestic Substances List (DSL). TSCA (Toxic Substance Control Act): This product is listed on the TSCA Inventory.

Refer to federal, state, and local legislation for further requirements.

APPENDIX D – Construction Mitigation and Reclamation Plan

KEYSTONE XL PROJECT

CONSTRUCTION, MITIGATION, AND RECLAMATION PLAN

April 2012
Rev. 4

9.0 DRAWINGS AND FIGURES

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1.0 INTRODUCTION

The construction, mitigation, and reclamation requirements described in this Plan apply to work on all of TransCanada Keystone Pipeline, L.P.'s (Keystone's) Keystone XL Project (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; and
- waterbodies and riparian areas.

Keystone, during the construction, operation, and maintenance of the Project, 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, or local rules and regulations, or other permits or approvals that are applicable to the Project. Additionally, Keystone may deviate from specific requirements of this Plan on specific private lands as agreed to by 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.

The Project will be designed, constructed, operated and maintained in a manner that meets or exceeds applicable industry standards and regulatory requirements. Keystone's Integrity Management Plan and Emergency Response Plan outlines the preventative maintenance, inspection, line patrol, leak detection systems, SCADA, and other pipeline integrity management procedures to be implemented during operation of the Project.

2.0 GENERAL CONDITIONS

2.1 Training

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.

The construction contractor (Contractor), and all of his subcontractors shall ensure that persons engaged in Project 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. Prior to construction, all Project personnel will be trained on environmental permit requirements and environmental specifications, including fuel handling and storage, cultural resource protection methods, stream and wetland crossing requirements, and sensitive species protection measures.

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 comprehensive environmental training session. All other Contractor personnel shall attend a 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 prior to commencing work on the Project.

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 that signifies attendance at environmental training. In order to ensure successful compliance, Contractor personnel shall attend repeat or supplemental training if compliance is not satisfactory or as new, significant new issues arise.

All visitors and any other personnel without specific work assignments shall be required to attend a safety and environmental awareness orientation.

2.2 Environmental Inspection

Keystone will use Environmental Inspectors on each construction spread. The Environmental Inspectors will review the Project activities daily for compliance with state, federal and local regulatory requirements. The Environmental Inspectors will have the authority to stop specific tasks as approved by the Chief Inspector. They can also order corrective action in the event that construction activities violate the provisions of this Plan, landowner requirements, or any applicable permit requirements.

2.3 Advance Notice of Access to Property Prior to Construction

Prior to initially accessing landowners' property, 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). 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 construction.

Prior notice shall consist of a personal contact, a telephone contact, or delivery of written notice to the landowner to inform the landowner of whereby the landowner or tenant is informed of Keystone's intent to initially access the land. The landowner or tenant need not acknowledge receipt of written notice before Keystone can enter the landowner's property.

Keystone will coordinate with managers of public lands to reduce conflicts between construction activities and recreational uses. Keystone will consult with land managers on state and federal lands regarding any necessary construction and maintenance restrictions consistent with management and use of such lands. Damages from disruption of recreational uses of private lands will be the subject of compensation negotiations with individual landowners.

If pipeline activities occur during the winter season Keystone will consult with the appropriate regulatory agencies to establish the appropriate protective measures to avoid or mitigate wildlife seasonal, timing or migration concerns.

2.4 Other Notifications

The Contractor shall notify, in writing, both Keystone and the authority having jurisdiction over any road, railroad, canal, drainage ditch, river, foreign pipeline, or other utility to be crossed by the pipeline 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 that creates a sheen on a wetland or waterbody, 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.

The Contractor shall immediately notify Keystone of a Project-related injury to or mortality of a threatened or endangered animal.

2.5 Damages to Private Property

Pipeline construction activities shall be confined to the construction right-of-way, temporary work space, 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.

2.6 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 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.

2.7 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, public road, 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 private access roads are constructed, they shall be designed to maintain proper drainage and shall be built to minimize soil erosion.

Sufficiently sized gaps shall be left in all spoil and topsoil wind rows and a hard or soft plug shall be left in the trench at all temporary private access roads and obvious livestock or wildlife trails unless the landowner agrees 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.

2.8 Aboveground Facilities

Locations for aboveground facilities shall be selected in a manner so as to be as unobtrusive as reasonably possible to ongoing agricultural or other landowner activities occurring on the lands adjacent to the facilities. If it is not feasible, to avoid interference, such activities 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. Aboveground facilities shall avoid floodplains and wetlands to the maximum extent possible. Additionally, they shall be located to avoid existing drain tile systems to the extent possible. To further reduce visual impacts from aboveground pipeline facilities and structures, Keystone will comply with standard industry painting practices with respect to aboveground facilities. Keystone will address any visual aesthetics issues with landowners in individual consultations.

2.9 Minimum Depth of Cover

The pipeline shall be installed so that the top of the pipe and coating is 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 or concrete coated pipe is utilized for negative buoyancy of the pipeline, the minimum depth of cover shall be measured from the top of the concrete to the original ground contour. The following table indicates standard depths that would apply to pipeline construction.

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

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.

2.10 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, and rock.

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, cleanup, and disposal procedures. This material shall be segregated for handling and disposal as hazardous wastes.

The Contractor shall be responsible for ensuring that human wastes are 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 HDD 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, or 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 cleanup

The Contractor shall remove all trash and wastes from Contractor yards, and Pipe Stockpipe Sites, 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 be trained in accordance with the applicable regulator 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 49 CFR Parts 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 abide by all applicable noise regulations 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. Keystone will give advanced notice to landowners within 500 feet of right-of-way prior to construction, limit the hours during which construction activities with high-decibel noise levels are conducted, coordinate work schedules, and ensure that construction proceeds quickly through such areas. The Contractor shall minimize noise in the immediate vicinity of herds of livestock or poultry operations, which are particularly sensitive to noise.

Keystone will set up a toll-free telephone line for landowners to report any construction noise-related issues.

2.13 Weed Control

Keystone will prepare a weed management plan for each state crossed by the project, as required. In general, these plans will consider the following measures listed below.

Prior to mobilization for the Project, 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 or soil-borne pest infested areas, or utilize cleaning stations to remove vegetative materials using water under high pressure (see detail Drawings 30 and 31).

In areas of isolated weed populations, the Contractor shall strip topsoil from the full width of the construction right-of-way and store the topsoil separately from other topsoil and subsoil. The Environmental Inspectors will identify these locations in the field prior to grading activities.

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, trenching, or other soil disturbing work at locations identified in the construction drawings.

Keystone will implement Best Management Practices (BMPs) for conducting vegetation control where necessary before and after construction. Typical agricultural herbicides, developed in consultation with county or state regulatory agencies, will be used. Herbicide types will be determined based on the weed species requiring control. The Contractor shall apply herbicides, where required, within one 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 prior to construction shall be non-residual or shall have a significant residual effect no longer than 30 days. Herbicides applied during construction shall be non-residual. Keystone will implement BMPs in the use of pesticides and herbicides along the pipeline corridor to reduce potential impacts to avian and wildlife species.

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 will retain control over the surface use of the land after construction (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 by a state-licensed pesticide applicator.

Keystone shall be responsible for reimbursing all reasonable costs incurred by owners of land adjacent to aboveground facilities when the landowners must control weeds on their land which can be reasonably determined to have spread from land occupied by Keystone's aboveground facilities.

2.14 Dust Control

The Contractor shall at all-time control airborne 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 is 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 in these areas. Emissions from construction equipment combustion, open burning, and temporary fuel transfer systems and associated tanks will be controlled to the extent required by state and local agencies through the permit process.

The Contractor shall take appropriate precautions to prevent fugitive emissions caused by sand blasting 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.

Additional measures may be required by state regulations or local ordinances. The Contractor will comply with all applicable state regulations and local ordinances with respect to truck transportation and fugitive dust emissions.

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 fire authorities and their designated representative to contact shall be maintained on site by construction personnel.
- Adequate firefighting equipment shall be available on site in accordance with the applicable regulatory requirements shall be available on site.
- The level of forest fire hazard shall be posted at the construction office (where visible for workers) and workers shall be made aware of the hazard level 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, and chain saws; and heavy equipment adequate for the construction of fire breaks when needed.
- Specifically, the Contractor shall supply and maintain in working order an adequate supply of fire extinguishers for each crew engaged in potentially combustible work such as welding, cutting, grinding, and burning of brush or vegetative debris.
- In the event of a fire, the Contractor shall immediately use resources necessary 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, county, or local applicable regulations.
- Any burning will be done within the right-of-way. Only small piles shall be burned 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 flammable materials.
- Smoking shall be prohibited on the entire construction site when the fire hazard is high.

2.17 Road 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. Detail drawing 21 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. 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 or railroad crossings. Each boring will be expected to take 1 to 2 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 can be finished and the road resurfaced in 1 or 2 days. Keystone will take measures, such as posting signs at open-cut road crossings, to ensure safety and minimize traffic disruptions.

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; and
- 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 allow;
- using low ground weight, 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; and

- installing geotextile material or construction mats in problem areas.

"Stop work" authority will be designated to the chief inspector but will be implemented when recommended by the Environmental Inspector.

2.19 Cultural Resources

Keystone intends to avoid cultural resources to the extent practicable by rerouting the pipeline corridor and related appurtenances, avoiding construction activities on properties listed in or eligible for listing in the National Register of Historic Places (NRHP), as well as boring or using HDD through culturally sterile soils.

The Contractor shall implement the measures outlined in any unanticipated discovery plan or any Programmatic Agreement that is adopted to minimize disturbance to cultural sites and shall take immediate action as outlined in the Programmatic Agreement if any unanticipated cultural discovery is encountered during construction.

The preferred treatment of any historical property or culturally significant site is avoidance. Where required, Keystone will monitor the construction spread using a cultural resource monitor working under the direction of a professional who meets the standards of the *Secretary of the Interior's Historic Preservation Professional Qualification Standards* (48 FR 44716, September 29, 1983).

Prior to commencing construction, Keystone also will provide an appropriate level of training to all construction personnel so that the requirements of any unanticipated discovery plan or Programmatic Agreement are understood and unanticipated discoveries quickly identified.

In the event an unanticipated cultural discovery is made, the Contractor will immediately halt all construction activities within a 100-foot radius, including traffic; notify the Keystone Environmental Inspector; and implement interim measures to protect the discovery from looting or vandalism. The appropriate federal, state, local, or tribal authorities will be notified of discovery within 48 hours of the initial find. Construction will not proceed within the 100-foot radius of discovery site until all mitigation measures defined in the Programmatic Agreement are concluded and Keystone receives approval from the appropriate agencies that construction may resume. No work or activity within the 100-foot buffer area may take place until approvals are communicated at the spread level by the lead Environmental Inspector.

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, and hydraulic and other fluids during normal upland applications and special applications within 100 feet of perennial streams or wetlands.

Keystone will prepare a project-specific Spill Prevention Containment and Countermeasure (SPCC) Plan. The Contractor shall provide additional information to complete the SPCC Plan for each construction spread, and shall provide site-specific data that meets the requirements of 40 CFR Part 112 for every location used for staging fuel or oil storage tanks and for every location used for bulk fuel or oil transfer. Each SPCC Plan will be prepared prior to introducing the subject fuel, oil, or hazardous material to the subject location.

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. Bulk fuel and storage tanks will be placed only at Contractor yards. No bulk fuel and storage tanks will be placed in the construction ROW. 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.
- The Environmental Inspector shall inspect the tank site for compliance with the 100-foot setback requirement and approve the tank site prior to installing bulk fuel or storage tanks on the construction yard.
- 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 streams 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.
- Fixed fuel dispensing locations will be provided with secondary containment to capture fuel from leaks, drips, and overfills.
- Temporary liners, berms, or dikes (secondary containment) shall be constructed around the aboveground bulk tanks, providing 110 percent containment volume of the largest storage tank or trailer within the containment structure, so that potential spill materials shall be contained and collected in specified areas. 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.

- Drivers of tank trucks are responsible for setting brakes and chocking wheels prior to off loading. 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 overfilling the temporary tank.
- Prior to departure of any tank truck, all vehicle outlets shall be examined closely by the driver for leakage, tightened, adjusted or replaced to prevent leakage while in transit.
- A supply of sorbent and barrier materials sufficient to allow the rapid containment and recovery of spills shall be maintained at each construction staging area. 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 or disposed in an approved landfill, 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 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 aboveground 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 be informed.
- Drain valves on temporary tanks shall be locked to prevent accidental or unauthorized discharges from the tank.
- Oil and other hazardous materials stored in 350-gallon totes, 55-gallon drums, 5-gallon pails, smaller retail-size containers or other portable containers will be staged or stored in areas with a secondary temporary containment structure. Secondary containment structures may consist of temporary earthen berms with a chemical resistant liner, or a portable containment system constructed of steel, PVC, or other suitable material. The secondary containment structure will be capable of containing 110 percent of the volume of material stored in these areas.

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

The Contractor will ensure that all equipment is free of leaks prior to use on the Project and prior to entering or working in or near waterbodies or wetlands. Throughout construction, the Contractor will conduct regular maintenance and inspections of the equipment to reduce the potential for spills or leaks.

Rubber-tired vehicles (pickup trucks, buses) normally shall 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.

Each fuel truck that transports and dispenses fuel to construction equipment or Project vehicles along the construction ROW or within equipment staging and material areas shall carry an oil spill response kit and spill response equipment onboard at all times. In the event that response materials are depleted through use or their condition is deteriorated through age, the materials will be replenished prior to placing the fueling vehicle back into service.

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 cleanup of spills of fuel and other hazardous materials. Each construction crew, including cleanup 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. Crew members must know and follow the procedure for reporting spills.
- Refueling and lubricating of construction equipment shall be restricted to upland areas at least 100 feet away from streams 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, spill containment, and cleanup. The Environmental Inspector shall ensure that signs are installed identifying restricted areas.
- No fuel, oil or hazardous material storage, staging, or transfer other than refueling will occur within 100 feet of any storm drain, drop inlet, or high consequence area (HCA).
- 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.
- Stationary equipment will be placed within a secondary containment if it will be operated or require refueling within 100 feet of a wetland or waterbody boundary.

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.

3.2 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 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 in 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 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; and
- 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 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; and
- 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 planning stages of construction. A Keystone representative shall be identified to serve as contact in the event of a spill during construction activities. In the event of a spill meeting government reporting criteria, the Contractor immediately shall notify the Keystone representative who, in turn, shall notify the appropriate regulatory agencies.

Any material released into water that creates a sheen must be reported immediately to Keystone. The Contractor is required to notify Keystone immediately if there is any spill of oil, oil products, or hazardous materials that reaches a wetland or waterbody. Incidents on public highways shall be reported to Keystone and the appropriate agencies by Keystone.

If a spill occurs on navigable waters of the United States, Keystone shall notify the National Response Center (NRC) at 1-800-424-8802. For spills that occur on public lands, into surface waters, or into sensitive areas, the appropriate governmental agency's district office also shall 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); and
- commence recovery of the spill and cleanup 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 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 shall also be notified and involved in the incident.

For 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.

For a spill threatening a waterbody, berms or trenches shall be constructed to contain the spill prior to entry into the waterbody. 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 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 (flood irrigation, ditch irrigation, pivot, wheel, or other type of 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 being constructed.
- If the pipeline 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. If 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 compensated reasonably for all such crop damages.
- If the pipeline 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. If 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 compensated reasonably 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 safe and efficient construction of the pipeline. The following mitigable measures shall be implemented:

- Construction traffic shall be restricted to the construction right-of-way, existing public 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.
- 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. All work shall be conducted in accordance with applicable permits.

- In areas designated for topsoil segregation, the actual depth of the topsoil, to a maximum depth of 12 inches, will be stripped from:
    - The area excavated above the pipeline; or
    - The area above the pipeline plus the spoil storage; or
    - The area above the pipeline plus the working side; or
    - Entire ROW

  as required by applicable permit agreements with the landowner or as dictated by site-specific conditions.

- Stripped topsoil is to be stockpiled in a windrow along the edge of the right-of-way. The Contractor shall perform work in a manner 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, topsoil piles shall be tackified using either water or a suitable tackifier (liquid mulch binder).
- Gaps in the rows of topsoil will be left in order to allow drainage and prevent ponding of water adjacent to or on the right-of-way.
- Topsoil shall not be utilized to construct ramps at road or waterbody crossings.
- In areas with defined saline or sodic soil concerns, a triple-ditch method will be used to segregate problem soils as indicated in Detail 67 and 67A.
- If frozen topsoil conditions are encountered during winter construction, specialized construction equipment (i.e. ripping, frozen topsoil cutter, road reclaimer, etc) may be required to adequately segregate and conserve topsoil resources.

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 to the extent practicable..
- Agricultural areas that have 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 to 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; and
- 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, 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 of 0.5 inches or greater. 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., drivable 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 Contractor is responsible for properly installing, maintaining, and replacing temporary and permanent erosion controls throughout construction and cleanup. In wetland or riparian zones, the Contractor will install sediment control structures along the construction right-of-way edges prior to vegetation removal where practicable. The aforementioned sediment barriers may be used interchangeably or together depending on site-specific conditions. In most cases, silt fence shall be utilized where longer sediment barriers are required.

Sediment barriers shall be installed below disturbed areas where there is hazard of offsite sedimentation. These areas include:

- the base of slopes adjacent to road crossings;

- the edge of the construction right-of-way adjacent to and upgradient of a roadway, flowing stream, spring, wetland, or impoundment;
- 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 (Detail 8).

Sediment barriers placed at the toe of a slope shall be set a 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 fence or straw bale sediment barriers (in lieu of drivable 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. Sediment shall be removed and placed where it shall not reenter the barrier when sediment loading is greater than 40 percent or if directed by Keystone. 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 cleanup of the construction right-of-way.

4.5.3 Trench Plugs

The Contractor shall use trench plugs at waterbody and wetland crossings at the direction of the Environmental Inspector 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 install temporary slope breakers on slopes greater than 5% on all disturbed lands 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 4 percent.

If so directed by the landowner, the Contractor may not install temporary slope breakers (water bars) in cultivated land.

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 permitted in the landowner agreement 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 or ditch outlet,

sediment barriers, check berms, or other appropriate measures shall be used to control erosion.

4.5.6 Temporary Mulching and Cover Crops

Unless otherwise directed by Keystone, the Contractor shall apply temporary seed and/or mulch on disturbed construction work areas that have been inactive for one month or are expected to be inactive for a month or more. The Contractor shall not apply temporary mulch in cultivated areas unless specifically requested by the landowner or in areas particularly prone to erosion. The Contractor shall not apply mulch within wetland boundaries.

Temporary mulch of straw or equivalent applied on slopes shall be spread uniformly to cover at least 75 percent of the ground surface at an approximate rate of 2 tons per 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 per acre.

All seed that is used as a temporary cover crop will be approved and/or provided by Keystone.

4.5.7 Tackifier

When wetting topsoil piles with water does not prevent wind erosion, the Contractor shall temporarily suspend topsoil handling operations and apply a tackifier to topsoil stockpiles at the rate recommended by the manufacturer. The type of Tackifier will be approved by Keystone.

Should construction traffic, cattle grazing, heavy rains, or other related construction activity disturb the tackified topsoil piles and create 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 mitigative 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);
- limiting access and thus minimizing the frequency of all vehicle traffic;
- digging ditches to improve surface drainage;

- using timber riprap, matting, or geotextile fabric overlain with soil; and
- stopping construction 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. All work shall be conducted in accordance with applicable permits.

- Where required, subsoil shall be segregated from topsoil in separate, distinct rows with a separation that shall limit any admixing of topsoil and subsoil during handling.
- Triple ditch soil handling will be completed at sites identified by Keystone according to Detail 67 and 67A to prevent soil degradation.
- 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 operations 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.
- If trenching, pipe installation and backfill operations take place during frozen soil conditions, final clean-`up (including additional trench compaction, subsoil feathering, final contouring and topsoil replacement) will be delayed until the subsoil and topsoil thaw completely the following spring/summer. A pronounced subsoil berm will be left over the trench line until final clean-up takes place to account for settlement of thawing backfill. Gaps will be left in the berm to maintain cross-ROW drainage

The Contractor shall prepare a blasting plan that is applicable to any locations where blasting will be necessary adjacent to existing high pressure pipelines, overhead or underground utilities, farm operations, or public crossings. The Contractor and its blasting supervisor shall be thoroughly familiar with and comply with the rules and regulations of Occupational Safety and Health Administration (OSHA) and all federal, state, county and local regulations governing blasting operations. Keystone will file the blasting plan with applicable state or local jurisdictions, where required. Excavation and blasting along the ROW may uncover paleontological resources of scientific value. Keystone will consult with the appropriate regulatory agencies in each state on the applicability and requirements for Paleontological Resource Protection Plans. Keystone will prepare and file plans addressing vertebrate fossils with any respective states, as required.

Should blasting be necessary for removal of rock, the following mitigative measures may be implemented:

- The Contractor shall use non-electric initiation systems for all blasting operations. If required by the blasting plan, blasting will be monitored for vibration levels and peak particle velocity. This work shall be performed by a third-party vibration monitoring consultant hired by and reporting to the Constructor Representative. The Contractor shall arrange for detonations to be carried out in cooperation with this consultant.
- Prior to using explosives, the Contractor shall advise residents of the immediate area, in order to prevent any risk of accidents or undue disturbances.
- No blasting shall be done without approval of the Constructor Representative. Prior to any detonation of explosives in the vicinity of a loaded line, dwelling, structure, overhead or underground utility, farm operation, or public crossings, a minimum of 48 hour's notice shall be given to the Constructor Representative, in order that the appropriate people can be notified and the upstream and downstream mainline valves can be staffed.
- The Contractor shall obtain all necessary permits and shall comply with all legal requirements in connection with the use, storage, and transportation of explosives.
- Blasting mats or subsoil may be piled over the trench line to prevent rock 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.
- The Contractor shall at all times protect his workers and the public from any injury or harm that might arise from drilling dust and the use of explosives.
- Only workers thoroughly experienced in handling explosives shall be permitted to supervise, handle, haul, load or shoot explosives. In those jurisdictions where the licensing of blasters is mandatory, the Contractor shall provide the Constructor Representative with proof of the required certification for every person so required.
- The drilling pattern shall be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) in order to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications.
- Blasting testing of surface-water resources and water wells within 150 feet of the centerline will be performed in compliance with all applicable permits.

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 Environmental 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.

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 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).
- 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 Lowering In

The objectives of welding, field joint coating, and lowering 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 lowering in, unless otherwise specified by Keystone in response to site-specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Shavings produced during beveling 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 create a continuous line of pipe that may be left in 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 for passage of livestock and wildlife.
- Prior to the application of epoxy powder, urethane epoxy, or other approved pipe coatings, a tarp shall be placed underneath the pipe in wetlands to collect any overspray of epoxy powder and liquid drippings. Excess powder, liquid, or other hazardous materials (e.g. brushes, rollers, gloves) shall be continuously collected and removed from the construction right-of-way and disposed of in a manner appropriate for these materials.

4.9 Padding and Backfilling

The objective of padding 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 in accordance with the requirements of the Stormwater Pollution Prevention Plan (SWPPP) in order to avoid damaging adjacent areas. Detail 5 and Detail 6 provide typical examples of dewatering structures.
- 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 damage and/or shall correct the damage 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 necessary to minimize the potential for water movement down the ditch and potential subsequent erosion.
- During backfill, the stockpiled subsoil shall be placed back into the trench before replacing the topsoil.
- Topsoil shall not be utilized for padding the pipe.
- 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 or by the wheels or tracks of equipment traversing down the trench.
- The lesser of 4 feet or the actual depth of topsoil cover, shall not be backfilled with soil containing rocks of any greater concentration or size than existed prior to pipeline construction in the pipeline trench, bore pits, or other excavations.

4.10 Cleanup

The objective of cleanup 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 cleanup, unless otherwise approved or directed by Keystone based on specific conditions or circumstances. All work shall be conducted in accordance with applicable permits.

- Cleanup shall occur immediately following backfilling operations when weather or seasonal conditions allow.
- All garbage and construction debris (e.g., lathing, ribbon, welding rods, pipe bevel shavings, pipe spacer ropes, end caps, pipe skids) 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.
- Where topsoil has been segregated, subsoil shall not be permanently placed on top of topsoil.
- 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.
- During cleanup, temporary sediment barriers such as silt fence and hay bale diversions will be removed; accumulated sediment will re-contoured with the rest of the ROW; and permanent erosion controls will be installed as necessary.
- After construction, all temporary access shall be returned to prior construction conditions unless specifically agreed with the landowner or otherwise specified by Keystone.
- Warning signs, aerial markers, and cathodic protection test leads shall be installed in locations in compliance with U.S. Federal code and in locations that shall not impair farming operations where practicable.
- 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 Revegetation

The objectives of reclamation and revegetation 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 will typically be relieved in subsoils that have received substantial construction traffic, as determined by Keystone, prior to replacing and respreading topsoil. Compaction will typically not be relieved in topsoils that have been left in place and that have not been driven on. Any rock that is brought to the surface during decompaction activities will be removed until the quantity, size, and distribution of rock is equivalent to that found on adjacent land as determined by the Environmental Inspector. Compaction will typically be relieved as follows:

- Compacted cropland compacted shall be ripped a minimum of 3 passes at least 18 inches deep and all pasture shall be ripped or chiseled a minimum of three passes at least 12 inches deep before replacing topsoil.
- Areas of the construction right-of-way that were stripped for topsoil salvage shall be ripped a minimum of 3 passes (in cross patterns, as practical) 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). After 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 de-compacted construction right-of-way shall be tested by the Contractor at regular intervals for compaction in agricultural and residential areas. 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 up to a maximum of 12 inches. Topsoil compaction on cultivated fields shall be alleviated with cultivation methods by the contractor.
- 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 NRCS shall be consulted by Keystone and the landowner.

Plowing under of organic matter including wood chips and manure, or planting of a green crop such as alfalfa to decrease soil bulk density and improve soil structure or any other measures in consultation with the Natural Resource Conservation Service (NCRS) shall be considered if mechanical relief of compaction is deemed not satisfactory.

In the first year after construction, Keystone will inspect the ROW to identify areas of erosion or settling. Subsequently, Keystone will monitor erosion and settling through aerial patrols, which are part of Keystone's Integrity Management Plan, and through landowner reporting. Landowner reporting will be facilitated through use of Keystone's toll-free telephone number, which will be made available to all landowners on the ROW. Landowner reporting also may be facilitated through contact with Keystone's field offices.

Keystone plans to minimize impacts on soil productivity that may result from construction activities, but recognizes that some short- to long-term decreases in agricultural productivity are possible. Keystone recognizes its responsibility to restore agricultural productivity on the pipeline ROW and to compensate landowners for demonstrated decreases in productivity that may result from any degradation of agricultural soils along the ROW.

4.11.2 Rock Removal

- 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 This effort will result in an equivalent quantity, size and distribution of rocks to that found on adjacent lands, as determined by the Environmental Inspectors.
- 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) commonly used for agricultural soils in the area 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 Natural Resource Conservation Service 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 cleanup 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 construction 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; and to support an adequate seedbed; and to ensure that seed incorporation or soil packing equipment can operate without becoming plugged with mulch.
- Identified seeding areas shall be seeded as specified by Keystone. Seeding rates shall be based on pure live seed.
- Weather conditions, construction right-of-way constraints, site access, topography and soil type shall influence the seeding method to be used (i.e., drill seeding versus broadcast seeding).
- The Contractor shall delay seeding as directed by Keystone until the soil is in the appropriate condition for seeding.
- The Contractor shall use a Truax brand or Keystone approved 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, as directed by Keystone.
- 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 consistent with the local or regional agricultural practices.

- Broadcast or hydro seeding, used in lieu of drilling, shall utilize NRCS-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 intense livestock grazing of the construction right-of-way during the first growing season by utilization of temporary fencing or deferred grazing, or increased grazing rotation frequency.

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 other suitable materials 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 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. In general, permanent slope breakers should be installed immediately downslope of all trench breakers. Permanent slope breakers 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 to four percent 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 per acre of straw or its equivalent. The Environmental Inspector may reduce the application rate or forego mulching an area altogether if there is an adequate cover of rock or organic debris to protect the slope from erosion, or if annual companion crops have stabilized the soil.

Mulch application includes straw mulch, hydro mulch and tackifier or other materials as approved by Keystone.

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 2 to 3 inches. A regular farm disk shall not be used to crimp mulch. The crimping of mulch shall be performed across the slope of the ground, not parallel to it. In addition, in areas of steep terrain, tracked vehicles may be used as a means of crimping mulch (equipment running up and down the hill to leave crimps perpendicular to the slope), provided they leave adequate coverage of mulch.

In soils possessing high erosion potential, the Contractor may be required to make two passes with 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 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. No asphalt-based tackifiers shall be used on the Project.

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 with no bridging of rills, gullies, or other low areas.

4.11.5.5 Riprap and Stream Bank Stabilization

Disturbed banks of streambeds and waterbodies shall be restored to their approximate original contours unless otherwise directed. Erosion protection shall be applied as specified in the construction drawings.

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 riprap, bio-stabilization, or engineered structures such as brush layering, logwalls, cribwalls, or vegetated geo-grids. See Details 20, 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. Native rock shall be utilized wherever practicable.

4.11.6 Fences

Upon completion of all backfilling, cleanup, 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.

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 Farm Terraces

Keystone will work with landowners and farm service agencies to ensure restoration of farm terraces to their pre-construction function. Keystone may elect to negotiate a fair settlement with the landowner to employ a local land leveling contractor to restore the terrace.

Before any groundwork is performed in areas with farm terraces, Keystone will conduct a civil survey to document the location and contours of each terrace. Both the channel contour and the terrace berm will be surveyed within the construction right-of-way and up to 100 feet on either side of the ROW boundaries. The pre-construction survey will

provide a baseline to ensure the proper restoration of the terrace following construction.

The Contractor will maintain the pre-disturbance drainage of water along the terrace channel and will install temporary flume pipe for this purpose. As necessary, temporary erosion control measures such as water bars and sediment barriers will be installed and maintained throughout construction to reduce the potential for soil erosion along or off the construction ROW.

Following installation of the pipe, the trench will be backfilled, and the Contractor will restore the terrace contours as agreed to with the landowner.

Should the landowner agree to have a local contractor restore the terraces, the Contractor will backfill the trench and restore the terrace using typical compaction methods for pipeline construction with the understanding that the landowner's contractor will re-excavate the location and re-install the terrace utilizing land levelling equipment and special compaction methods.

Should the landowner desire the Contractor to restore the terraces, the pipeline contractor will compact the trench before the terrace berm is replaced. Following restoration of the terraces, final contours and grades will be re-surveyed and documented with survey notes. Keystone will perform post-construction monitoring and inspection with the landowner's concurrence. Should the terraces require further work, Keystone will either compensate the landowner to perform the work or arrange for a local contractor to perform the work.

4.11.8 Right-of-Way and Pipeline Markers

Upon completion of all backfilling, cleanup 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. 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.
- 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 or appropriate facilities.
- Areas of disturbance in native range shall be seeded with a native seed mix after topsoil replacement.
- 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.

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. Keystone will address mitigation, reclamation and remediation measures with individual landowners and comply with any applicable state requirements. These measures include non-vegetative remediation to reverse impacts on windbreaks, shelterbelts, and living snow fences. Where the pipeline follows an existing ROW in forested areas, Keystone attempted to route the pipeline as close as practical to the existing ROW. 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 of 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 may salvage all marketable timber from designated areas.

- Tree stumps shall be grubbed to a maximum of 5 feet on 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 designee'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 ROW disturbance. Skidders or alternate equipment shall be used to transport salvaged logs to stacking sites.
- Trees shall be felled to fall toward the center line of the right-of-way to avoid breaking trees and branches off ROW. Leaners (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..
- 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 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 revegetation 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: (1) approximately 2000 feet apart in timbered areas; (2) on sites located on approved temporary workspace in existing cleared areas; (3) in non-merchantable stands of timber; or (4) if no other options are available, in merchantable timber stands. Deck sites shall be appropriately sized to accommodate the loading equipment.
- If the landowner does not want the timber, the Contractor shall remove decked timber from the construction right-of-way and transport it to a designated all-weather access point or mill

4.14 Residential and Commercial/Industrial Areas

4.14.1 Residential and Commercial Areas

The principal measures that shall be used to mitigate impacts on existing residential and commercial areas include the following unless otherwise directed or approved by Keystone based on site-specific conditions or circumstances. 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;
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;
- fencing the edge of the construction work area that is within 25 feet 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;
- 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; and
- immediately after backfilling the trench, restoring all lawn areas, shrubs, specialized landscaping, fences, and other structures within the construction work area to 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.
- to the extent possible, preserving mature trees and landscaping while ensuring the safe operation of construction equipment;

4.14.2 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, at 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, ditches, and streams; and
- 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.

4.14.3 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 or mitigation of environmental damages on their property. The Construction Manager or his designated representative shall respond to the landowner within 24 hours of receipt of the phone call.
- If the landowner has not received a response or is not satisfied with the response, he can contact Keystone's representative at 1-877-880-4881. The landowner should expect a response within 48 hours.

4.15 Fragile Soil Clean-up and Reclamation/Revegetation

4.15.1 General

Fragile soil types are a result of the high percentage of sand content that exists within the surficial soil. Theses soil types exist within regions found in southern South Dakota and central Nebraska and fragile due to their inherent high wind and water erosion potential, low water holding capacity and arid nature of the region, rolling to steep terrain and usually consists of predominantly native prairie landscapes and supports a variety of uses such as livestock grazing, wildlife habitat and recreational opportunities.

4.15.2 Right-of-way Construction

- KXL will educate construction personnel regarding these areas and the necessity to strictly adhere to Project Best Management Practices (BMPs) designed to minimize impacts.

- Minor route re-alignments will be incorporated through these areas to avoid particularly erosion-prone locations, such as ridge tops and existing blowouts as much as practicable.
- KXL will avoid highly saturated areas, such as wetland, to the maximum extent possible.
- Construction soil handling procedures will strive to reduce the width of disturbance to the native prairie landscape by adopting "Trench-line or Blade-width stripping procedures where practicable.
- Topsoil conservation will be conducted on all areas where excavation occurs.
- Topsoil piles will be protected from erosion through matting, mulching, watering or tackifying as deemed practicable.
- Traffic management limitations will be employed on specific areas possessing high erosion potential or sensitive habitat.

4.15.3 Right-of-Way Reclamation

- Native seed mixes will be developed with input from the local NRCS offices and through collaboration with regional experts. All seed will be certified noxious weed-free and will be calculated on a pure live seed (PLS) basis.
- Straw or native prairie hay may be used as mulch, applied to the right-of-way and crimped into the soil to prevent wind erosion. All mulch will be documented as noxious weed-free.
- Land imprinting may be employed to create impressions in the soil, thereby reducing erosion, improving moisture retention and creating micro-sites for seed germination.
- Sediment logs or straw wattles will be used in place of slope breakers (short terraces) that are constructed of soil. Using sediment logs will result in less soil disturbance to the right-of-way.
- Photodegradable matting will be applied on steep slopes or areas prone to extreme wind exposure such as north- or west-facing slopes and ridge tops. Biodegradable pins will be used in place of metal staples to hold the matting in place.
- Keystone will work with landowners to evaluate fencing the right-of-way from livestock, or alternatively, provide compensation to rest a pasture until vegetation can become established. Management concerns such as livestock access to water or movement within a pasture would be incorporated as necessary.

4.15.4 Post-Construction

Keystone is committed to post-construction monitoring and repair and will monitor reclamation on the right-of-way for several years and repair

erosion and reseed poorly revegetated areas as necessary. During monitoring, landowners are informed of our efforts and intentions.

A noxious weed management plan will be established on these lands pending consultation with state and county experts

4.16 Operations and Maintenance

Operations and maintenance programs, such as vegetation management, pipeline maintenance, integrity surveys, and hydrostatic testing, may have an impact on the final reclamation of the right-of-way. To ensure 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. 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 compensating to the landowner to reclaim the area.
- Trench depressions on ditch line that may interfere with natural drainage, vegetation establishment, or land use shall be repaired as expediently as practicable by Keystone or by compensating the landowner to repair the area.
- Post-construction monitoring inspections shall be conducted after the first growing season to determine the success of revegetation, unless otherwise required by permit. 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 unless otherwise required by permit.
- 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, unless otherwise required by permit.
- 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 by any applicable plan and in conjunction with the landowner.
- Keystone shall be responsible for correcting tile line or irrigation system

repairs that fail, provided those repairs were made by Keystone. Keystone shall not be responsible for tile line or irrigation system repairs which Keystone compensated the landowner to perform.

- When requested by owners in cultivated land, Keystone shall monitor the yield of land impacted by construction with the help of agricultural specialists. If yield deficiencies are indicated compared to yields on unaffected land, 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, bushes, structures, including houses, tool sheds, 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 tenant throughout the operating life of the pipeline to allow expedient communication of issues and problems as they occur. Keystone shall provide the landowner 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. These 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 NRCS office 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 ensures 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 tiles affected by construction of the Project. A typical right-of-way layout and typical orientation for crossing drain tiles is provided in Detail 25. Typical header and main

crossovers are provided in Details 26 and 27. 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 individual private landowners and 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 on the Project'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 pipeline.

5.2.2 Privately Owned Drain Tiles

Right-of-way agents shall meet with landowners and tenants of privately owned land along the route. As a minimum, the right-of-way agents shall ascertain the data concerning drain tiles outlined in 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 or 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

The Project shall be installed at a depth of cover and elevation so as not to 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 Right-of-Way 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 if disturbed, may require 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 jump overs as depicted on Detail 26, Header/Main Crossovers of Keystone XL 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 Project. The existing header will be 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’s property by a significant quantity, thereby reducing the risk that repairs will fail.

5.3.4 Future Drain Tiles/Systems

Keystone shall attempt to determine where public agencies and private landowners or tenants are proposing to install drain tile systems in the future. 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;

- restricting the work of the pipe lower in crew if ground conditions are too wet to adequately support the heavy equipment;
- limiting travel of heavy equipment the working lane of the construction right-of-way where possible;
- limiting travel of heavy equipment to one pass over the drain tile per work crew where possible; and
- removing and replacing topsoil during drain tile replacement should tile be crushed on the working side of the right-of-way.

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, landowners, tenants, and 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 acceptable to the landowners and tenants.

5.4.2 Pipeline Contractor Repair

In the event local drain tile contractors are not available to subcontract the supervision and repair, permanent repair shall be made with the Contractor's supervision, equipment, and labor.

5.4.3 Landowner/Tenant Repair

The landowner or tenant may agree to take responsibility for the permanent repair of his drain tiles if not precluded by regulatory agency. The landowner or tenant shall be requested to ensure his ability to coordinate and complete the drain tile repair in a timely manner 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 installation so repairs can be made if necessary.

5.5.1 Temporary Repairs During Construction

Drain tiles damaged or cut during the excavation of the 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 procedure 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 county inspectors, where applicable, and the landowner or tenant. Detail 29, Permanent Repair Method of Drain Tiles, depicts the minimum materials and installation procedure 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 construction inspectors, county inspectors, as applicable, and the landowner or tenant or his representative.

Keystone shall designate inspector(s) for the sole purpose and responsibility for inspection of all repairs 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 these sources is 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 the replacement drain tile is: (1) the proper size and type; (2) installed at the proper grade; (3) properly supported and backfill beneath the drain tile is properly placed and compacted; and (4) properly tied into the existing drain tile. The inspection shall be documented on the Drain Tile Inspection Report Form.

A drain tile repair shall not be accepted until Keystone's construction inspector and the landowner or tenant or designated representative approves the inspection form.

6.0 WETLAND CROSSINGS

6.1 General

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 both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Lands shall be implemented to the extent practicable.

A dry wetland is defined in Section 6.5.1. In these wetlands, equipment can traverse the wetland without the support of mats or timber riprap.

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 environment types, supplemental support in the form of timber riprap 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 flexifloats or equivalents.

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 during construction in all areas and until permanent seeding is complete 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 and unless the USACE or other regulatory authority authorizes a greater width.

The Contractor shall locate extra work areas (such as staging areas and additional spoil storage areas) shall be 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 public roads and private roads acquired by Keystone from the landowner shown on the construction drawings.

To the extent practicable, 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.

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; and
- 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 drivable berms. Removable sediment barriers can be removed during the construction day, but shall be re-installed after construction has stopped for the day 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. All work shall be conducted in accordance with applicable permits.

- limit the duration of construction-related disturbance within wetlands to the extent practicable;

- use no more than two layers of timber riprap to stabilize the construction right-of-way;
- cut vegetation off at ground level leaving existing root systems in place and remove it from the wetland for disposal;
- limit pulling of tree stumps and grading activities to directly over the trench line unless safety concerns require the removal of stumps from the working-side of the construction ROW;
- segregate a maximum of 12 inches of topsoil from the area disturbed by trenching in dry wetlands, where practicable;
- restore topsoil to its approximate original stratum, after backfilling is complete;
- dewater the trench in a manner to prevent erosion and heavily silt-laden flowing directly into any wetland or waterbody;
- remove all timber riprap and prefabricated equipment mats upon completion of construction;
- locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable;
- prohibit storing hazardous materials, chemicals, fuels, lubricating oils, or perform concrete coating activities in a wetland, or within 100 feet of any wetland boundary;
- perform all equipment maintenance and repairs upland locations at least 100 feet from waterbodies and wetlands;
- avoid parking equipment overnight within 100 feet of a watercourse or wetland;
- prohibit washing equipment in streams or wetlands;
- install trench breakers and/or seal the trench to maintain the original wetland hydrology, where the pipeline trench may drain a wetland;
- attempt to refuel all construction equipment in an upland area at least 100 feet from a wetland boundary (otherwise follow the procedures outlined in Section 3); and
- 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.

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. 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.
- 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 riprap or timber mats; and
- 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

Where standing surface water or high groundwater levels make trenching difficult, trench widths 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. Using floatation devices, the pipe string is pushed and pulled from the extra workspace to the trench.

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. Backfill 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 and other construction debris shall be removed upon completion of construction. As much as is feasible, the Contractor shall replace topsoil and restore original contours 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 revegetation, 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.

The Contractor shall not use fertilizer, lime, or mulch in wetlands unless required in writing by the appropriate land management agency.

All wetland areas within conservation lands or easements will be restored to a level consistent with any additional criteria established by the relevant managing agency.

7.0 WATERBODIES AND RIPARIAN AREAS

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 areas delineated as jurisdictional natural or artificial stream, river, or drainage, 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, to the extent practicable, shall implement the provisions of both Section 6 - Wetland Crossings and Section 7 - Waterbodies and Riparian Areas.

The Contractor shall supply and install advisory signs in a readily visible location along the construction right-of-way at 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 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. All equipment maintenance and repairs will be performed in upland locations at least 100 feet from waterbodies and wetlands. All equipment parked overnight shall be at least 100 feet from a watercourse or wetland, if possible. Equipment shall not be washed in streams or wetlands.

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. Keystone will complete site-specific

crossing plans for certain waterbody crossings if required by the applicable regulatory agencies during federal or state permitting processes.

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 water's edge 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 shall be installed at all flowing waterbodies and as directed by the Keystone EI. Equipment crossings shall be constructed as described in Details 16, 17
and/or 18.

Equipment crossings shall be perpendicular to drainage bottoms wherever possible.

Erosion and sediment control barriers will be installed and maintained around vehicle access points as necessary to prevent sediment from reaching the waterway.

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, 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 work 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, the culvert shall be of sufficient length to convey the stream flow through the construction zone.

The Contractor shall maintain equipment bridges to prevent 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, and the expected time and duration of construction) at the time of crossing. Construction will involve dry-ditch techniques at crossings where the timing of construction does not adequately protect environmentally sensitive waterbodies, as determined by the appropriate regulatory authority. Where required, horizontal directional drilling (HDD) will be used at designated major and sensitive waterbodies crossings. 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 Stream Crossing – Dry Flume Method - (Detail 13)
- Flowing Stream Crossing – Dry Dam-and-Pump Method - (Detail 14)
- Horizontal Directional Drill Crossing - (Detail 15)
- Horizontal Bore Crossing - (Detail 21)

In conjunction with the appropriate jurisdictional agency, Keystone will develop specific crossing plans for major water bodies that contain recreationally or commercially important fisheries, or are classified as special use. Keystone will consult with state fisheries agencies with respect to applicable construction windows for each crossing and develop specific construction and crossing methods for open cuts in conjunction with USACE permitting and USFWS consultation.

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 (Detail 12) 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 Stream 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, 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.
- 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 Stream 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 to maintain 1.5 times the flow present in the stream at the time of construction;

- at least one back up pump available on site;
- dams 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 installed;
- streambed scour 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 as permitted by the appropriate regulatory authority at a Keystone-approved location. Disposal options may include spreading over the construction right-of-way in an upland location approved by Keystone or 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 waterbody crossings 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 whenever 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. To the extent practicable, grubbing shall be limited to the ditch line plus an appropriate width to accommodate safe vehicle access and the crossing.

7.7 Temporary Erosion and Sediment Control

The Contractor shall install and maintain 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 and maintain 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 may be used for intermittent and major waterbodies with steep stream banks.

The trench shall be closely inspected to confirm that the specified cover and 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 suitable negative buoyancy control, 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 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 is complete, 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 Contractor will restore the contours of the bed and banks of all waterways immediately after pipe installation and backfill, except over the travel lane. Travel lanes and bridges may stay in place until hydrostatic testing and cleanup are complete. All materials used to support construction activities will be removed from waterbodies and wetlands, including, but not limited to, flumes, mats, plastic sheeting, and sandbags.

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 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 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 permits for hydrostatic test water. The Contractor shall keep water withdrawal/discharge permits 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. Keystone will obtain water samples for analysis from each source before filling the pipeline. In addition, water samples will be taken prior to discharge of the water, as required by state and federal permits.

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; and
- name of person taking sample.

Staging/work areas for filling the pipeline with water will be located a minimum of 100 feet from the waterbody or wetland boundary if topographic conditions permit. The Contractor will install temporary sediment filter devices adjacent to all streams to prevent sediments from leaving the construction site.

The Contractor shall screen the intake hose to prevent the entrainment of fish or debris. The hose shall be kept at least 1 foot 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.

During hydrostatic test water withdrawals, the Contractor will maintain adequate flow rates in the waterbody to protect aquatic life and provide for downstream uses, in compliance with regulatory and permit requirements.

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.

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 pre-tests 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 back flushing 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 back flush valve on the filter closed during the filling operation. The Contractor shall be responsible for the proper disposal of materials back flushed from the filter or filter cartridges. The Contractor shall not be allowed to back flush the filter into the stream or other water source.

During water-filling of the pipeline, the Contractor shall employ 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 follows:

Nominal OD	Max GPM
36”	3000

The Contractor shall maintain flow rates as necessary to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

In areas where zebra mussels are known to occur, all equipment used during the hydrostatic test withdrawal and discharge will be thoroughly cleaned before being used at subsequent hydrostatic test locations to prevent the transfer of zebra mussels or their larvae (veligers) to new locations.

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.

To avoid impacts from introduced species, no inter-basin transfers (discharge) of hydrostatic test water will occur.

The discharge operation will be monitored and water samples will be taken prior to the beginning of the discharge to ensure that it complies with the Project and permit requirements. If required by state permits, additional water quality testing will be conducted during discharge, in accordance with permit conditions.

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 devices, 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 of 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" outside diameter) 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 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. Additional best management practices, such as the use of plastic sheeting or other material to prevent scour, will be used as necessary to prevent excessive sedimentation during dewatering.

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. A dewatering filter bags may be sued as an alternative to show bale dewatering structures. A dewatering filter bag is shown in Detail 5.

Typical Drawing Index

NOTE: **The following typical drawings are included for ease of reference.**

- Details 1 through 31 can be found in the Construction Mitigation and Reclamation Plan

REVISIONS
01 2008-11-05 REVISED TITLES, ADDED/DEL. DETAILS
02 2010-10-08 REVISED TITLES
03 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT
FIA # 4359 | CHAINAGE: | DISCIPLINE # 03
TITLE: DETAIL INDEX
SCALE N.T.S. | DWG No 4359-03-ML-00-700 | REV 03

TC_A4_BR.DWG 8.5X11

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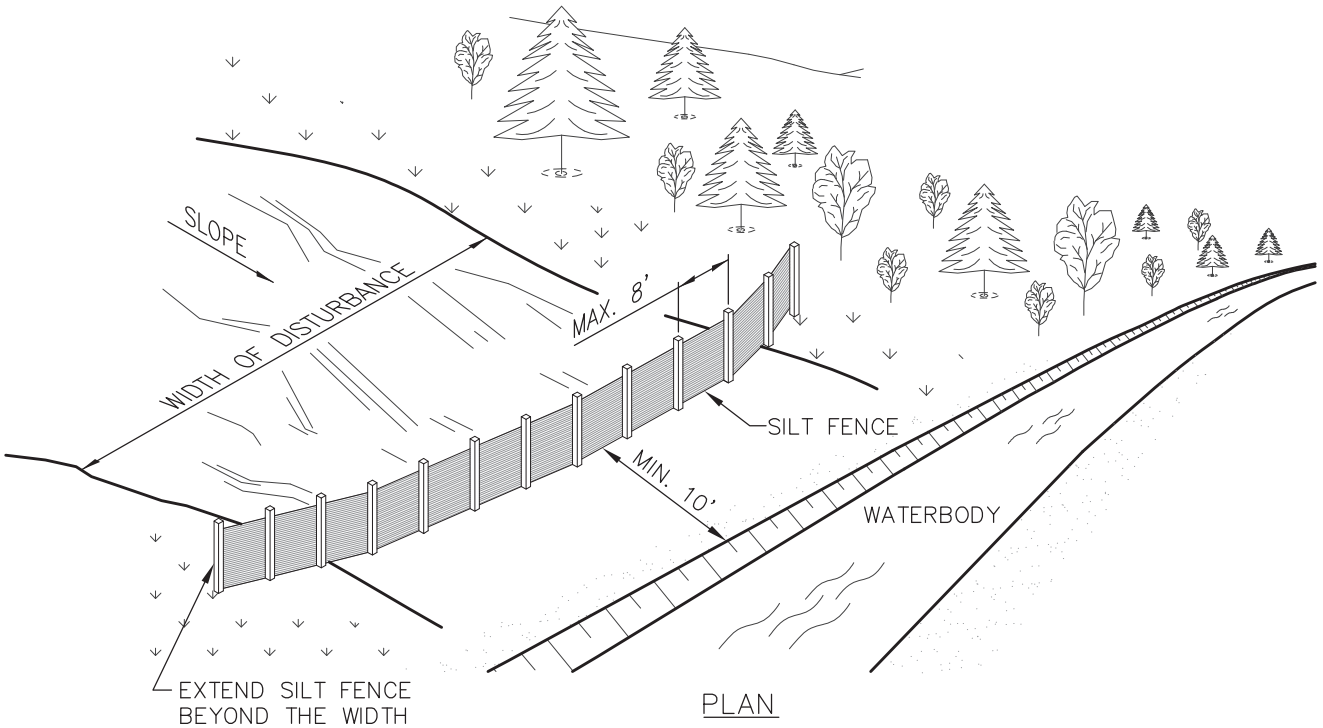

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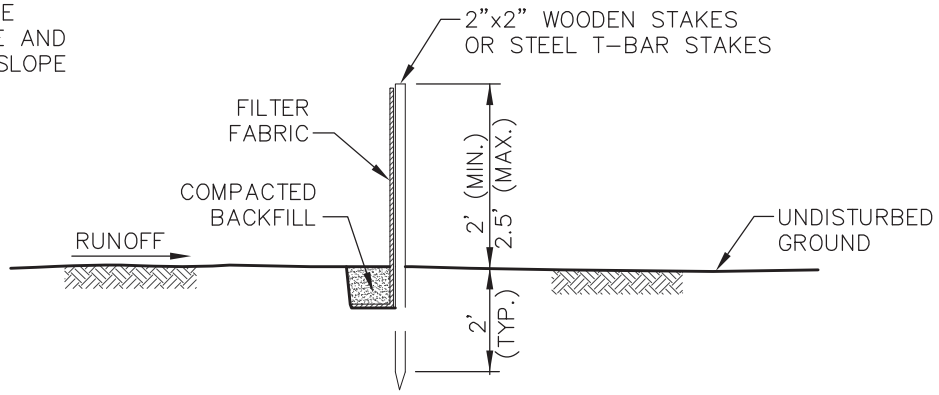

SECTION "A-A"

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"x2" 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. REPLACE DAMAGED OR INEFFECTIVE SILT FENCE AS SOON AS POSSIBLE.
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 THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008-11-04 UPDATED DRAWING NOTES
02 2010-10-08 UPDATED DRAWING NOTES
03 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 1
TYPICAL SILT FENCE BARRIER

SCALE	DWG No	REV
N.T.S.	4359-03-ML-05-701	03

TC_A4_BR.DWG 8.5X11

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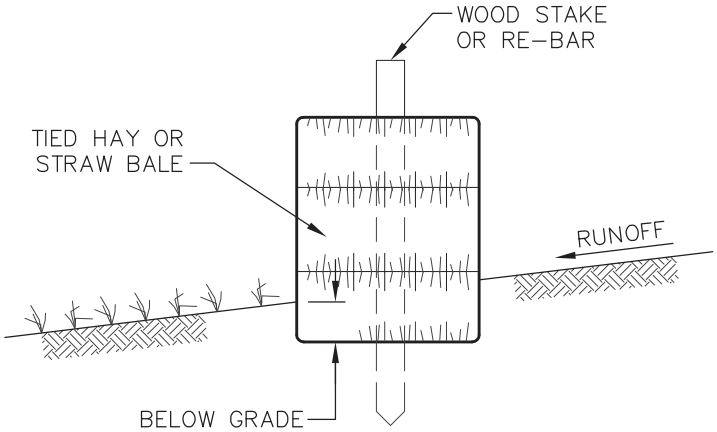
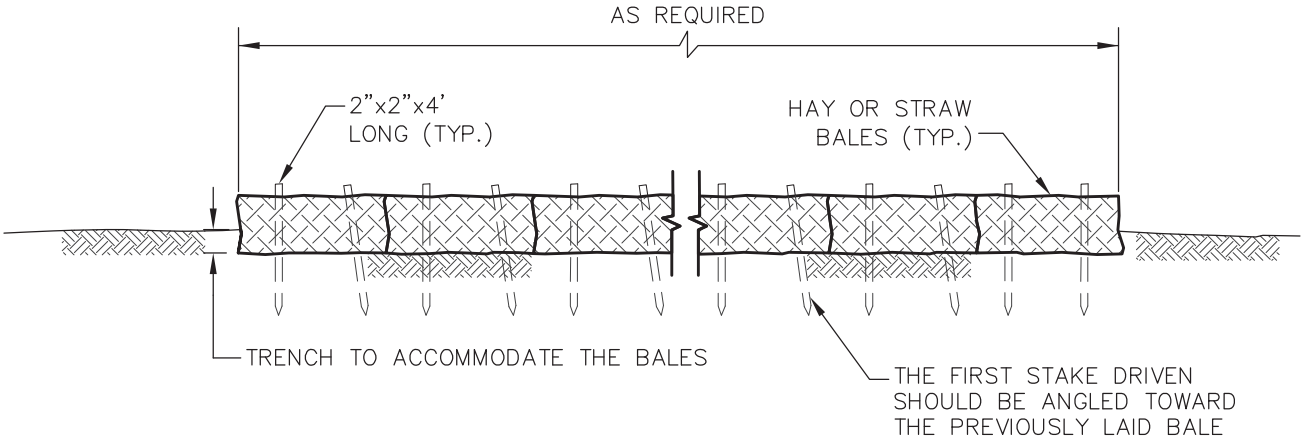


SECTION



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 AS SOON AS POSSIBLE. PAY CLOSE ATTENTION TO THE REPAIR OF DAMAGED BALES, END RUNS AND UNDERCUTTING BENEATH BALES.
5. INSTALLATION TO BE MODIFIED BY THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008-11-04 UPDATED DRAWING NOTES
02 2010-10-08 UPDATED DRAWING NOTES
03 2010-10-11 UPDATED DRAWING NOTES

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KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 2
TYPICAL STRAW OR HAY BALE BARRIER

SCALE	DWG No	REV
N.T.S.	4359-03-ML-05-702	03

TC_A4_BR.DWG 8.5X11

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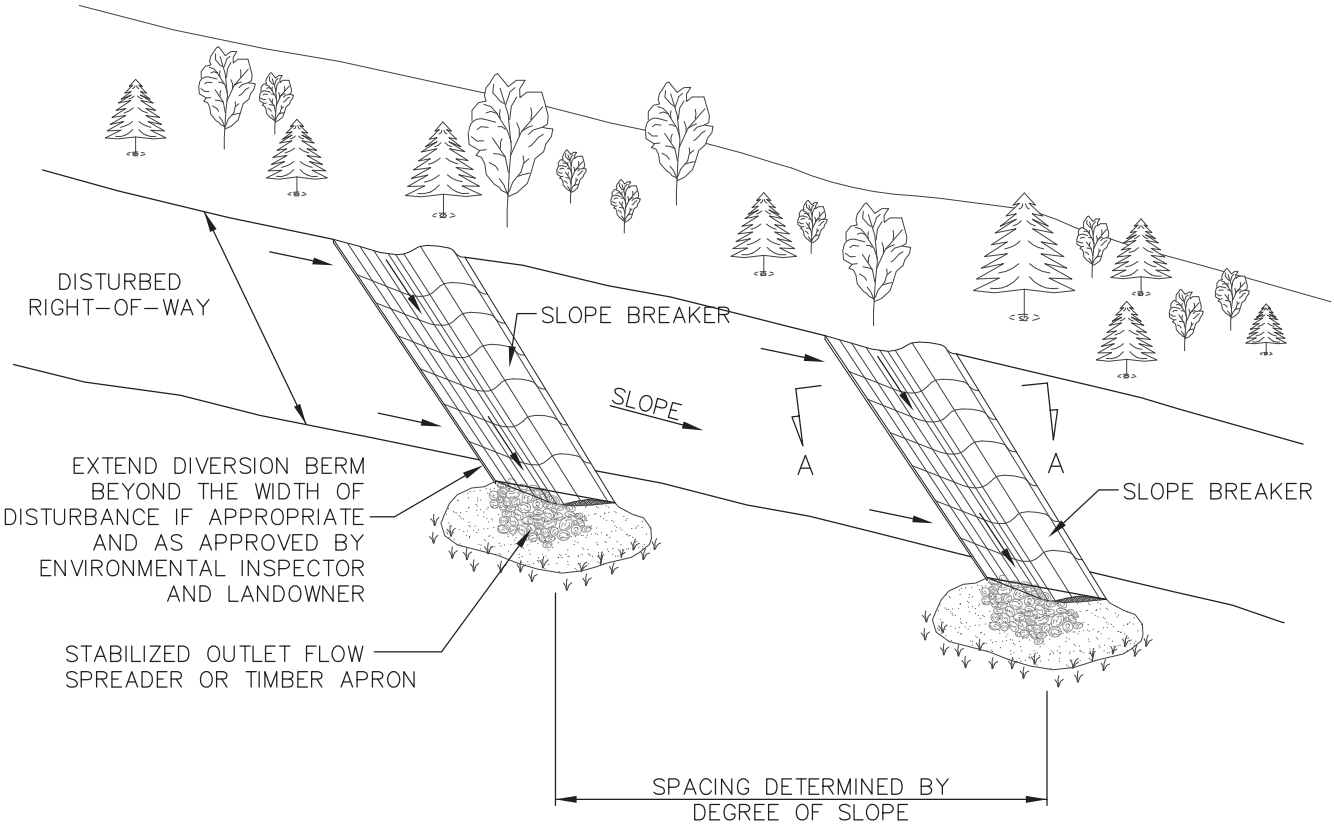

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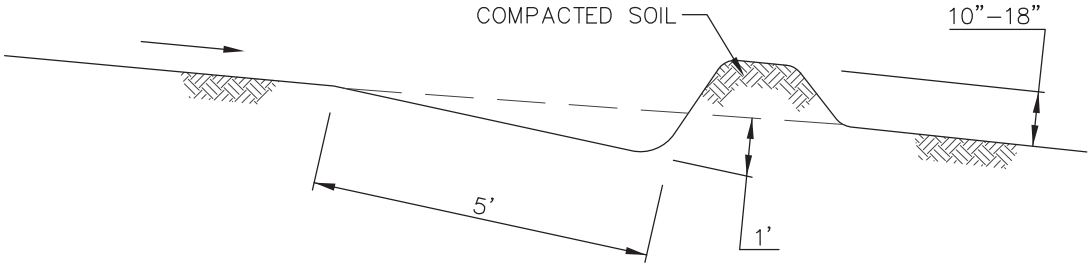

NOTES:

1. PERMANENT SLOPE BREAKERS TO PROVIDE POSITIVE DRAINAGE TO A STABILIZED OUTLET.
2. INSTALLATION SPECIFICATIONS TO BE MODIFIED BY THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.
3. THE CONTRACTOR SHALL INSTALL TEMPORARY AND PERMANENT SLOPE BREAKERS ON SLOPES GREATER THAN APPROXIMATELY 5% ON ALL DISTURBED LANDS AT THE FOLLOWING RECOMMENDED SPACING:

SLOPE (%)	SPACING (FEET)
5-15	300
>15-30	200
>30	100

REVISIONS
01 2008-11-04 MODIFIED DRAWING NOTES
02 2010-10-08 UPDATED DRAWING NOTES
03 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 3
TEMPORARY/PERMANENT SLOPE BREAKER DETAIL
(WATER BARS)

SCALE	DWG No	REV
N.T.S.	4359-03-ML-05-703	03

TC_A4_BR.DWG 8.5X11

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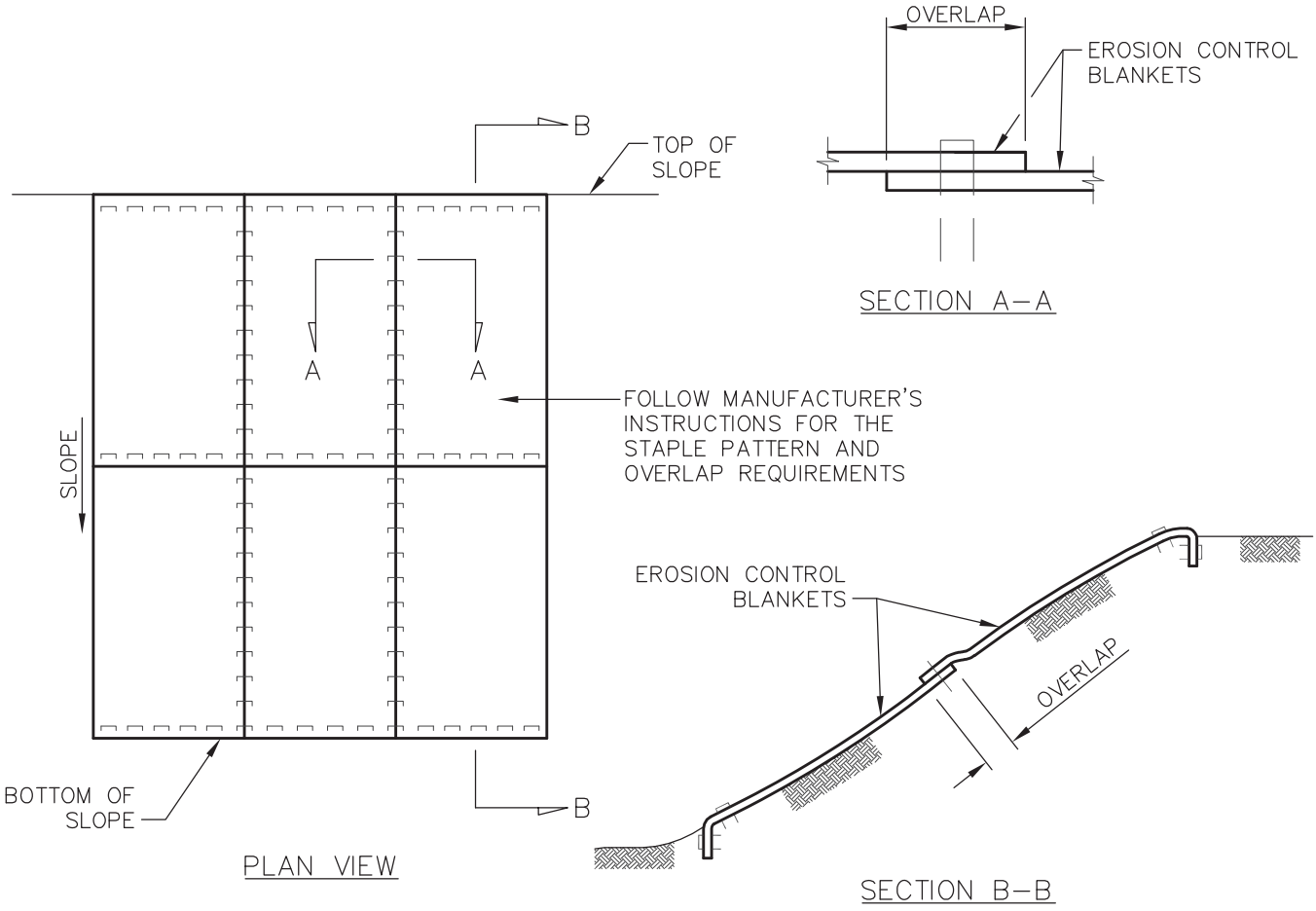

NOTES:

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 OR BIO–DEGRADEABLE PINS CAN BE USED WHERE SPECIFIED BY THE COMPANY.
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 THE PROJECT AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 4
EROSION CONTROL MATTING INSTALLATION

SCALE	DWG No	REV
N.T.S.	4359–03–ML–05–704	03

TC_A4_BR.DWG 8.5X11

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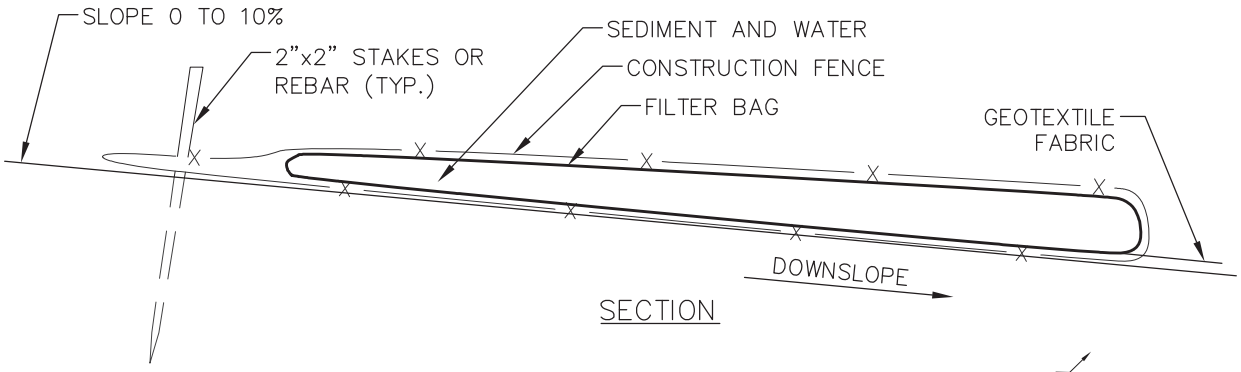

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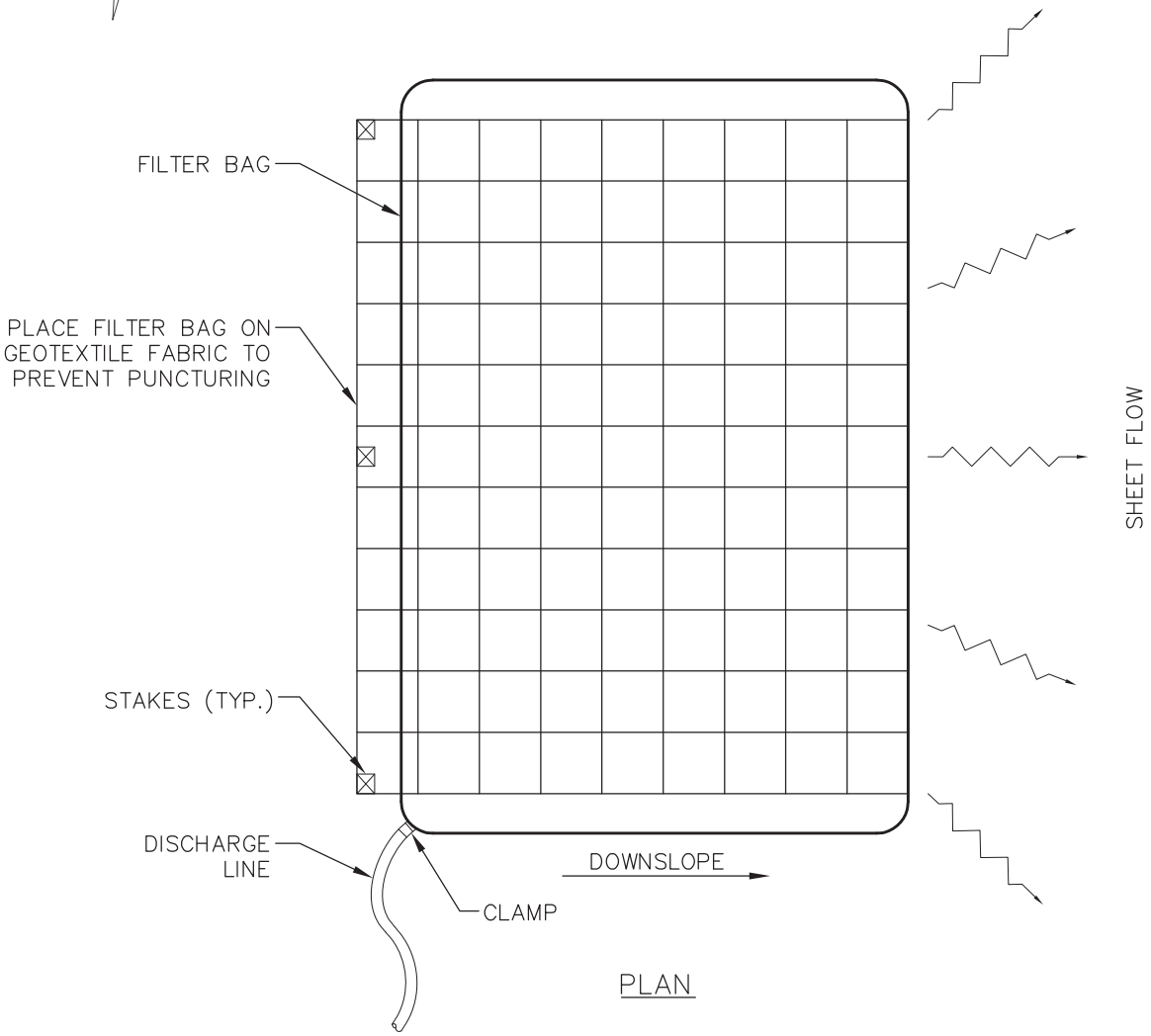

PLAN

NOTES:

1. MANUFACTURED NONWOVEN (FELT) 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 AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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01 2008-11-04 MODIFIED DRAWING NOTES
02 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 5
TYPICAL DEWATERING FILTER BAG

SCALE	DWG No	REV
N.T.S.	4359-03-ML-05-705	02

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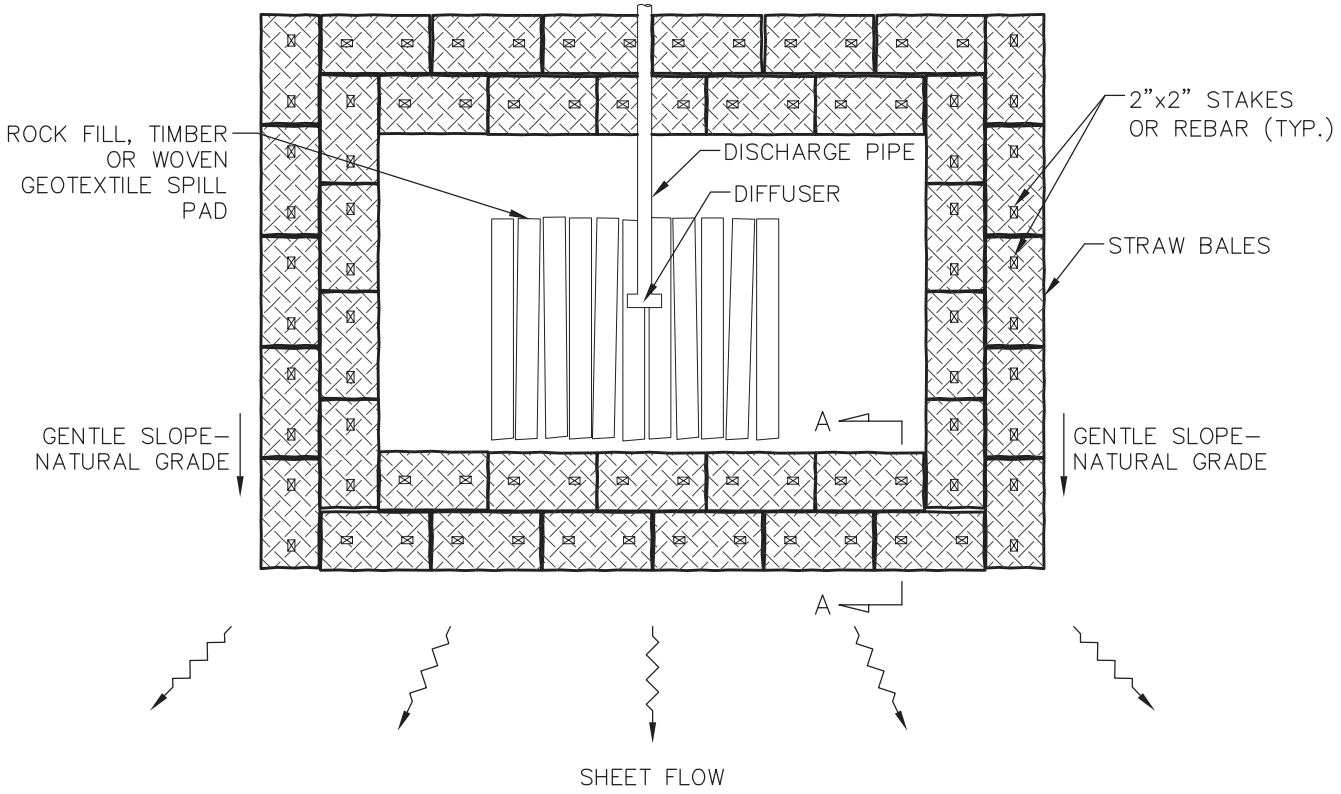

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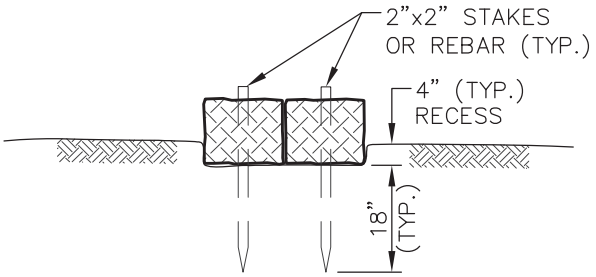

SECTION A–A

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 AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008-11-04 MODIFIED DRAWING NOTES
02 2010-10-08 UPDATED DRAWING NOTES
03 2010-10-11 UPDATED DRAWING NOTES

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DESIGNER: JMP (NAME) 2010-10-21 (DATE)
CHECKED BY: WSF
DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 6
TYPICAL STRAW BALE DEWATERING STRUCTURE

SCALE	DWG No	REV
N.T.S.	4359–03–ML–05–706	03

TC_A4_BR.DWG 8.5X11

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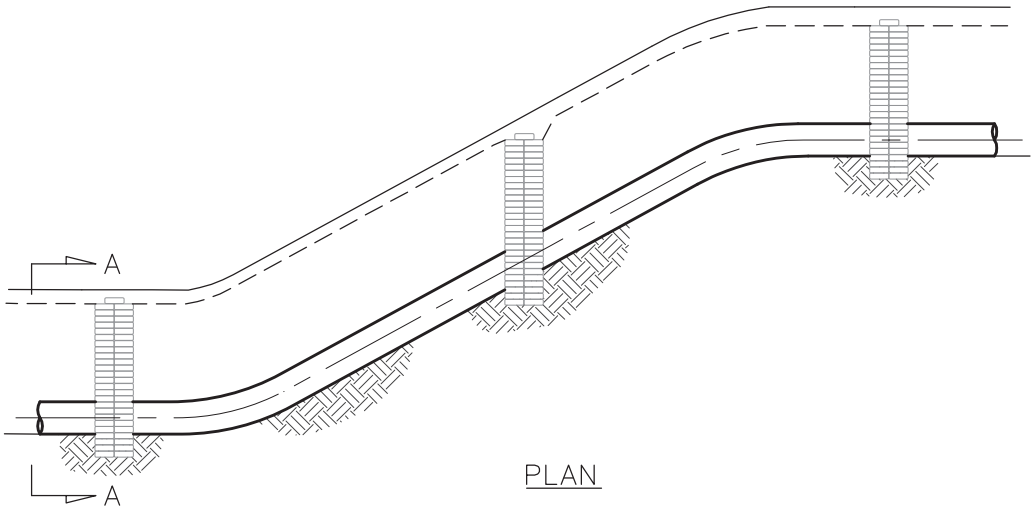
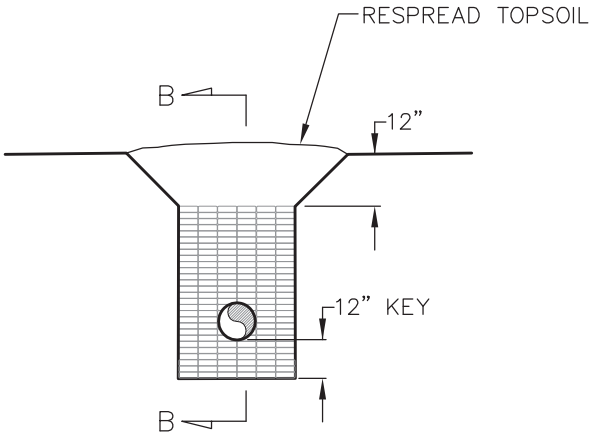
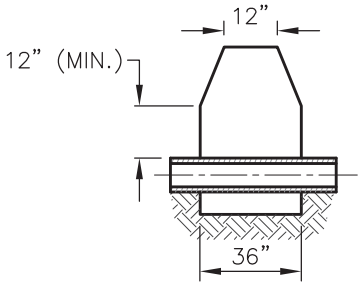


PLAN



SECTION A–A



SECTION B–B

NOTES:

1. TRENCH BREAKERS TO BE INSTALLED AS SHOWN ON THE CONSTRUCTION DRAWINGS, WHERE DESCRIBED IN THE PLAN, AND AS DIRECTED.
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 AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.
6. TRENCH BREAKERS SHALL BE INSTALLED SUCH THAT THE TOP OF EACH DOWNSLOPE BREAKER IS ABOVE THE BOTTOM OF THE NEXT UPSLOPE BREAKER.

REVISIONS
01 2008-11-04 UPDATED DRAWING NOTES
02 2010-10-11 UPDATED PLAN DETAIL

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DESIGNER: JMP (NAME) 2010-10-21 (DATE)	KEYSTONE XL PROJECT		
	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 7 TYPICAL PERMANENT TRENCH BREAKER		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-05-707 REV 02

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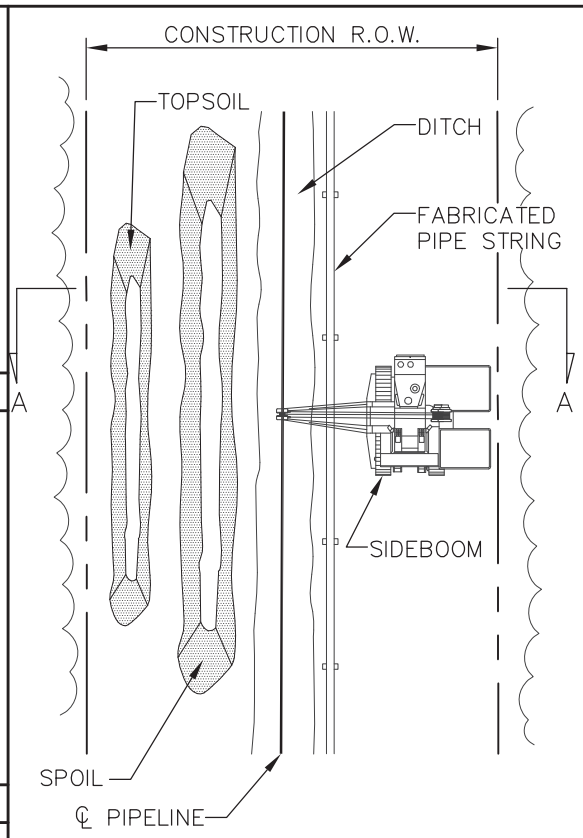
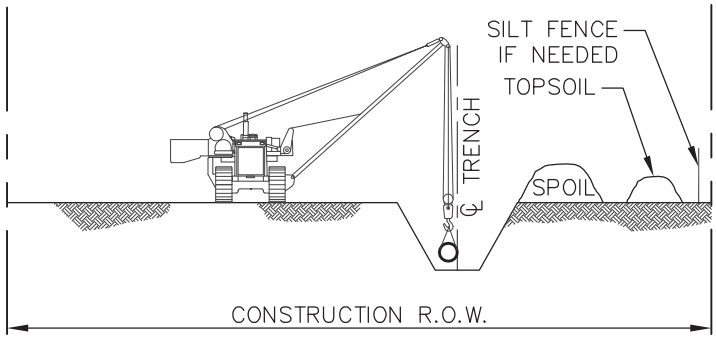


PLAN VIEW



SECTION "A–A"

CONSTRUCTION PROCEDURES:

1. IF THE WETLAND IS BEING CULTIVATED AND 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 THE PROJECT'S SPILL PREVENTION PROCEDURES.
4. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
5. DO NOT TRENCH WETLAND UNTIL PIPE IS READY TO INSTALL.
6. 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.
7. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT DOWN SLOPE EDGE OF RIGHT–OF–WAY ALONG WETLAND EDGE IF NEEDED TO CONTAIN SPOIL WITHIN RIGHT–OF–WAY.
8. RESTRICT ROOT GRUBBING TO ONLY THAT AREA OVER THE DITCHLINE AND REMOVE STUMPS FROM WETLAND FOR DISPOSAL.
9. CONDUCT TRENCH LINE TOPSOIL STRIPPING (IF TOPSOIL IS NOT SATURATED). SALVAGE TOPSOIL TO ACTUAL DEPTH OR A MAXIMUM DEPTH OF 12 INCHES.
10. TRENCH THROUGH WETLANDS.
11. PIPE SECTION TO BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
12. LOWER–IN PIPE. PRIOR TO BACKFILLING TRENCH, IF REQUIRED, TRENCH PLUGS SHALL BE INSTALLED AS REQUIRED. BACKFILL TRENCH.
13. RESTORE GRADE TO NEAR PRE–CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL AND INSTALL PERMANENT EROSION CONTROL.
14. IF UTILIZED, REMOVE TIMBER MATS OR PRE–FABRICATED MATS FROM WETLANDS UPON COMPLETION.
15. IN THE ABSENCE OF A DETAILED REVEGETATION PLANS, APPLY A TEMPORARY COVER CROP AS DIRECTED BY KEYSTONE.

REVISIONS
01 REVISED NOTES 3 & 4
02 2010–10–08 UPDATED DRAWING NOTES
03 2010–10–11 UPDATED DRAWING NOTES

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DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359	CHAINAGE:	DISCIPLINE # 03

TITLE: DETAIL 8
"DRY" WETLAND CROSSING METHOD

SCALE N.T.S.	DWG No 4359–03–ML–03–701	REV 03

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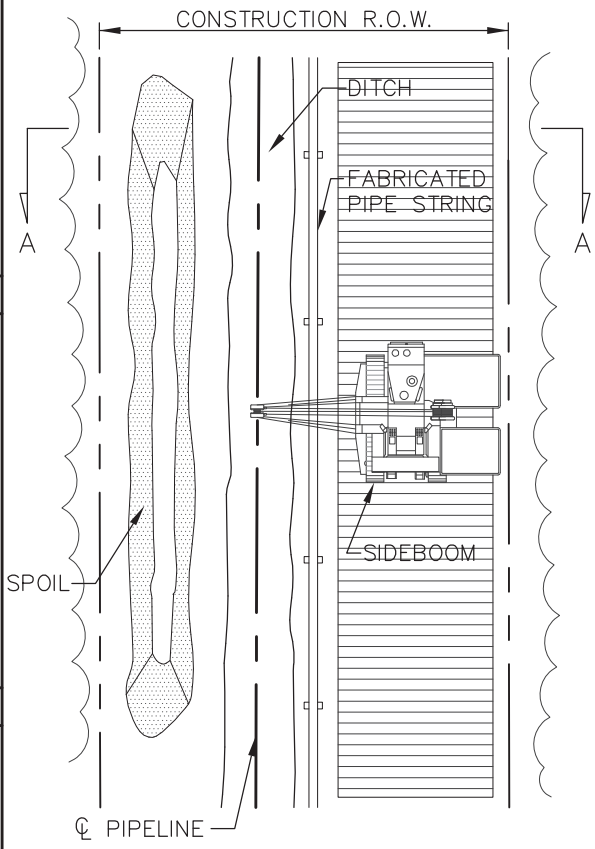
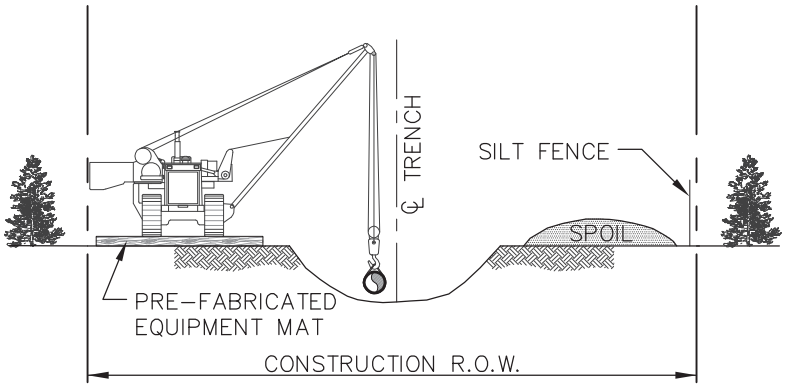


PLAN VIEW



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 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY IF DIRECTED BY THE PROJECT.
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. AVOID 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 REMOVED FROM WETLAND FOR DISPOSAL.
7. DO NOT TRENCH WETLAND UNTIL PIPE IS READY TO INSTALL.
8. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
9. LEAVE HARD PLUGS AT EDGE OF WETLAND UNTIL JUST PRIOR TO TRENCHING.
10. PIPE SECTION MAY BE FABRICATED WITHIN THE WETLAND AND ADJACENT TO ALIGNMENT, OR IN STAGING AREA OUTSIDE THE WETLAND AND WALKED IN.
11. TRENCH THROUGH WETLANDS.
12. LOWER-IN PIPE, INSTALL TRENCH PLUGS AT WETLAND EDGES AS REQUIRED AND BACKFILL IMMEDIATELY.
13. REMOVE TIMBER MATS OR PRE-FABRICATED MATS FROM WETLAND UPON COMPLETION.
14. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY, REPLACE TOPSOIL IF SALVAGED AND INSTALL PERMANENT EROSION CONTROL.

REVISIONS
01 REVISED NOTES 2 & 3
02 2010-10-11 UPDATED DRAWING NOTES

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DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 9
STANDARD WETLAND CROSSING METHOD

SCALE	DWG No	REV
N.T.S.	4359-03-ML-03-702	02

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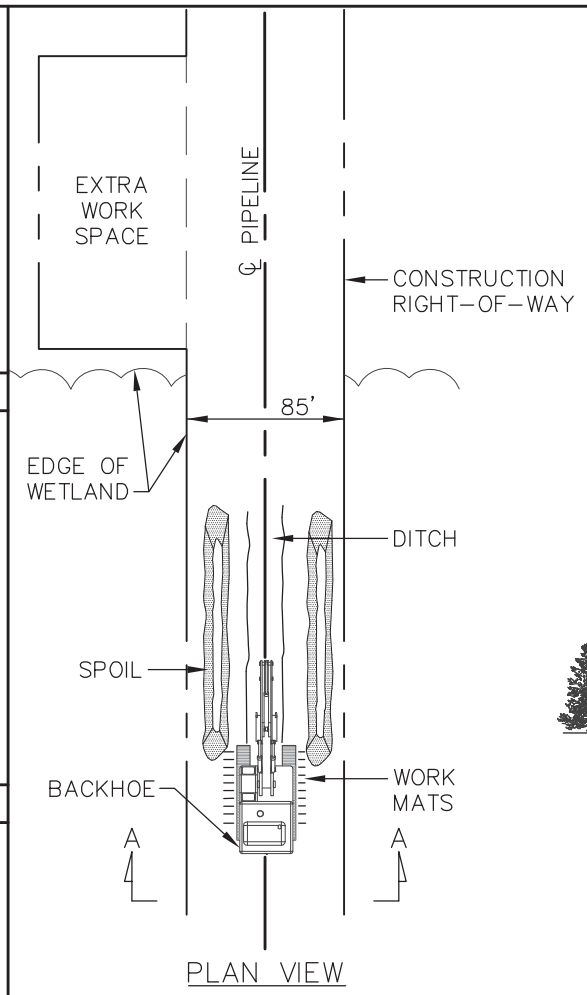
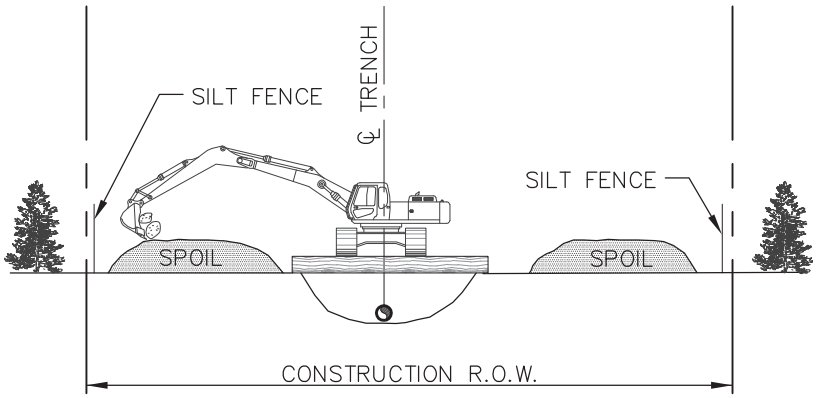


PLAN VIEW



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 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY AS DIRECTED BY THE PROJECT.
4. RESTRICT ROOT GRUBBING TO ONLY THE AREA OVER THE DITCHLINE.
5. DO NOT TRENCH WETLAND UNTIL PIPE IS READY TO INSTALL.
6. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
7. 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.
8. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT EDGE OF RIGHT–OF–WAY AND ALONG WETLAND EDGE IF PRACTICAL.
9. FABRICATE PIPE IN STAGING AREA OUTSIDE THE WETLAND IN THE EXTRA WORK SPACE AS INDICATED ON THE CONSTRUCTION DRAWINGS.
10. LEAVE HARD PLUGS AT THE EDGE OF THE WETLAND UNTIL JUST PRIOR TO PIPE PLACEMENT.
11. FLOAT PIPE IN PLACE, LOWER–IN, INSTALL TRENCH PLUGS AT WETLAND EDGES WHERE REQUIRED AND BACKFILL IMMEDIATELY.
12. REMOVE TIMBER MATS OR PRE–FABRICATED MATS OF NON–NATIVE MATERIAL FROM WETLANDS UPON COMPLETION.
13. RESTORE GRADE TO NEAR PRE–CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.
14. THE CONSTRUCTION RIGHT–OF–WAY FOR THIS TYPE OF CONSTRUCTION SHALL BE 85 FEET.

REVISIONS
01 REVISED NOTES 2, 3 & 13
02 2010–10–11 UPDATED DRAWING NOTES

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	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 10 PUSH/PULL WETLAND CROSSING METHOD		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359–03–ML–03–703 REV 02

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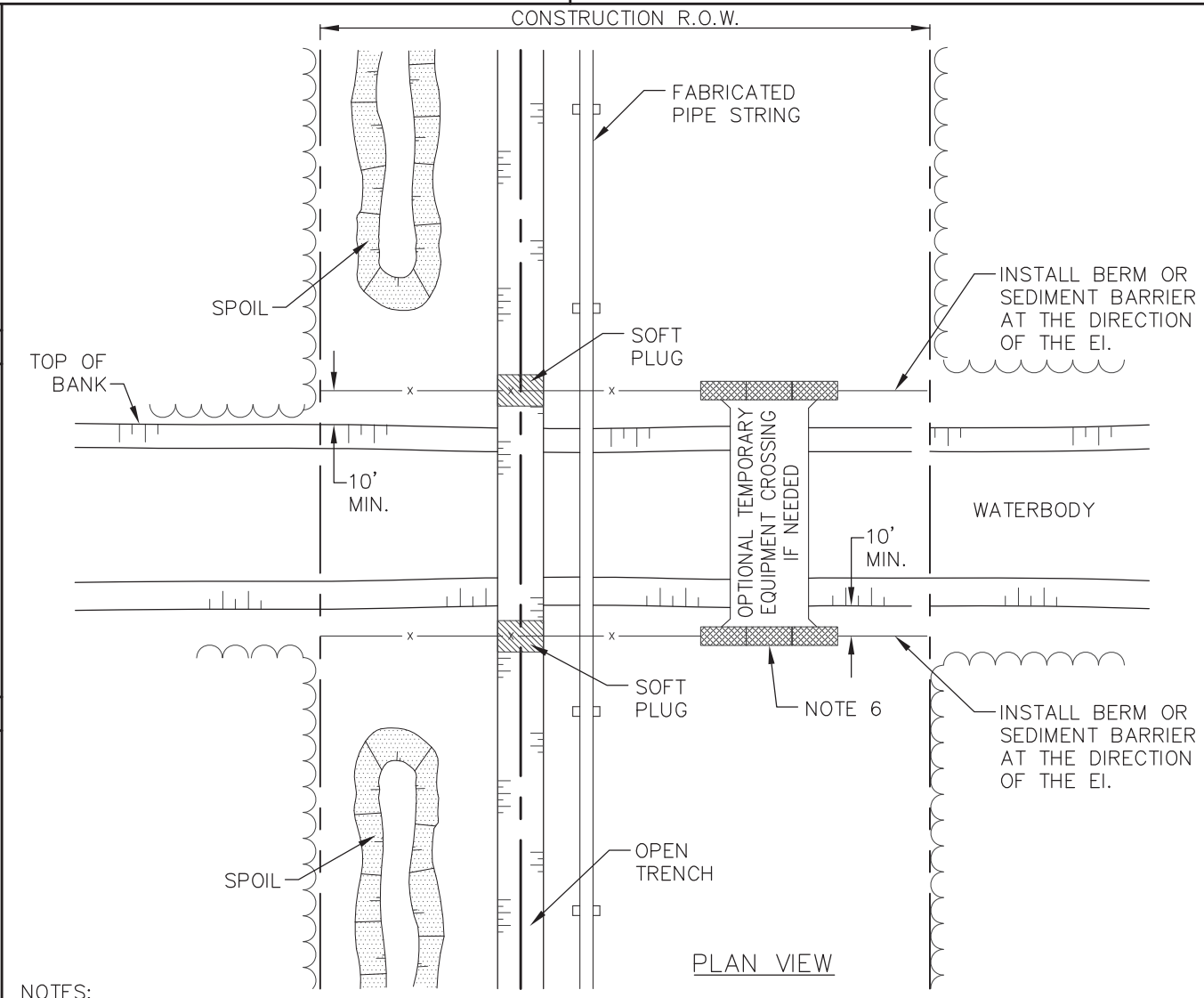

NOTES:

1. THIS METHOD APPLIES TO DRY WASHES, SWALES, INCISED DRAINAGES AND DITCHES WITH NO PERCEPTIBLE FLOW AT TIME OF CROSSING. IF FLOWS ARE PRESENT DURING CONSTRUCTION REFER TO DETAIL 12. CLEARING AND GRADING, TOPSOIL SALVAGE AND TOPSOIL STRIPPING DEPTHS SHALL BE THE SAME AS INDICATED FOR ADJACENT UPLAND UNLESS OTHERWISE DIRECTED BY KEYSTONE.
2. EI TO FLAG THE ORDINARY HIGH WATER MARK (OHWM) PRIOR TO CLEARING.
3. INSTALL SILT FENCE OR A BERM AT DIRECTION OF KEYSTONE EI TO PREVENT RUNOFF FROM ROW TO ADJACENT, UNDISTURBED DRAINAGE.
4. STOCKPILE TOPSOIL AND SPOIL SEPARATELY. TOPSOIL SHALL NOT BE STOCKPILED ACROSS THE DRAINAGE CHANNEL AND SHALL BE PLACED A MINIMUM OF 15 FEET FROM THE OHWM OR TO SUIT CONDITIONS AND PROTECT THE DRAINAGE AS DETERMINED BY KEYSTONE.
5. INSTALL TEMPORARY SLOPE BREAKERS WHERE IDENTIFIED BY THE EI.
6. TRENCH, STRING PIPE, AND BACKFILL USING STANDARD UPLAND CONSTRUCTION PROCEDURES UNLESS OTHERWISE DIRECTED BY KEYSTONE.
7. RESTORE WATERCOURSE CHANNEL AND BANKS (EXCEPT TRAVEL LANE IF USED) TO APPROXIMATE PRE-CONSTRUCTION PROFILE IMMEDIATELY AFTER PIPE IS LOWERED IN AND BACKFILLED. INSTALL PERMANENT EROSION CONTROLS WHERE DIRECTED BY KEYSTONE.
8. REMOVE ANY TEMPORARY CROSSING STRUCTURES AND/OR GRAVEL.

REVISIONS
01 UPDATED DRAWING NOTES
02 2010-10-08 UPDATED DRAWING NOTES
03 2010-10-11 UPDATED DRAWING NOTES

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JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	TITLE: DETAIL 11 TYPICAL OPEN CUT WET CROSSING METHOD NON-FLOWING WATERBODY		
		SCALE N.T.S.	DWG No 4359-03-ML-03-704	REV 03

TC_A4_BR.DWG 8.5X11

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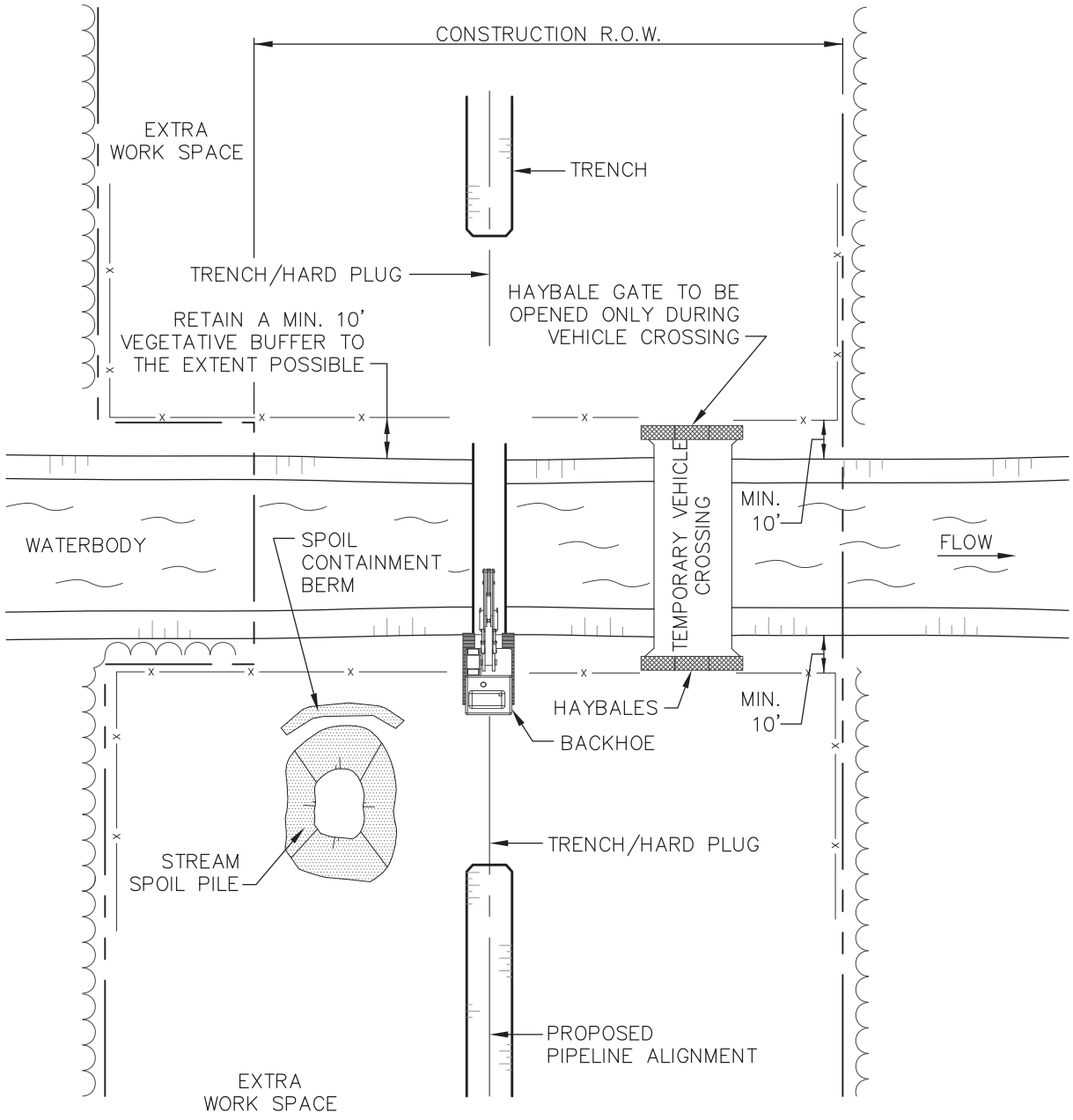

PLAN VIEW

REVISIONS | 01 | UPDATED DRAWING NOTES | 02 | 2010-10-11 REVISED TITLE BLOCK

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	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 12 TYPICAL OPEN CUT WET CROSSING METHOD FLOWING WATERBODY		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-03-705 REV 02

TC_A4_BR.DWG 8.5X11

CADD DRAWING: DO NOT MAKE MANUAL REVISIONS

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 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 PRE-CONSTRUCTION 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.

REVISIONS | 01 | 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 12A
TYPICAL OPEN CUT WET CROSSING METHOD
FLOWING WATERBODY – CONSTRUCTION PROCEDURES

SCALE	DWG No	REV
N.T.S.	4359-03-ML-03-706	01

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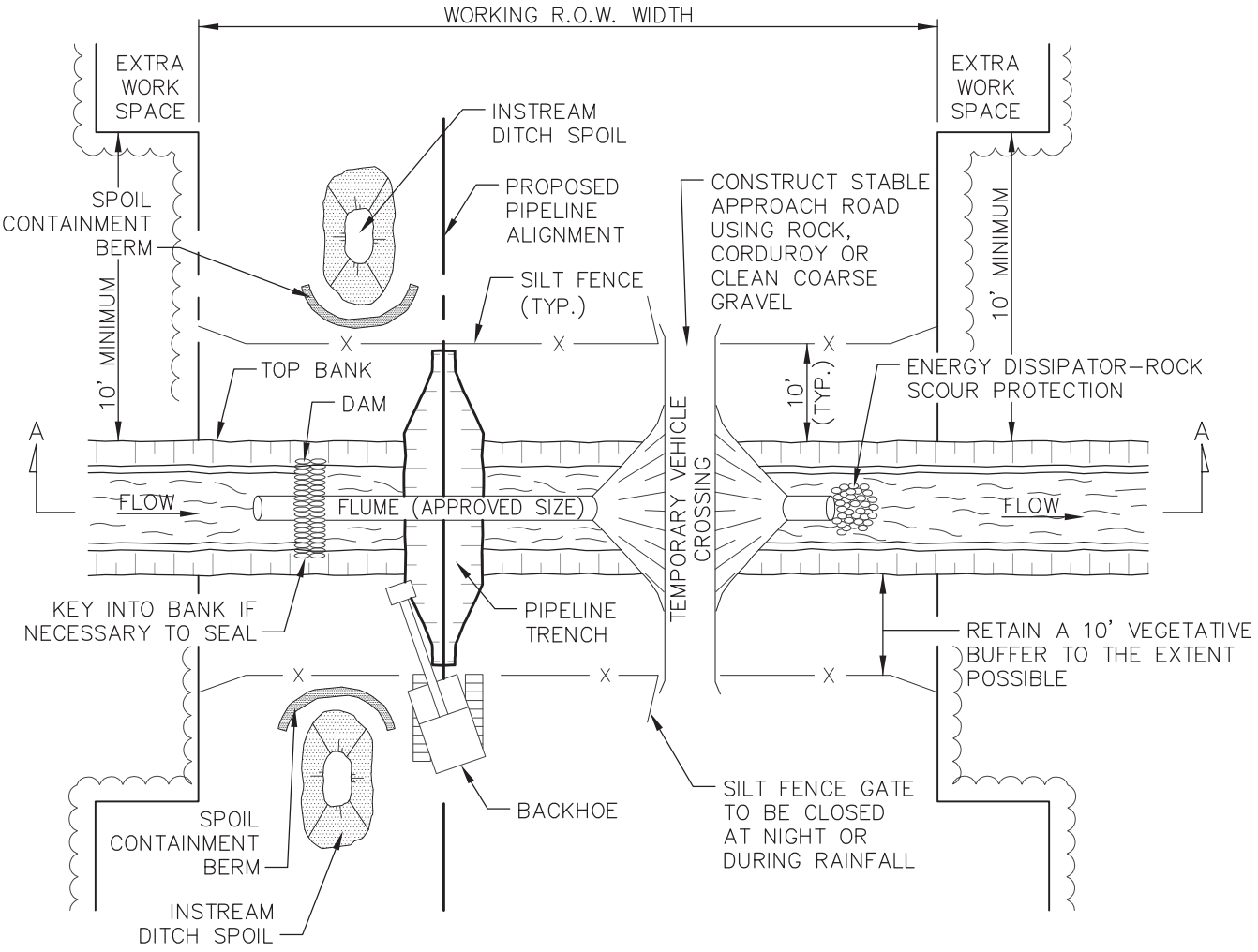
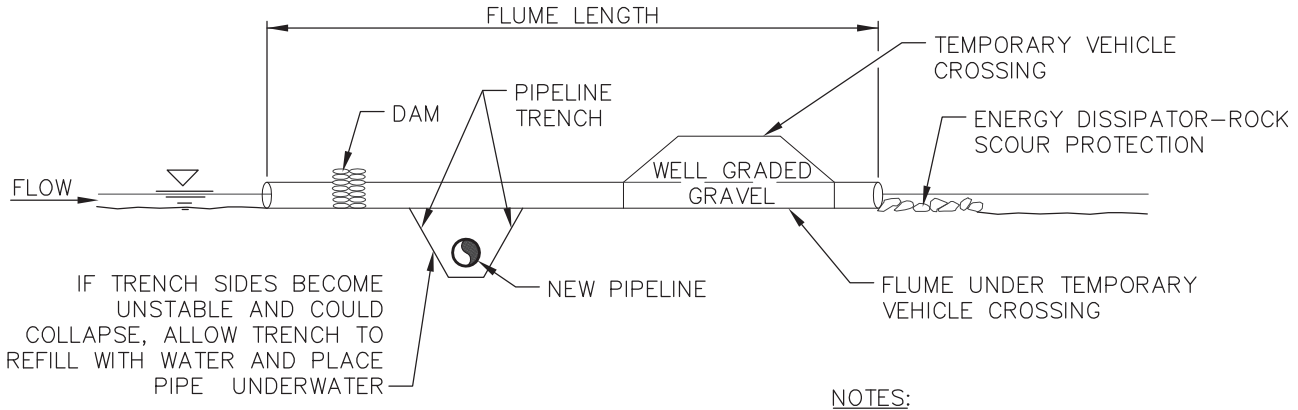


PLAN VIEW



SECTION A-A

NOTES:

1. PIPELINE PLACEMENT WITHIN RIGHT-OF-WAY CONCEPTUAL ONLY.
2. SEE DETAIL 13A FOR CONSTRUCTION PROCEDURES.

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DESIGNER: JMP (NAME) 2010-10-21 (DATE)

CHECKED BY: WSF

DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE

DETAIL 13
TYPICAL DRY FLUME CROSSING METHOD

SCALE N.T.S. | DWG No 4359-03-ML-03-707 | REV 01

TC_A4_BR.DWG 8.5X11

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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 MEASURE 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.
8. 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.)
9. 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.
   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 THE 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 STREAMBED 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.

REVISIONS
01 REVISED TITLE
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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE
DETAIL 13A
TYPICAL DRY FLUME CROSSING METHOD – CONSTRUCTION PROCEDURES

SCALE N.T.S. | DWG No 4359-03-ML-03-708 | REV 02

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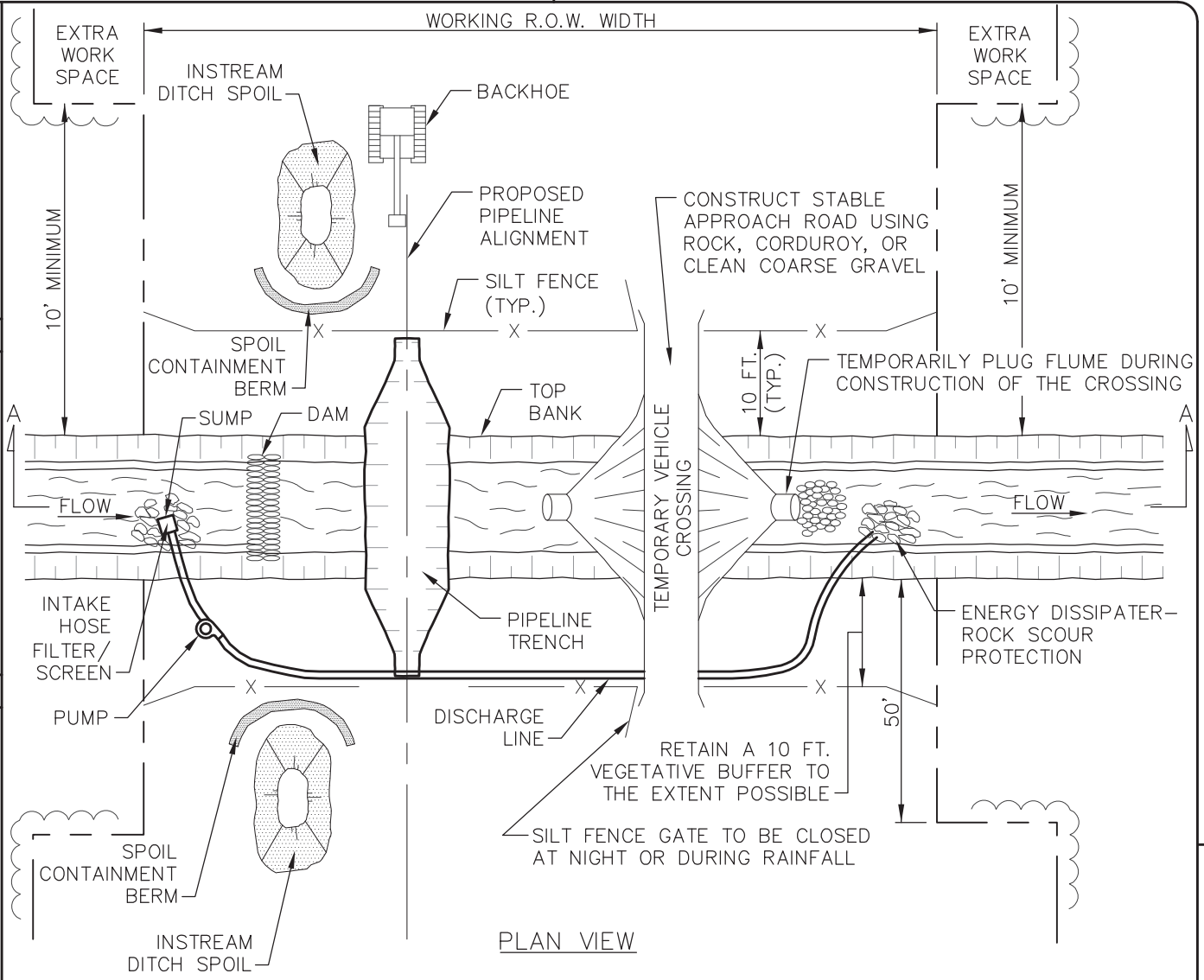

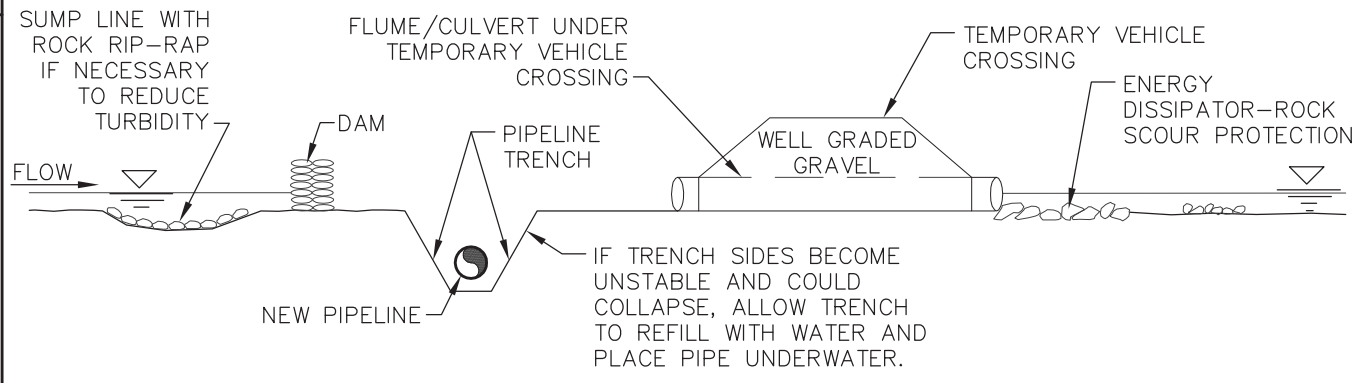

NOTES:

1. PIPELINE PLACEMENT WITHIN RIGHT-OF-WAY CONCEPTUAL ONLY.
2. SEE DETAIL 14A FOR CONSTRUCTION PROCEDURES.

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE

DETAIL 14
TYPICAL DAM AND PUMP CROSSING

SCALE N.T.S. | DWG No 4359-03-ML-03-709 | REV 01

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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 DISSIPATER 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 DISSIPATER 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.

REVISIONS
01 REVISED TITLE
02 2010-10-11 REVISED TITLE BLOCK

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DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359	CHAINAGE:	DISCIPLINE # 03

TITLE
DETAIL 14A
TYPICAL DAM AND PUMP CROSSING – CONSTRUCTION PROCEDURES

SCALE N.T.S.	DWG No 4359-03-ML-03-710	REV 02

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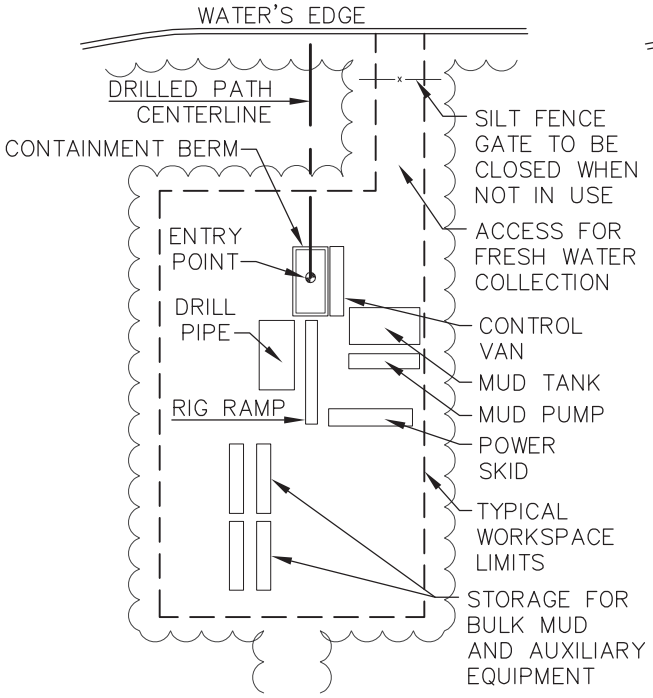
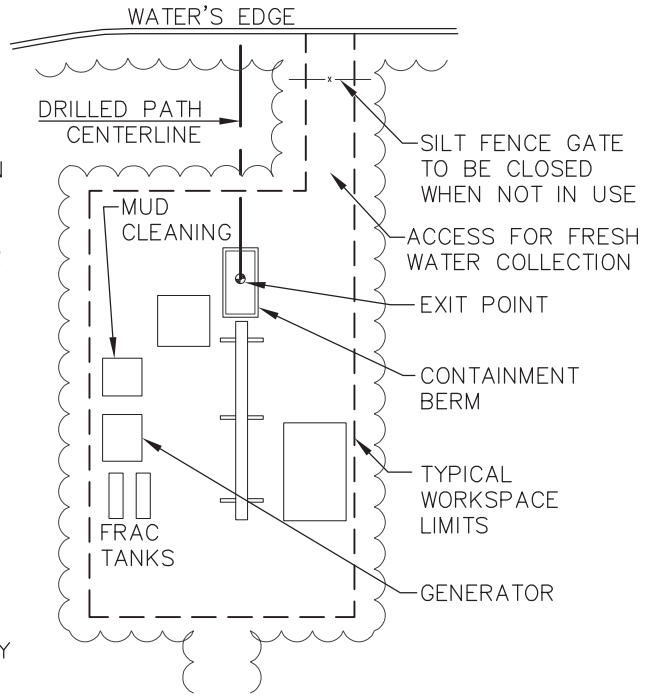


SITE PLAN
ENTRY SIDE



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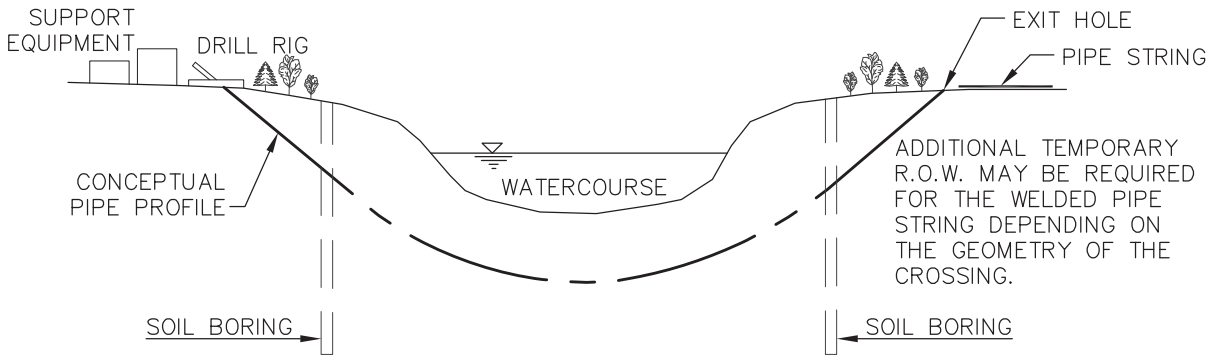
EXIT SIDE



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 HAND CUTTING BRUSH FOR TRACKING WIRES.
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.

REVISIONS
01 UPDATED DRAWING NOTES
02 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA # 4359	CHAINAGE:	DISCIPLINE # 03

TITLE
DETAIL 15
TYPICAL HORIZONTAL DRILL (HDD) SITE PLAN & PROFILE

SCALE N.T.S.	DWG No 4359-03-ML-03-711	REV 02

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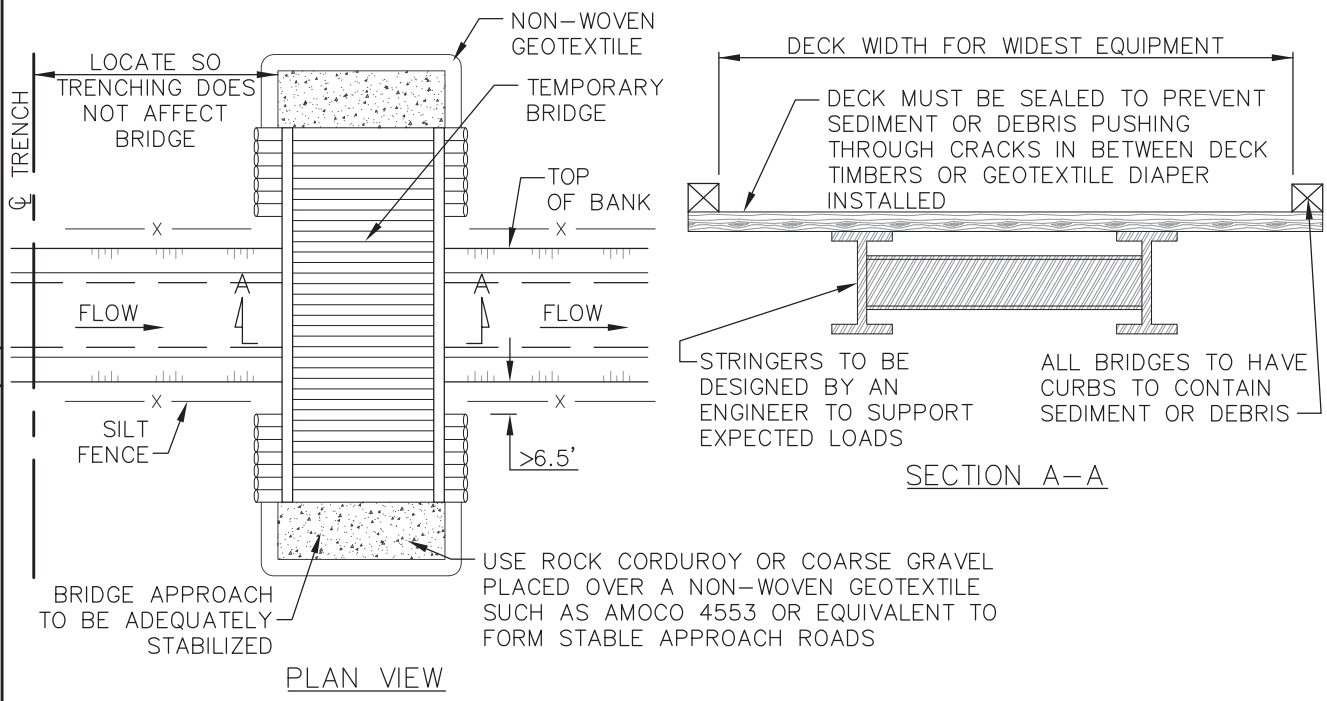
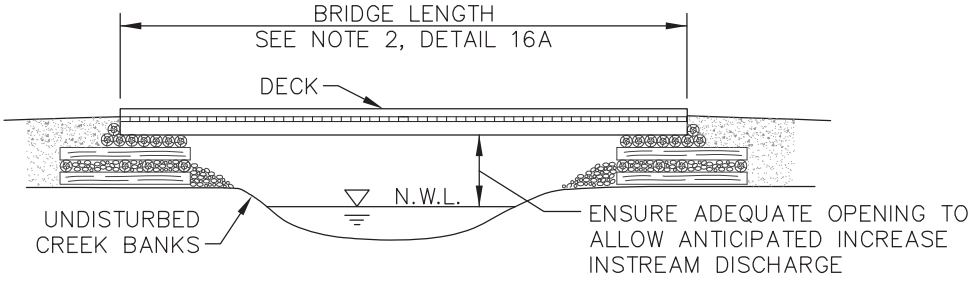
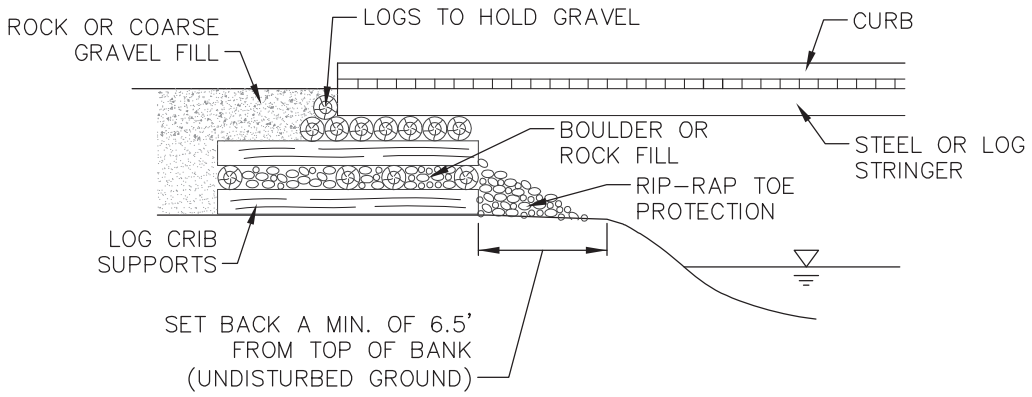




BRIDGE PROFILE



TYPICAL TEMPORARY CRIB ABUTMENT

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DESIGNER: JMP (NAME) 2010–10–21 (DATE)	KEYSTONE XL PROJECT		
	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 16 TYPICAL TEMPORARY BRIDGE CROSSING		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359–03–ML–03–712 REV 01

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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 FEET 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 FEET 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 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 FEET 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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DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 16A
TYPICAL TEMPORARY BRIDGE CROSSING -
CONSTRUCTION PROCEDURES

SCALE	DWG No	REV
N.T.S.	4359-03-ML-03-713	01

TC_A4_BR.DWG 8.5X11

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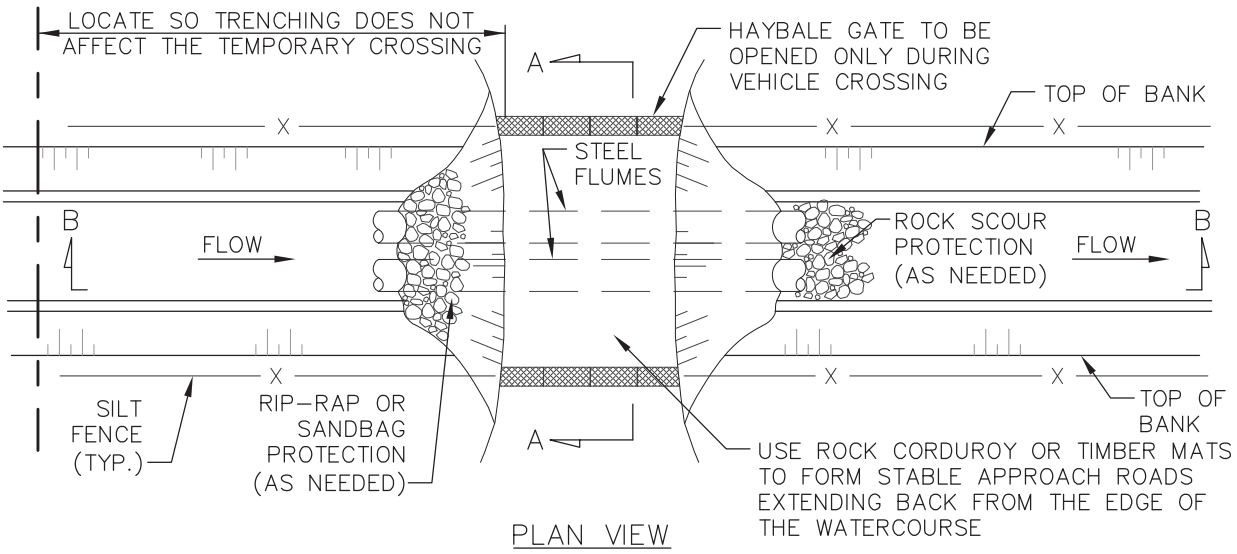
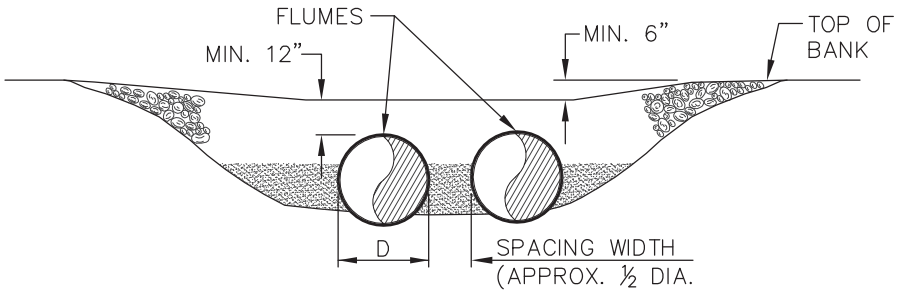
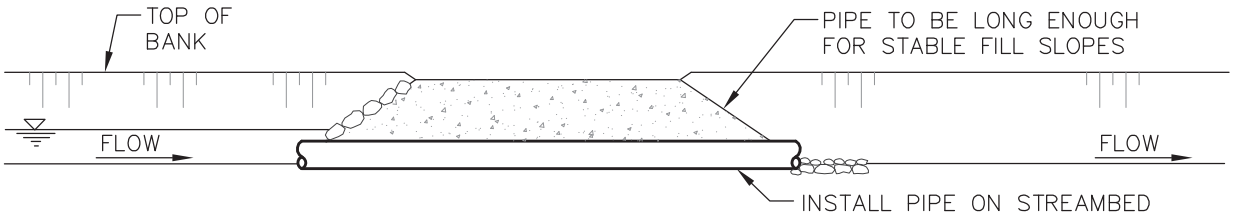


PLAN VIEW



SECTION A–A



SECTION B–B

CONSTRUCTION PROCEDURES:

THE FOLLOWING IS A SEQUENCE OF CONSTRUCTION AND PROCEDURES 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 FEET 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 WATERBODY BED DOWNSTREAM 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 DEBRIS ENTERING THE WATERBODY 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 WATERBODY (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 FEET FROM THE WATERBODY AND ABOVE THE HIGH WATER LEVEL.
6. FOLLOWING COMPLETION OF THE CROSSING, REMOVE ROCKFILL IN/OR AROUND FLUME PIPES FROM THE WATERBODY OR WETLAND.
7. RESTORE STREAM BANKS AND WATERBODY BOTTOM.

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE

DETAIL 17
TYPICAL FLUME BRIDGE CROSSING

SCALE N.T.S. | DWG No 4359–03–ML–03–714 | REV 01

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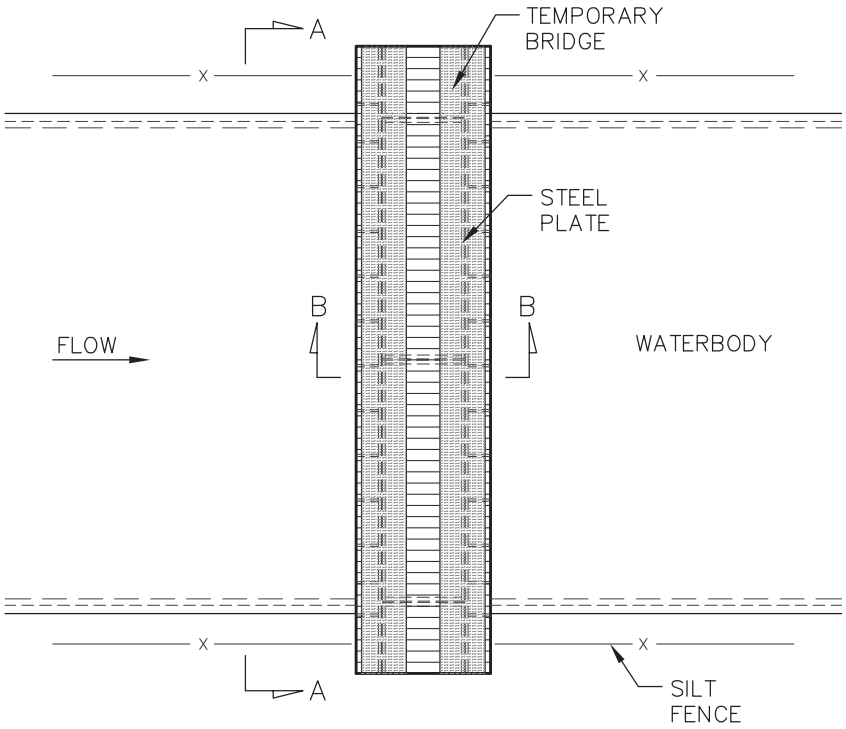
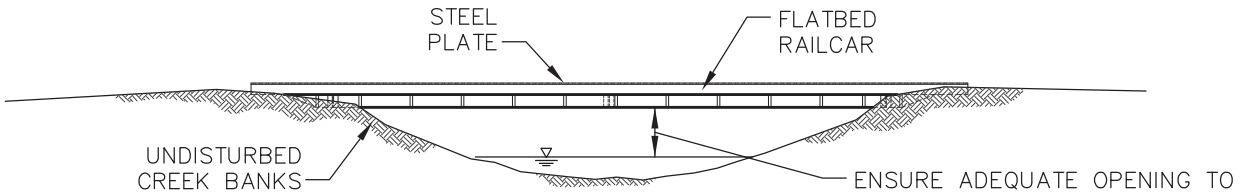
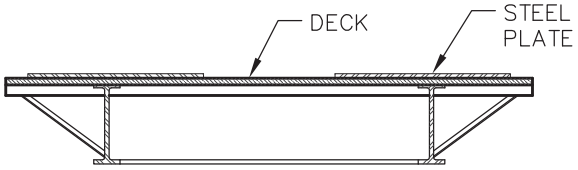


PLAN VIEW



SECTION A–A



SECTION B–B

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JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	TITLE: DETAIL 18 TYPICAL RAILCAR BRIDGE CROSSING		
		SCALE N.T.S.	DWG No 4359-03-ML-03-715	REV 01

TC_A4_BR.DWG 8.5X11

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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 STREAMBED, 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.

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KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 18A
TYPICAL RAILCAR BRIDGE CROSSING –
CONSTRUCTION PROCEDURES

SCALE	DWG No	REV
N.T.S.	4359-03-ML-03-716	01

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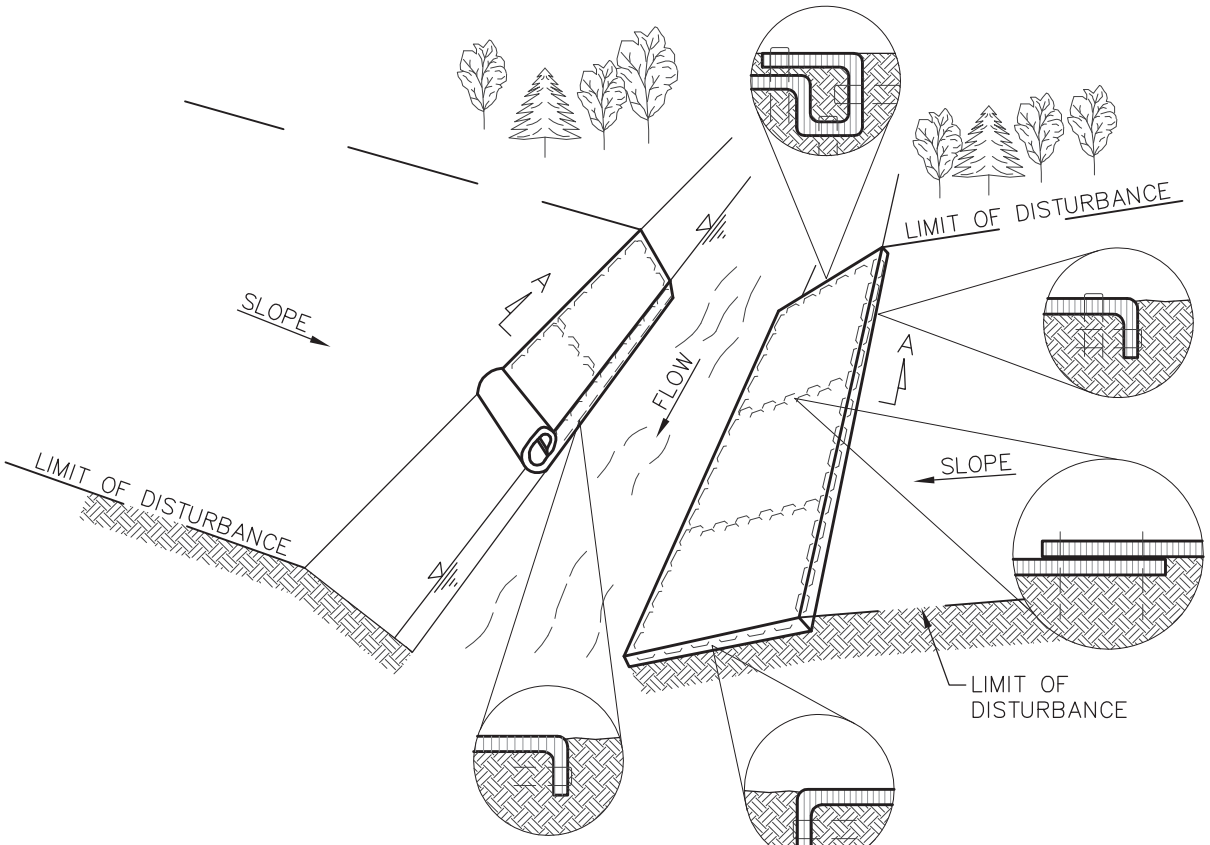

PLAN VIEW

SECTION A–A

NOTES:

1. INSTALL AND ANCHOR LINERS FOLLOWING MANUFACTURER'S INSTRUCTIONS.
2. PREPARE SOIL BEFORE INSTALLING CHANNEL LINER, INCLUDING THE APPLICATION OF
3. SEED. CHANNEL LINERS SHOULD EXTEND COMPLETELY ACROSS DISTURBED BANK AREAS TO PROTECT ERODIBLE SURFACES.
4. BEGIN AT THE END OF THE CHANNEL BY ANCHORING THE LINER IN A TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
5. ROLL LINER IN DIRECTION OF WATER FLOW.
6. INSTALL LINERS END–OVER–END (SHINGLE STYLE) WITH OVERLAP USING A DOUBLE ROW OF STAGGERED STAPLES 4 INCHES BELOW THE FIRST ROW IN A STAGGERED PATTERN.
7. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FEET INTERVALS. USE A ROW OF STAPLES 4 INCHES BELOW THE FIRST ROW IN A STAGGERED PATTERN.
8. 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 INCHES AND STAPLED.
9. THE CHANNEL LINER SHOULD EXTEND TO THE BASE OF THE CHANNEL AND STAPLED. FOR CHANNELS WITH VERY LITTLE OR NO FLOW, EXTEND A MINIMUM OF 1 FOOT BELOW THE LOW WATER LEVEL AND STAPLE IN PLACE.
10. INSTALLATION SPECIFICATIONS TO BE MODIFIED AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
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FIA # 4359	CHAINAGE:	DISCIPLINE # 03

TITLE
DETAIL 19
FLEXIBLE CHANNEL LINER INSTALLATION

SCALE N.T.S.	DWG No 4359–03–ML–05–708	REV 02

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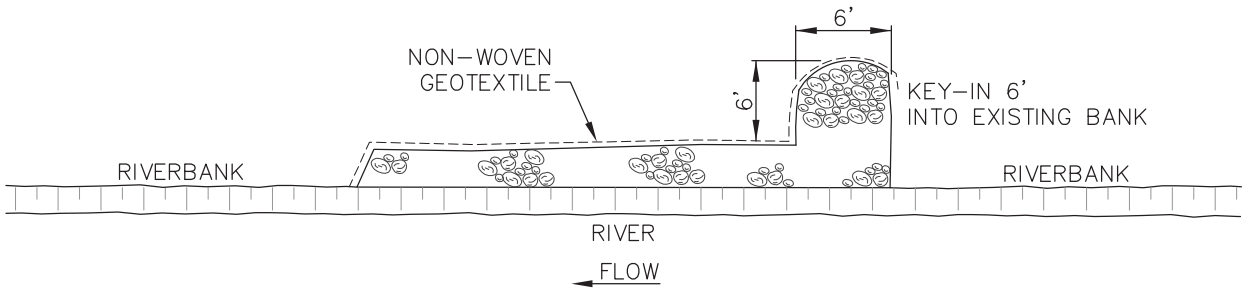
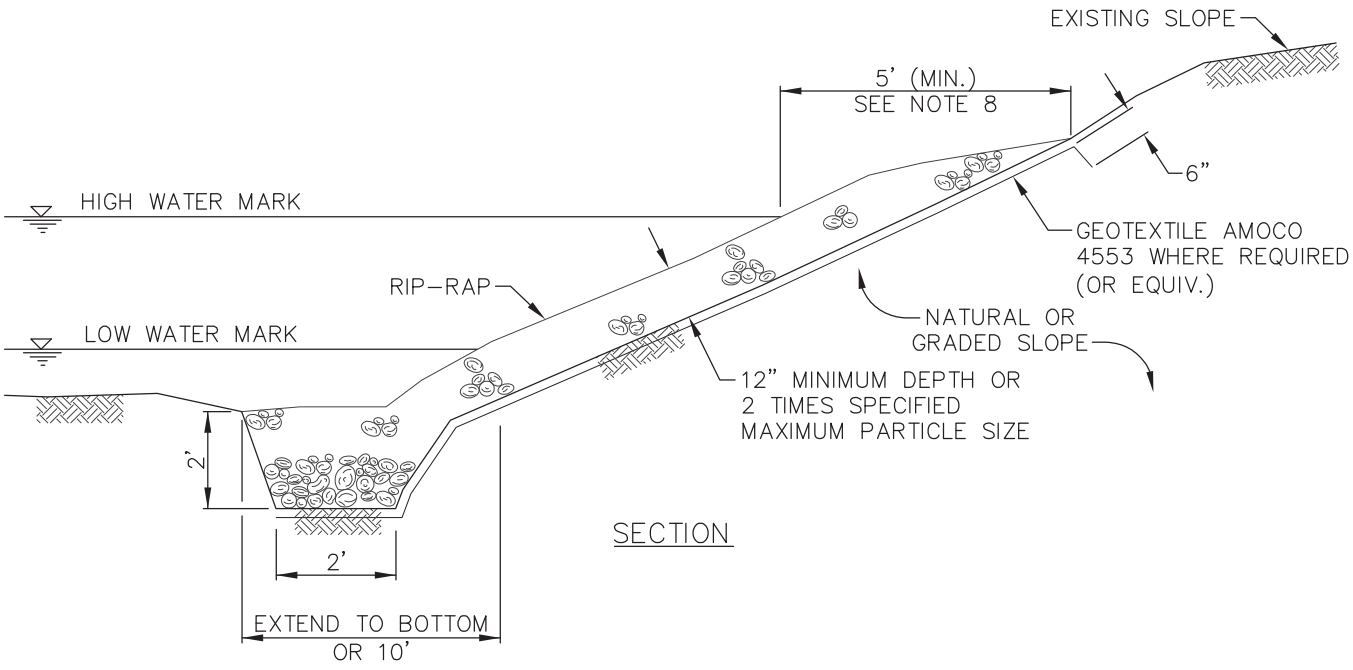


PLAN



SECTION

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 FEET. ABOVE THE NORMAL HIGH WATER MARK OR 5 FEET ALONG THE SLOPE, WHICHEVER IS LESS.
9. INSTALLATION SPECIFICATIONS TO BE MODIFIED TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
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		FIA # 4359	CHAINAGE:	DISCIPLINE # 03
JMP (NAME)	2010–10–21 (DATE)	TITLE: DETAIL 20 TYPICAL ROCK RIP–RAP		
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359–03–ML–05–709	REV 02

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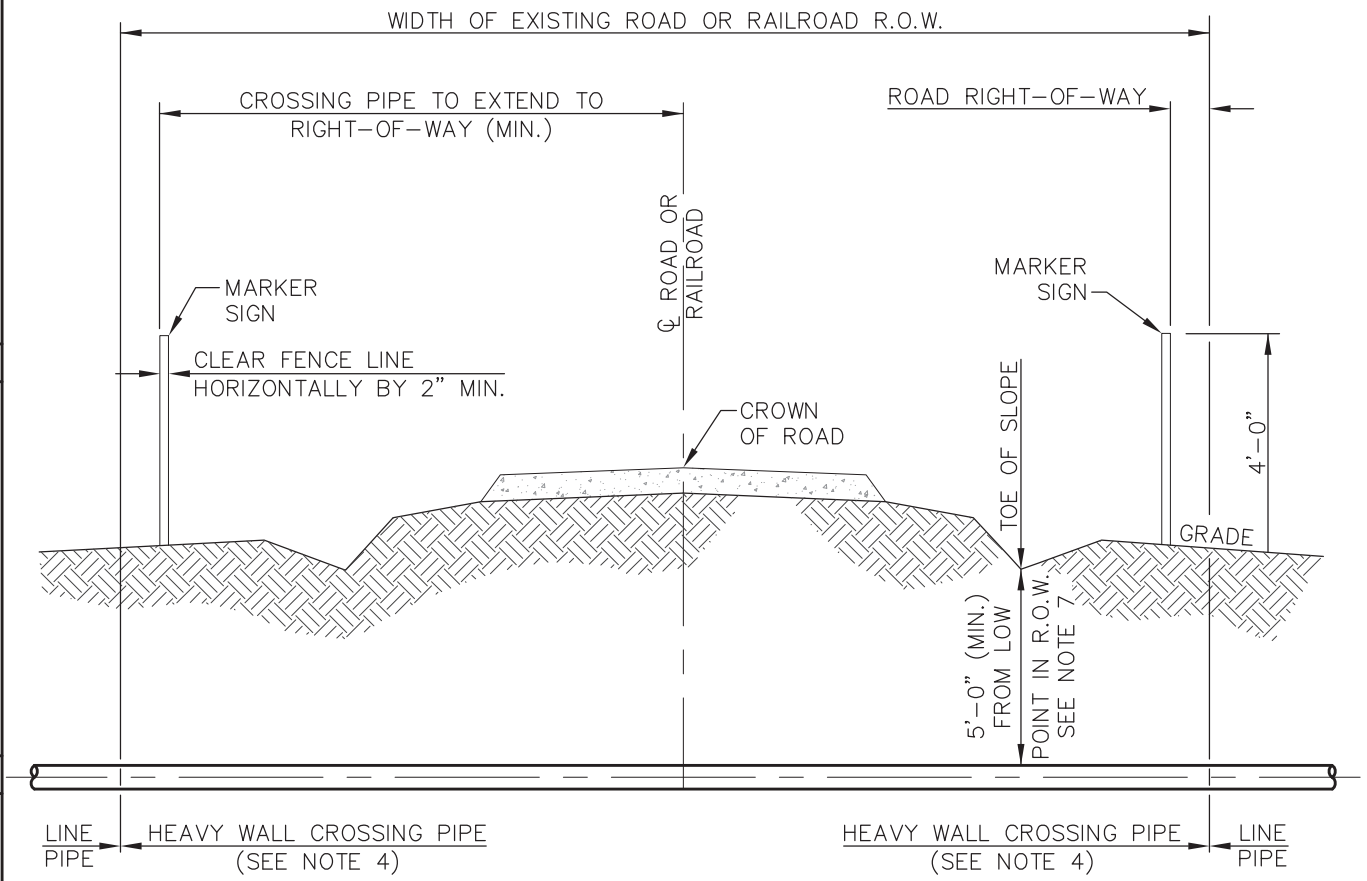

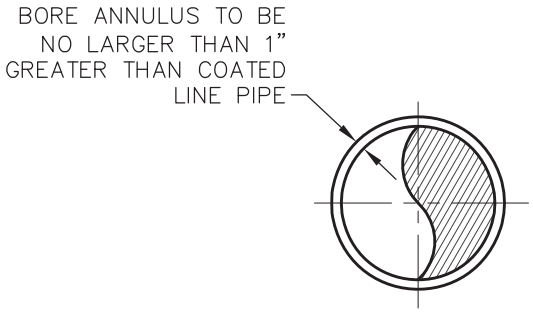

NOTES:

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 AND TEST STATIONS TO BE INSTALLED ON RIGHT-OF-WAY LINE NEXT TO FENCE IF POSSIBLE.
6. THE CROSSING PIPE SHALL BE STRAIGHT WITH NO VERTICAL OR HORIZONTAL BENDS WITHIN ROAD RIGHT-OF-WAY.
7. MINIMUM PIPELINE COVER IN DRAINAGE DITCHES AT PUBLIC ROADS IS 60 INCHES; 36 INCHES IN CONSOLIDATED ROCK.

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CHECKED BY: WSF	DESIGN CHECKER: RW P7100	TITLE: DETAIL 21 TYPICAL UNCASED ROAD/RAILROAD CROSSING BORE DETAIL		
		SCALE N.T.S.	DWG No 4359-03-ML-03-717	REV 02

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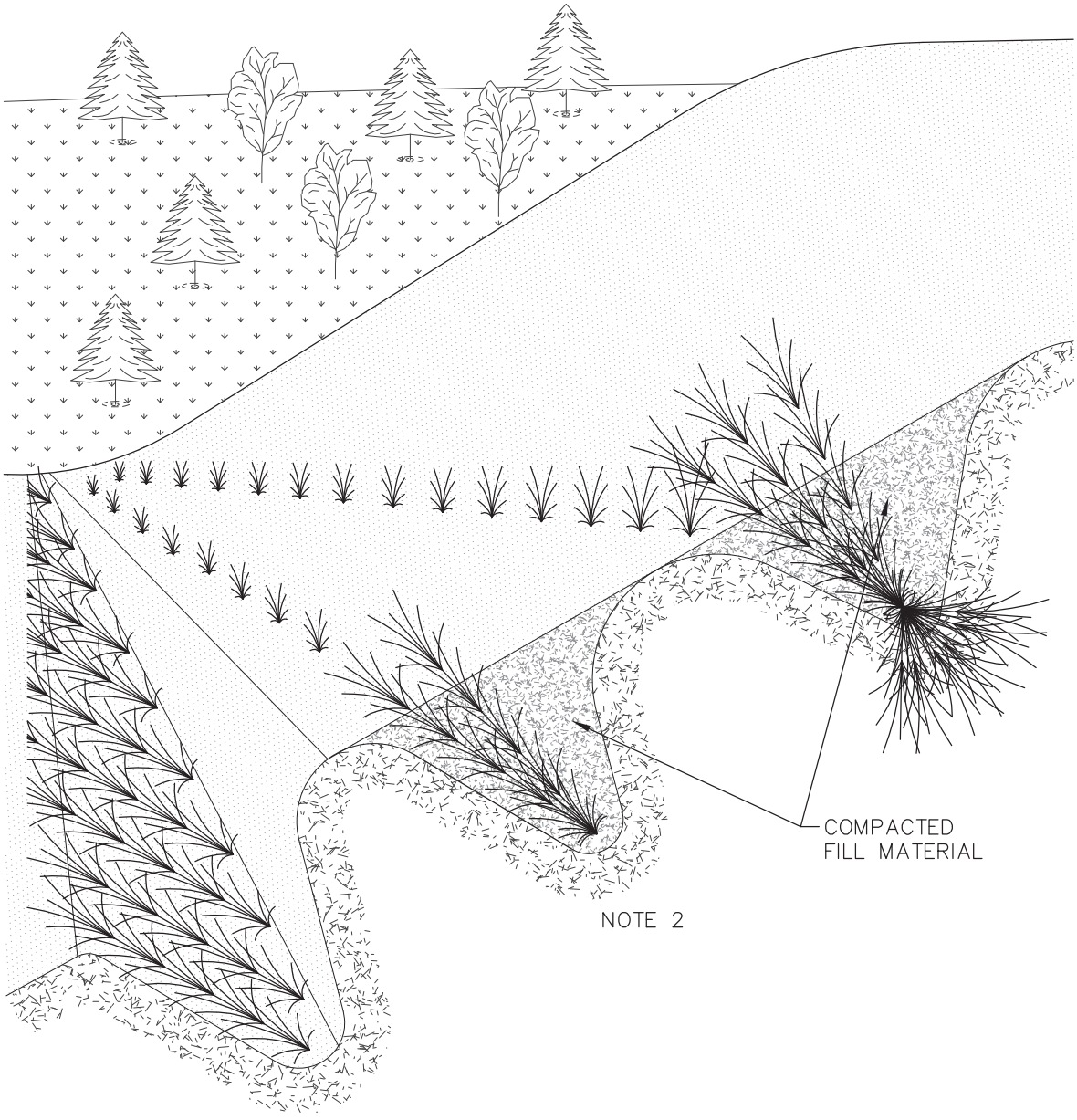

NOTES:

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 AS NECESSARY TO SUIT SITE CONDITIONS.

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FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 22
STREAMBANK RECLAMATION –
BRUSH LAYER IN CROSS CUT SLOPE

SCALE N.T.S. | DWG No 4359-03-ML-05-710 | REV 02

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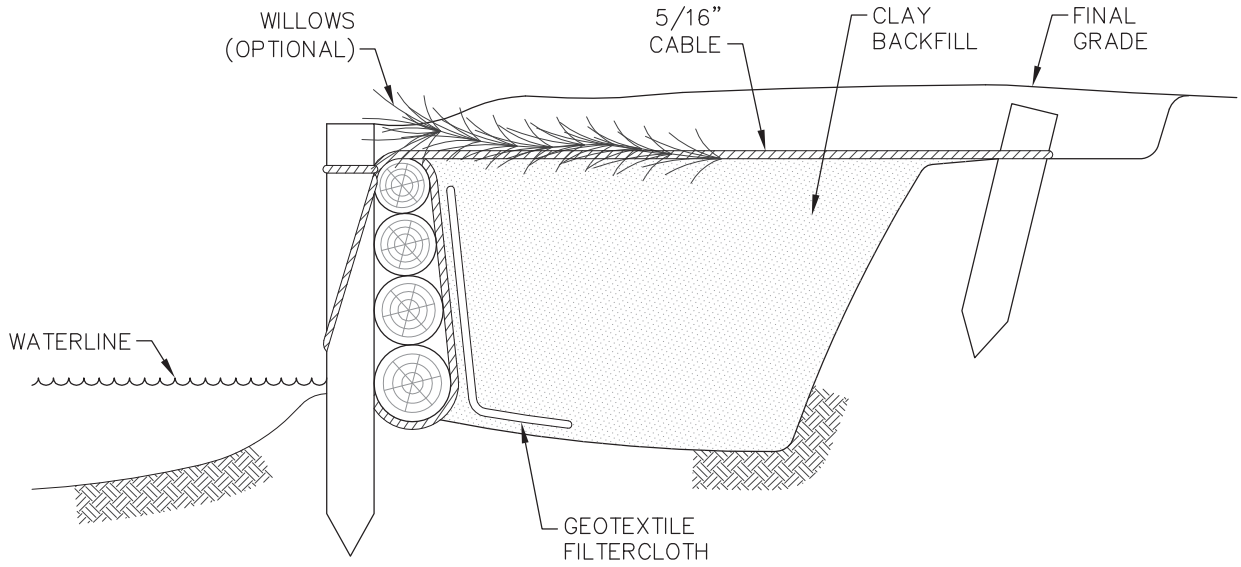

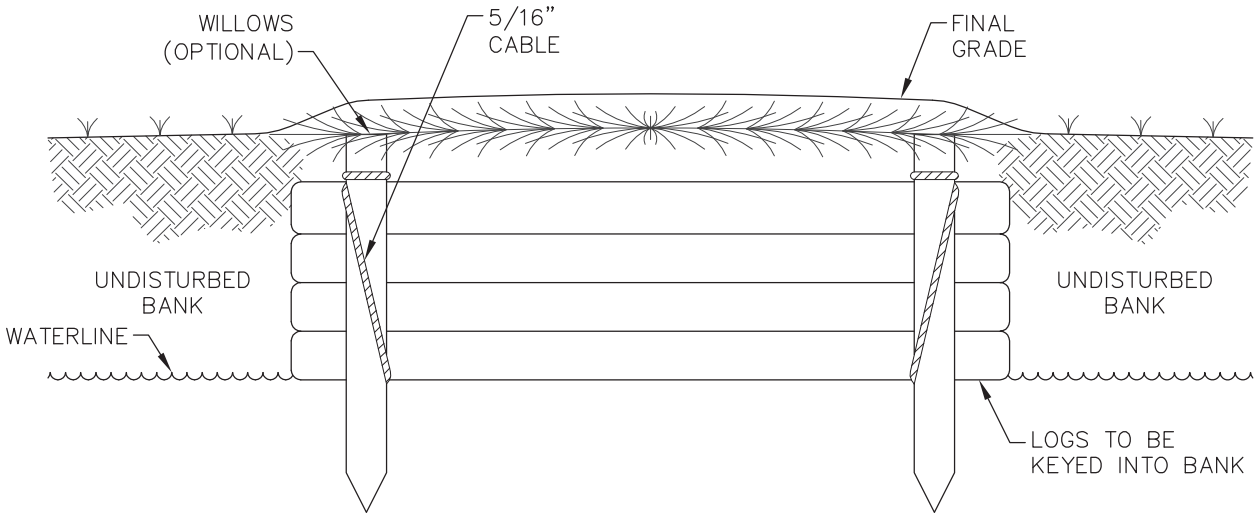

NOTES:

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 AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

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FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 23
STREAMBANK RECLAMATION – LOGWALL

SCALE	DWG No	REV
N.T.S.	4359-03-ML-05-711	02

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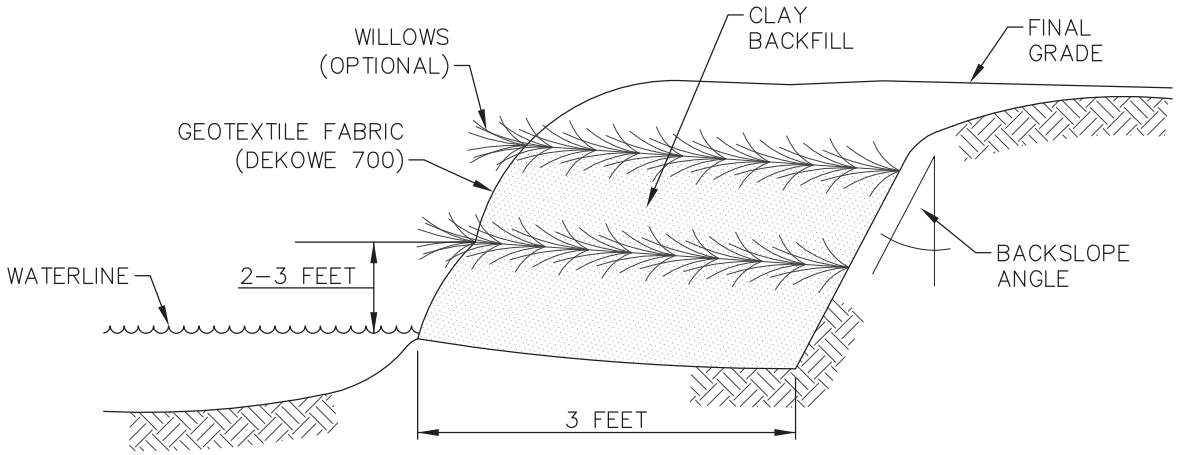

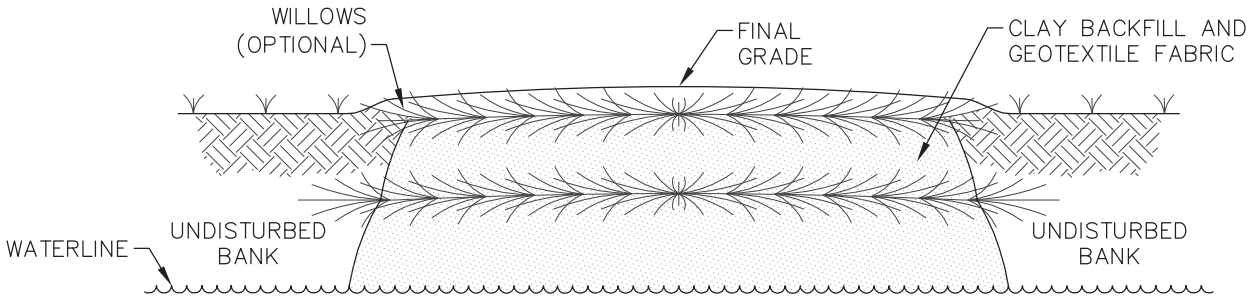

NOTES:

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 (8'x2') 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 AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 2008-11-04 UPDATED DRAWING NOTES
02 2010-10-11 REVISED TITLE BLOCK

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DESIGNER: JMP (NAME) 2010-10-21 (DATE)
CHECKED BY: WSF
DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE
DETAIL 24
STREAMBANK RECLAMATION –
VEGETATED GEOTEXTILE INSTALLATION

SCALE	DWG No	REV
N.T.S.	4359–03–ML–05–712	02

TC_A4_BR.DWG 8.5X11

CADD DRAWING: DO NOT MAKE MANUAL REVISIONS

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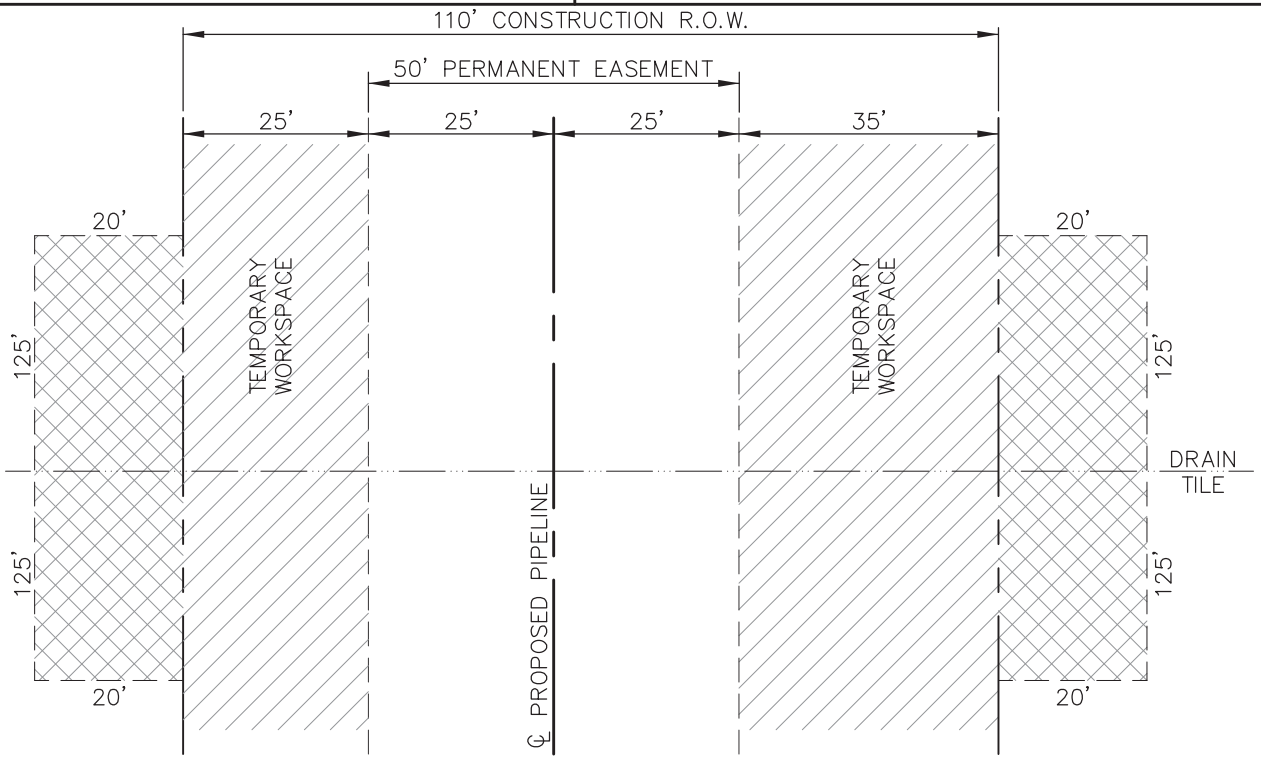
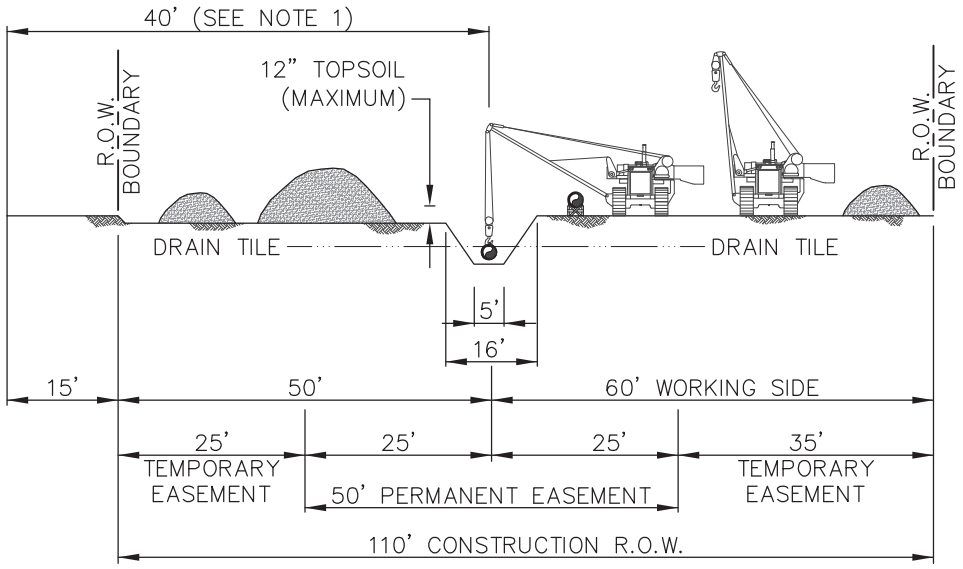


PLAN VIEW



ELEVATION

NOTES:

1. THE OFFSET FROM A FOREIGN PIPELINE, WHERE APPLICABLE, WILL BE 40' FOR MOST LOCATIONS, 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 AS NECESSARY TO SUIT ACTUAL SITE CONDITIONS.

REVISIONS
01 REVISED NOTE 3; DELETED DIMENSION
02 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA #	CHAINAGE:	DISCIPLINE #
4359		03

TITLE: DETAIL 25
TYPICAL R.O.W. LAYOUT/SOIL HANDLING
110' CONSTRUCTION R.O.W. 50' EASEMENT
DRAIN TILE CROSSING

SCALE	DWG No	REV
N.T.S.	4359-03-ML-03-718	02

TC_A4_BR.DWG 8.5X11

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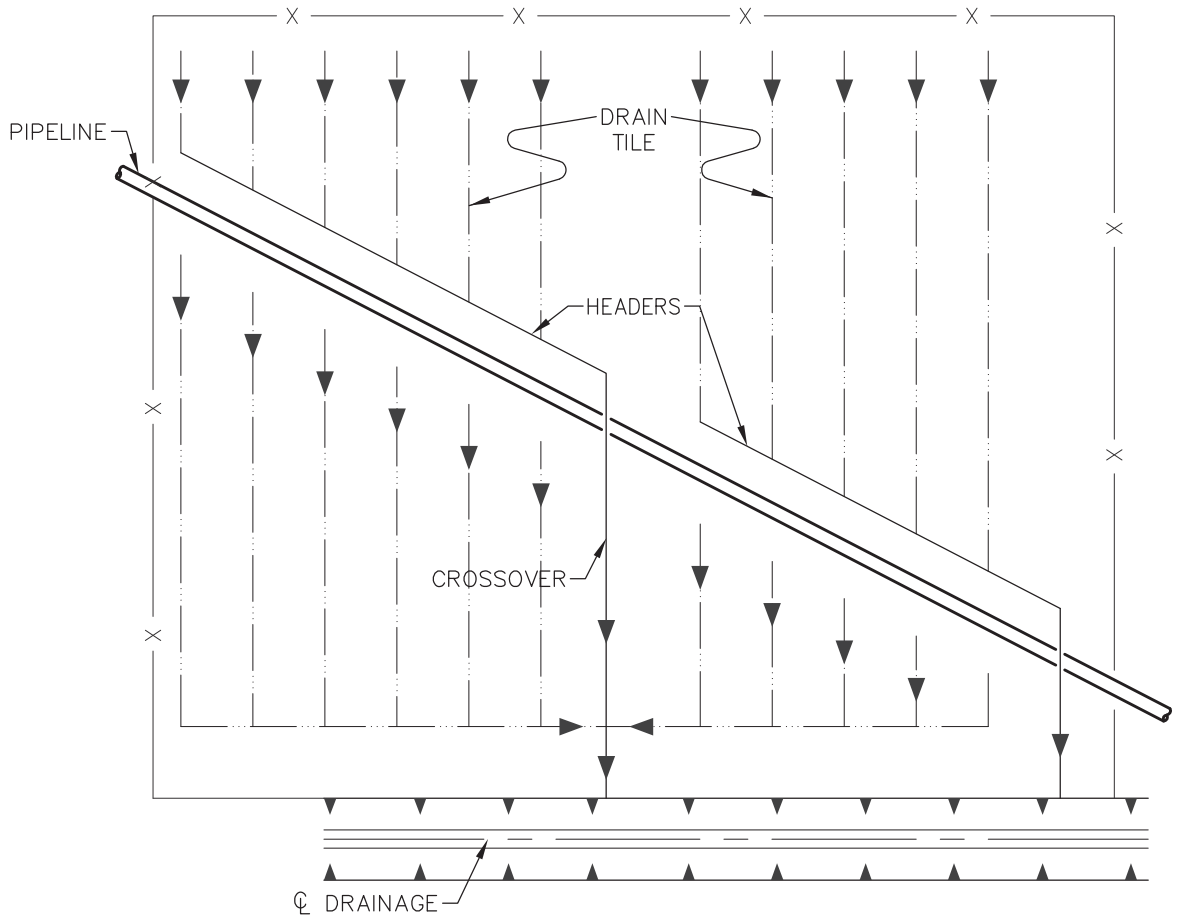

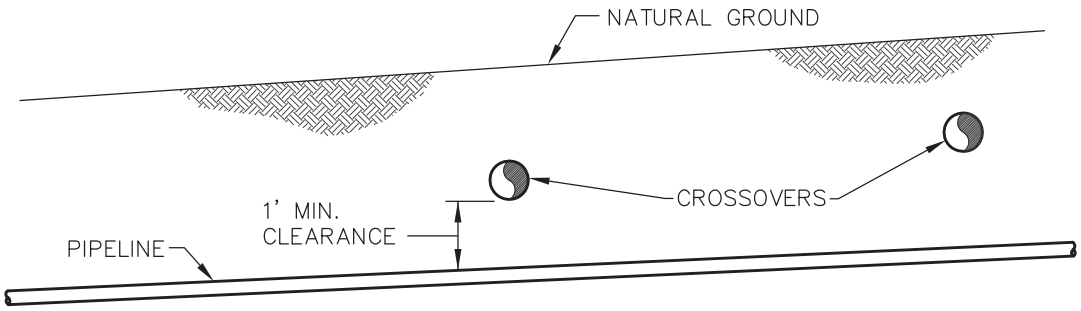

PROFILE

REVISIONS
01 ADDED DIMENSION
02 2010-10-11 REVISED TITLE BLOCK

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE
DETAIL 26
HEADER/MAIN CROSSOVERS OF PIPELINE

SCALE N.T.S. | DWG No 4359-03-ML-03-719 | REV 02

TC_A4_BR.DWG 8.5X11

CADD DRAWING: DO NOT MAKE MANUAL REVISIONS

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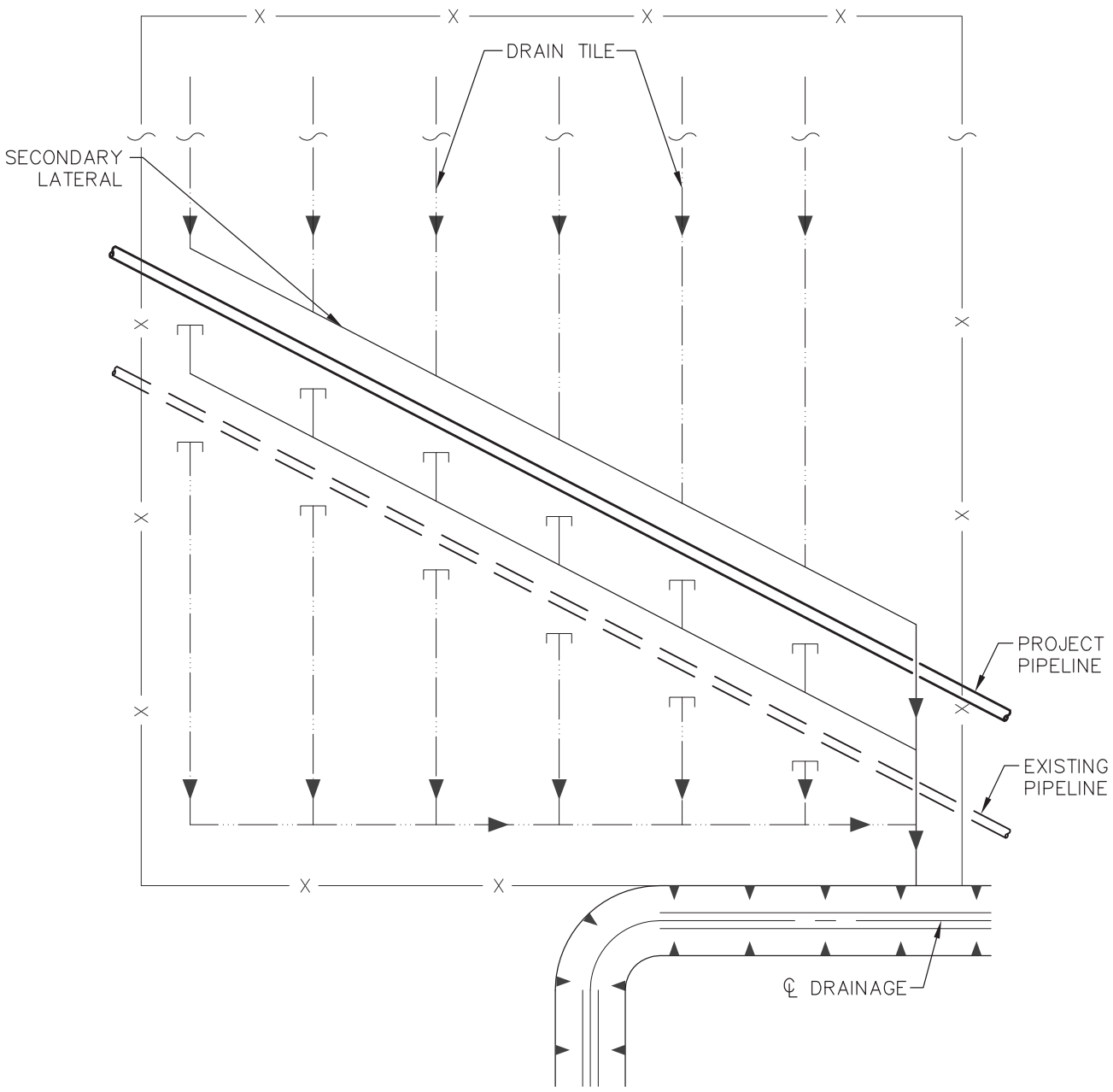
RELOCATE/REPLACE DRAINAGE HEADER/MAIN



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02 2010-10-11 REVISED TITLE BLOCK

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DESIGNER:		KEYSTONE XL PROJECT		
JMP (NAME)	2010-10-21 (DATE)	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
CHECKED BY: WSF	DESIGN CHECKER: RW P7100	TITLE: DETAIL 27 HEADER/MAIN CROSSOVERS OF PIPELINE		
		SCALE N.T.S.	DWG No 4359-03-ML-03-720	REV 02

TC_A4_BR.DWG 8.5X11

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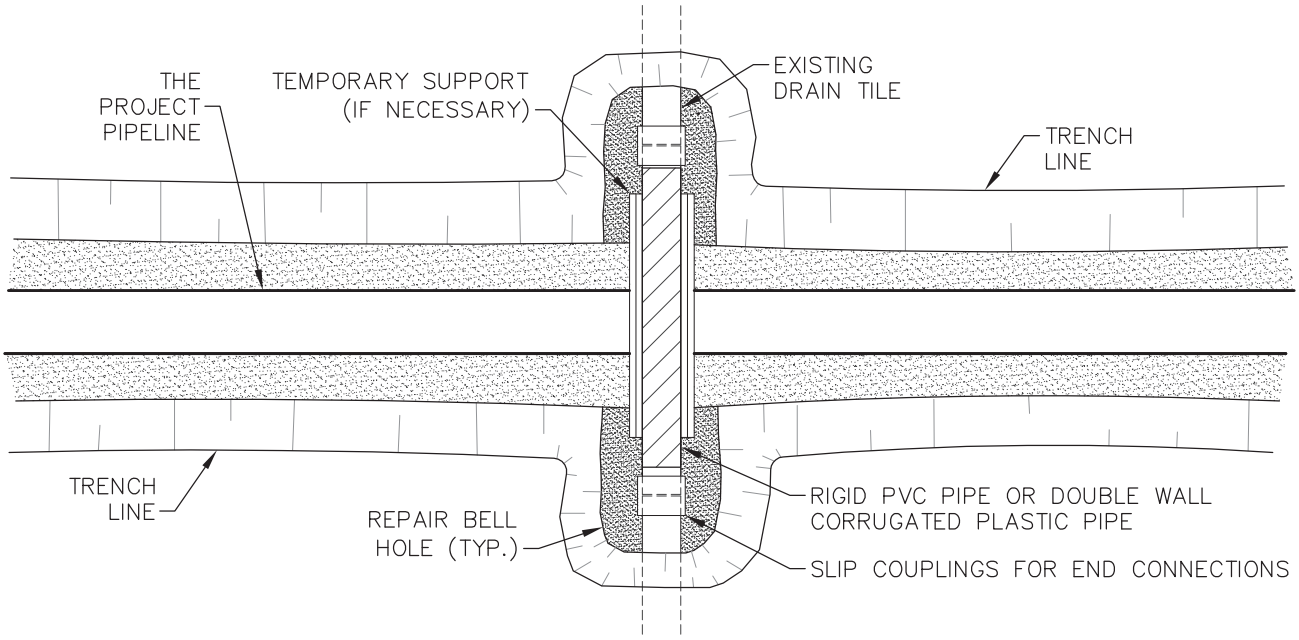
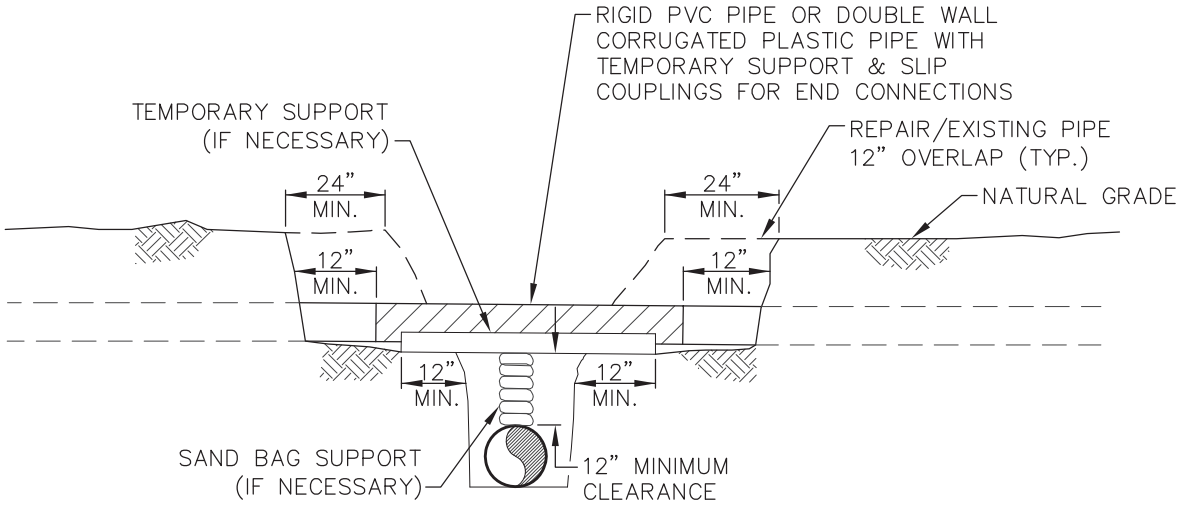


PLAN



PROFILE

NOTES:

1. IMMEDIATELY REPAIR TILE IF WATER IS FLOWING THROUGH TILE AT TIME OF TRENCHING.
2. SCREEN ALL EXPOSED ENDS OF TILE LINES.

REVISIONS
01 2008-11-04 UPDATED DRAWING NOTES
02 2010-10-11 REVISED TITLE BLOCK

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	FIA # 4359	CHAINAGE:	DISCIPLINE # 03
	TITLE: DETAIL 28 DRAINAGE AND IRRIGATION TEMPORARY DRAIN TILE REPAIR		
CHECKED BY: WSF / DESIGN CHECKER: RW P7100	SCALE N.T.S.	DWG No 4359-03-ML-03-721	REV 02

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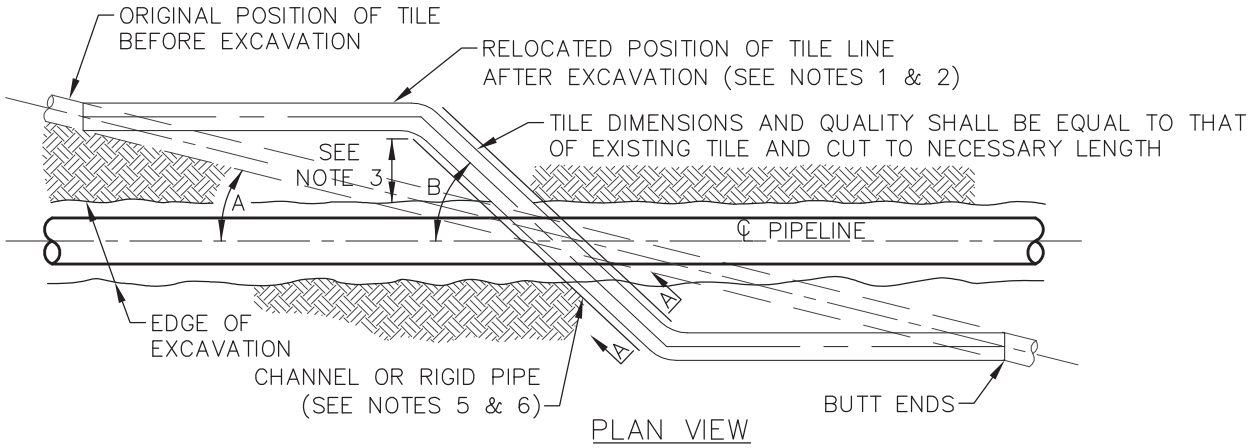
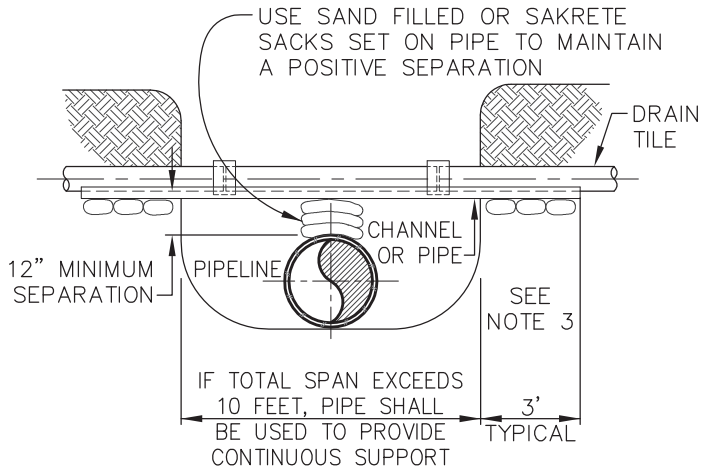
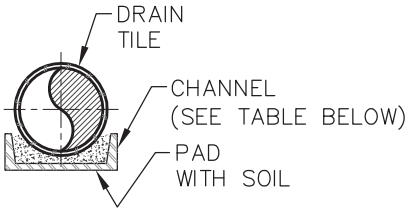
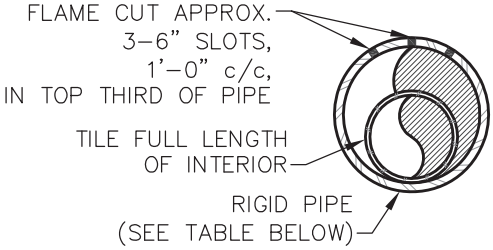


PLAN VIEW





SECTION "A–A" CHANNEL (SPANS < 10 FEET)



SECTION "A–A" RIGID PIPE (SPANS > 10 FEET)

END VIEWS

NOTES:

1. TILE REPAIR SHALL MAINTAIN ORIGINAL ALIGNMENT AND GRADIENT WHEN ANGLE "A", BETWEEN PIPELINE AND ORIGINAL TILE, IS MORE THAN 20 FEET UNLESS OTHERWISE DIRECTED BY THE PROJECT REPRESENTATIVE.
2. WHEN ANGLE "A" IS LESS THAN 20 FEET, 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 THE PROJECT REPRESENTATIVE.
3. 3 FOOT 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 PROJECT REPRESENTATIVE IN ADVANCE. SITE SPECIFIC ALTERNATE SUPPORT SYSTEM TO BE DEVELOPED BY THE PROJECT REPRESENTATIVE AND FURNISHED TO CONTRACTOR FOR SPANS IN EXCESS OF 20 FEET, TILE GREATER THAN 10 INCHES 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.

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

REVISIONS
01 2008–11–04 UPDATED DRAWING NOTES
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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE: DETAIL 29
DRAINAGE AND IRRIGATION
PERMANENT DRAIN TILE REPAIR

SCALE N.T.S. | DWG No 4359–03–ML–03–722 | REV 02

TC_A4_BR.DWG 8.5X11

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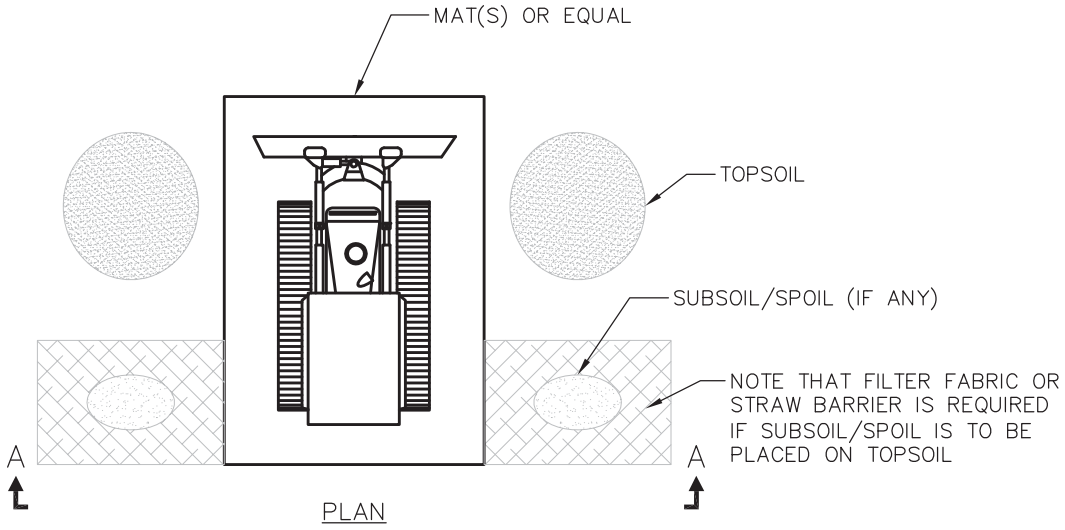
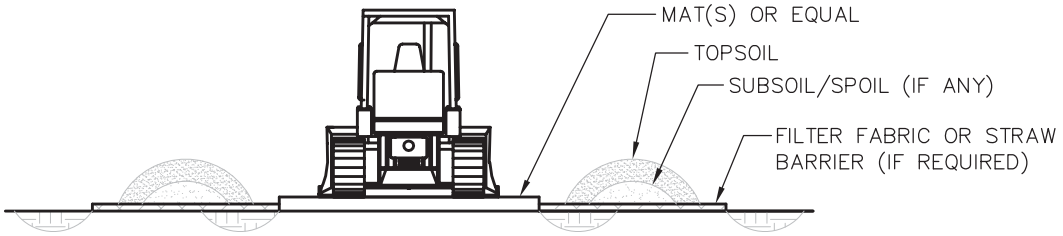


PLAN



SECTION A–A

CLEANING STATION NOTES:

1. ALL EQUIPMENT WILL BE REQUIRED TO BE CLEANED AT EQUIPMENT CLEANING STATIONS LOCATED AS SHOWN ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
2. STOCKPILE TOPSOIL/SUBSOIL AS SHOWN OR IN ANY CONFIGURATION APPROVED BY THE ENVIRONMENTAL INSPECTOR.
3. SHOVELS OR OTHER HAND TOOLS AND/OR COMPRESSED AIR WILL BE USED TO REMOVE AS MUCH AS MUCH SOIL AS PRACTICAL FROM TRACKED EQUIPMENT. EFFORT WILL BE FOCUSED ON TRACKS AND BLADES.
4. IF CONDITIONS ARE MUDDY, WHEELED EQUIPMENT WILL ALSO BE CLEANED USING HAND TOOLS TO REMOVE EXCESS SOIL FROM TIRES AND WHEEL WELLS.
5. CLEANING WILL BE CONDUCTED ON CONSTRUCTION MATS OR OTHER RAISED SURFACE TO MINIMIZE REATTACHMENT OF SOIL THAT HAS BEEN PREVIOUSLY REMOVED.
6. MATS WILL BE CLEANED BETWEEN EACH PIECE OF EQUIPMENT.
7. SOIL COLLECTED DURING THE CLEANING PROCESS WILL BE STOCKPILED AT A CONVENIENT LOCATION NEAR THE CLEANING STATION AND DISPOSED OF IN AN ACCEPTABLE LAND FILL.
8. IF THE SOIL HAS A SIGNIFICANT COMPONENT OF SUBSOIL, IT WILL BE PLACED OVER THE BACKFILLED TRENCH OR IN THE ADJACENT SPOIL STORAGE AREA, AND SUBSEQUENTLY COVERED WITH TOPSOIL. IF THE LAND OWNER DIES NOT APPROVE OF ON–SITE DISPOSAL, THE SOIL WILL BE TAKEN TO AN APPROVED DISPOSAL SITE.
9. SOILS CONTAMINATED WITH OIL OR GREASE WILL BE REMOVED AND DISPOSED OF IN ACCORDANCE PROJECT SPCCC PLAN.

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01 REVISED LABELS
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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE

DETAIL 30
EQUIPMENT CLEANING STATION DETAIL

SCALE N.T.S. | DWG No 4359–03–ML–05–713 | REV 02

TC_A4_BR.DWG 8.5X11

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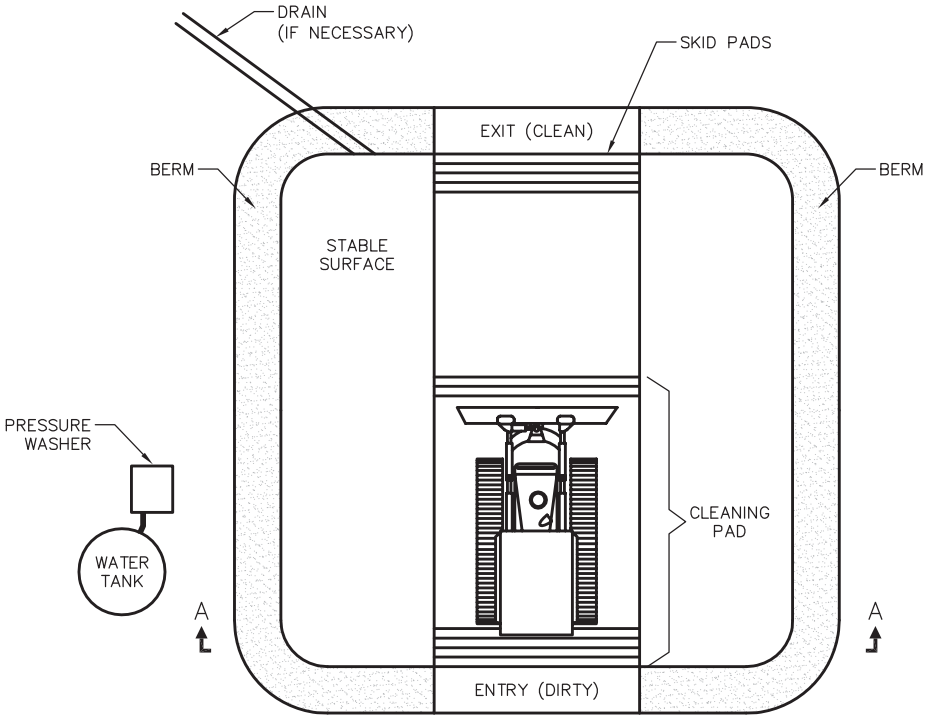
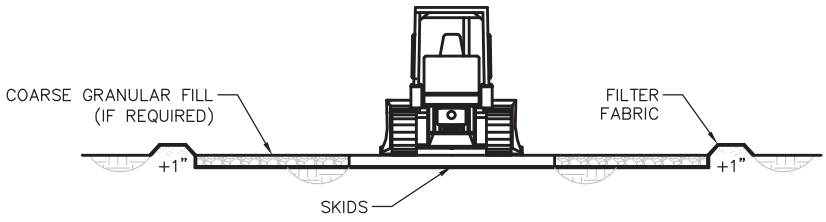


PLAN



SECTION A–A

WASH STATION NOTES:

1. ALL EQUIPMENT AND VEHICLES ARE REQUIRED TO BE CLEANED AT WASH STATION LOCATIONS SHOWN ON THE CONSTRUCTION DRAWINGS OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR. WASH STATIONS WILL BE CONSTRUCTED BY THE CONTRACTOR. WASHINGS WILL BE CARRIED OUT UNDER THE SUPERVISION AND TO SATISFACTION OF THE ENVIRONMENTAL INSPECTOR.
2. WASH WATER USED FOR CLEANING WILL NOT BE ALLOWED TO ENTER ANY WATERBODY, WETLAND, OR IRRIGATION CANAL/DITCH. ANY SOILS CONTAMINATED BY PETROLEUM–BASED, OR OTHER UNDESIRABLE MATERIALS FROM WASH STATIONS WILL BE REMOVED.
3. THE SIZE OF STATION WILL BE ADEQUATE TO ACCOMMODATE THE MAXIMUM SIZE OF EQUIPMENT EXPECTED.
4. EQUIPMENT WILL CONSISTENTLY ENTER THE "DIRTY END" AND EXIT THE "CLEAN END."
5. STABLE DRAINAGE FROM THE SITE WILL BE PROVIDED (IF NECESSARY). NO DISCHARGE TO STREAMS OR WETLANDS WILL BE ALLOWED.
6. WASH STATIONS WILL BE EQUIPPED WITH SKID PADS OR WASH RACKS TO PREVENT SOIL FROM BEING CARRIED ON TRACKS OR TIRES AS EQUIPMENT AND VEHICLES EXIT THE WASH STATION. SKIDS ARE TO BE CLEANED EACH TIME A PIECE OF EQUIPMENT IS CLEANED.
7. GRAVEL FILL (IF REQUIRED) AND FILTER FABRIC WILL BE REMOVED AND DISPOSED OF IN AN ACCEPTABLE LAND FILL.
8. THE DEPRESSION WILL BE BACKFILLED WITH BERMED MATERIAL.
9. CLEANING SITES WILL BE MONITORED DURING THE POST CONSTRUCTION MONITORING PROGRAM AND WEEDS WILL BE CONTROLLED PER THE NOXIOUS WEED MANAGEMENT PLAN.

REVISIONS
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KEYSTONE XL PROJECT

FIA # 4359	CHAINAGE:	DISCIPLINE # 03

TITLE
DETAIL 31
EQUIPMENT WASH STATION DETAIL

SCALE N.T.S.	DWG No 4359–03–ML–05–714	REV 02

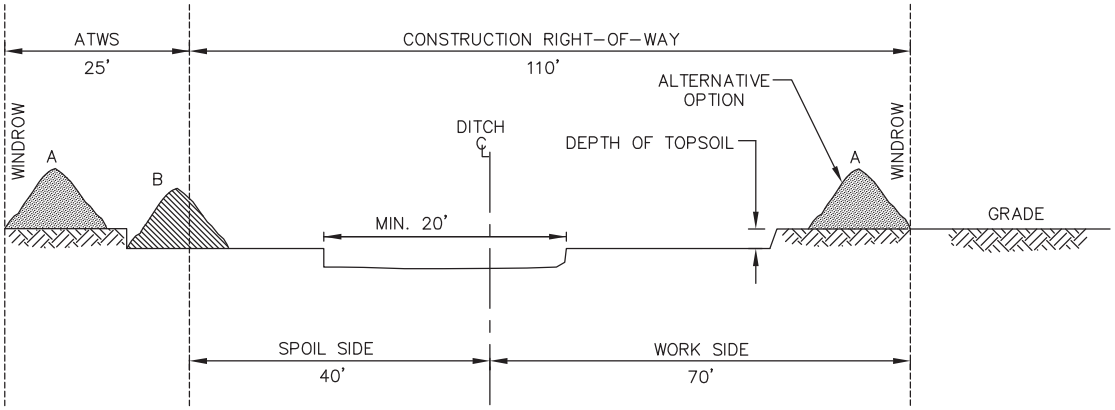
TC_A4_BR.DWG 8.5X11

CADD DRAWING: DO NOT MAKE MANUAL REVISIONS

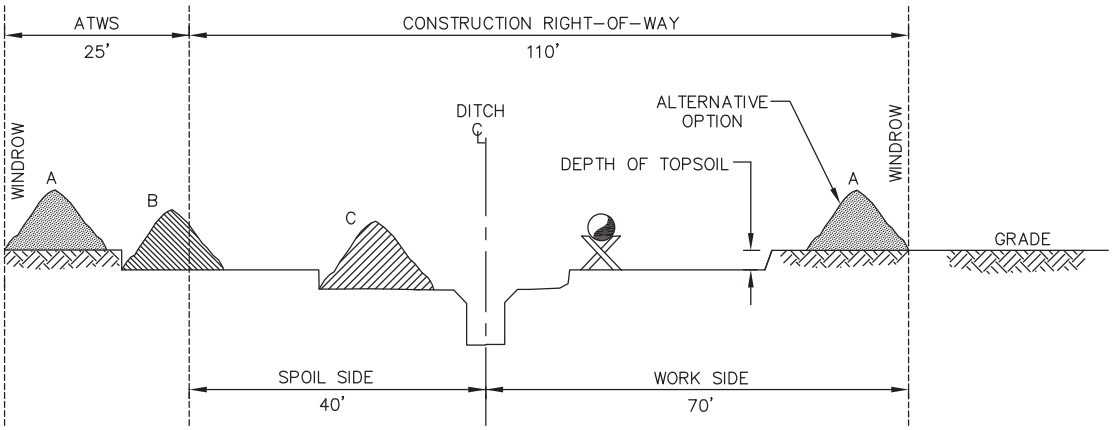
THESE ARE TYPICAL DRAWINGS; ACTUAL SITE CONDITIONS MAY VARY FROM THE SITE GRAPHICALLY REPRESENTED.

1. POTENTIAL LOCATIONS WHERE TRIPLE DITCH TOPSOIL CONSERVATION MAY BE COMPLETED ARE SHOWN ON THE ALIGNMENT SHEETS. KEYSTONE WILL DIRECT THE ACTUAL LOCATIONS WHERE TRIPLE DITCH WILL BE COMPLETED DURING, OR IMMEDIATELY PRIOR TO, TOPSOILING THE ROW. KEYSTONE MAY MODIFY TRIPLE DITCH PROCEDURES FROM THOSE DESCRIBED HERE TO ADDRESS SITE-SPECIFIC, OR SOIL-SPECIFIC, CONDITIONS.

2. STRIP TOPSOIL ("A" HORIZON) ACCORDING TO THE "A" HORIZON DEPTHS AND CONSTRUCTION DETAILS SHOWN ON CONSTRUCTION ALIGNMENT SHEETS. PLACE "A" HORIZON IN THE ADDITIONAL TEMPORARY WORKSPACE OR THE WINDROW WITHIN THE WORKING SIDE OF THE CONSTRUCTION RIGHT-OF-WAY. IN AREAS OF THICKER "A" HORIZON'S, "A" HORIZON MAY BE SPLIT TO BOTH SIDES OF THE RIGHT-OF-WAY.
REMOVE "B" HORIZON (2ND DITCH) TO DEPTHS SPECIFIED BY KEYSTONE AND STOCKPILE ON SPOIL SIDE. THE "B" HORIZON SHOULD BE REMOVED IN A STRIP AT LEAST 20 FEET WIDE OVER THE TRENCH TO ALLOW FOR STORAGE OF THE TRENCH SPOIL MATERIALS. MAINTAIN A MINIMUM OF 2 FEET BETWEEN "A" HORIZON AND "B" HORIZON STOCKPILES.



3. EXCAVATE TRENCH. ENSURE THE DIFFERENT SOIL HORIZONS ("B" HORIZON AND "C" HORIZON) ARE IN SEPARATE STOCKPILES. THE VISUAL DISTINCTION OF EACH PILE MUST BE POSSIBLE AT ALL TIMES. THE STOCKPILING SHALL ALLOW FOR RE-PLACEMENT OF THE SOIL HORIZONS BACK TO THEIR ORIGINAL SEQUENCE WITHOUT LOSS OF SOIL. MAINTAIN A MINIMUM OF 2 FEET BETWEEN "B" HORIZON AND "C" HORIZON STOCKPILES.



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DESIGN CHECKER: RW P7100

KEYSTONE XL PROJECT

FIA # 4359	CHAINAGE:	DISCIPLINE # 03

TITLE
DETAIL 67
TOPSOIL CONSERVATION DITCH & SPOIL STRIPPING TRIPLE DITCH

SCALE N.T.S.	DWG No 4359-03-ML-05-724	REV 03

TC_A4_BR.DWG 8.5X11

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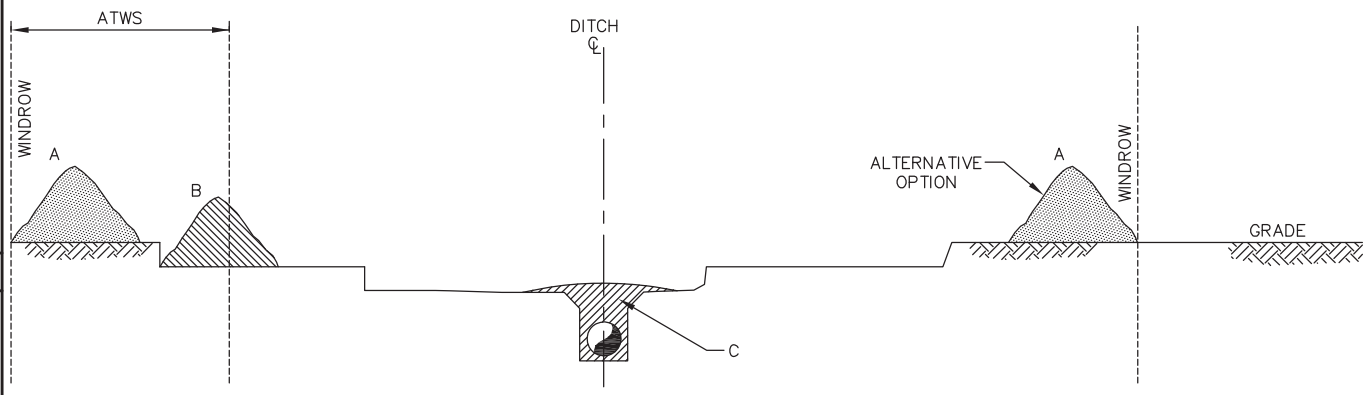
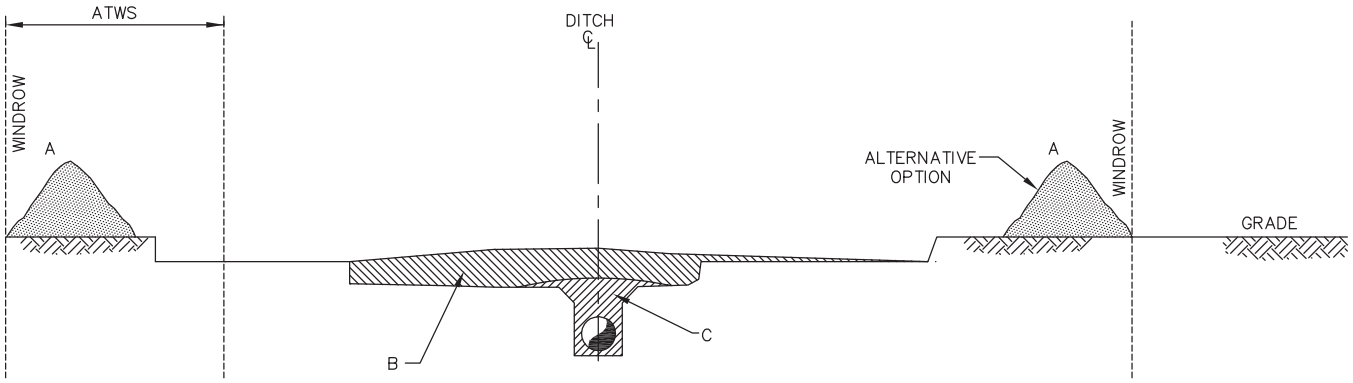
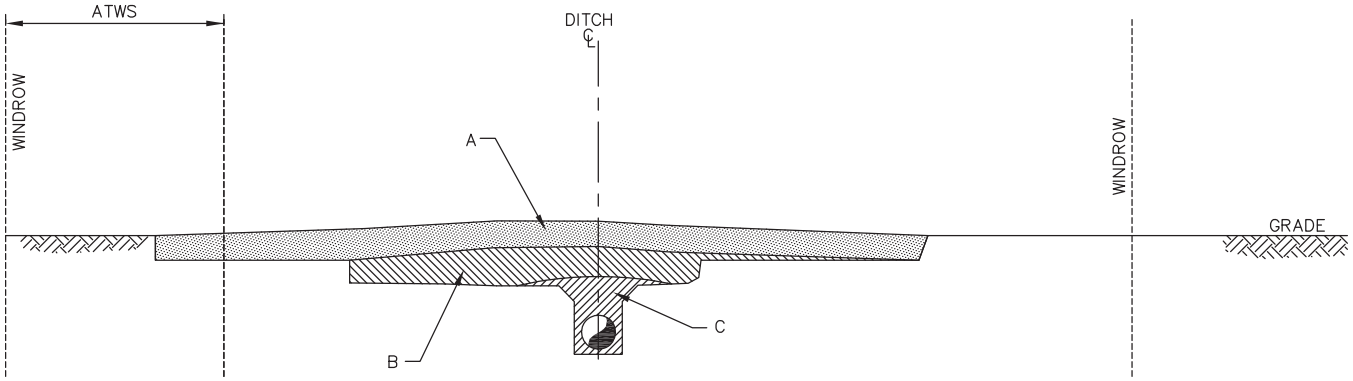
4. BACKFILL TRENCH AND COMPACT AS PER APPROVED PROCEDURE.. PLACE THE SOIL HORIZONS BACK IN THEIR ORIGINAL SEQUENCE IN THE TRENCH.



5. RELIEVE AREAS OF COMPACTION AND FEATHER (B) MATERIAL EVENLY OVER STRIPPED AREA.



6. REPLACE "A" HORIZON PILE EVENLY OVER STRIPPED AREA.



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DESIGNER: JMP (NAME) 2010-10-21 (DATE)

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KEYSTONE XL PROJECT

FIA # 4359 | CHAINAGE: | DISCIPLINE # 03

TITLE
DETAIL 67A
TOPSOIL CONSERVATION DITCH & SPOIL STRIPPING TRIPLE DITCH

SCALE N.T.S. | DWG No 4359-03-ML-05-725 | REV 03

TC_A4_BR.DWG 8.5X11

CADD DRAWING: DO NOT MAKE MANUAL REVISIONS

APPENDIX E – Nebraska Noxious Weed Management Plan

Since this report was completed in 2014, the centerline has been adjusted slightly with eight route refinements to further minimize environmental impacts, improve constructability and address agency and landowner requests. The route refinements total approximately 6.0 miles. Thus, the mile posts listed in Attachment B of this report have shifted slightly; however, no additional areas of noxious weeds will be impacted. Three areas of noxious weeds listed in Attachment B will now be avoided based on the route refinements: Mile Posts 614.94 – 614.96; 615.01-615.03; and 849.67-849.67.

Weed Control Contact changes from those listed in Attachment F of this report include:

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KEYSTONE XL PIPELINE PROJECT

NEBRASKA NOXIOUS WEED MANAGEMENT PLAN

Table of Contents

List of Attachments

1.0 INTRODUCTION

This plan has been developed to identify noxious weed control practices that will be implemented for the Nebraska portion of the Keystone XL Pipeline Project (Project). This plan was originally submitted to the Nebraska County Weed Superintendents of counties through which the route passed in October/November 2010. The Project route has been modified in Nebraska and so this plan has been updated to reflect the Project changes. As of March, 2013, the Project would affect nine counties in Nebraska including Keya Paha, Boyd, Holt, Antelope, Boone, Nance, Merrick, Polk, and York. All of the land crossed by the Project in Nebraska is privately owned. No Federal or State owned land is crossed by the Project in Nebraska.

A weed is defined as any plant which the Director of the Nebraska Department of Agriculture has promulgated to be detrimental to the production of crops or livestock or to the welfare of persons residing within the state. The weeds on the statewide noxious weed list and the county noxious weeds are found in Attachment A.

1.1 Nebraska Weed Laws and Regulations

The Nebraska Weed Control Act (NAC 2-945.01-2-966) imposes stewardship obligations upon local governing bodies (counties and weed districts) as well as public and private landowners throughout the state to control noxious weeds on land they own or control. The Nebraska Weed Control Act establishes a procedure for the voters of each county to determine if they want the Noxious Weed Control Act to be administered by the county board or by an independently elected body, referred to as the county weed district board. The Nebraska Weed Control Association is made up of control authorities and weed superintendents from 93 counties and associate members involved with noxious and invasive weed control in Nebraska. Local county government has responsibility for the implementation and enforcement of weed management in Nebraska. It is illegal, under the Weed Control Act, for any person to transport hay or other plant products containing noxious weed seed in such a manner that may contaminate fields or other lands.

2.0 NOXIOUS WEED MANAGEMENT REQUIREMENTS, COMMITMENTS, and GUIDELINES

Noxious weed management requirements and commitments are outlined in the Project's Construction Mitigation and Reclamation Plan (CMRP) and the Keystone XL Oil Pipeline Project Final Supplemental Environmental Impact Statement (FSEIS) (January 2014).

CMRP

Section 2.13 of the Project's CMRP explains how the Project will control noxious weeds. These commitments are outlined below.

1) The Contractor shall clean all construction equipment, including timber mats, prior to moving the equipment to the job site.

2) Prior to construction, Keystone will mark all areas of the right-of-way which contain infestations of noxious weeds and require equipment cleaning.

3) In areas of isolated noxious weed populations, the Contractor shall strip topsoil from the full-width of the construction right-of-way and store the topsoil separately from other topsoil and subsoil. The Environmental Inspectors (EIs) will identify these locations in the field prior to grading activities.

4) The Contractor shall use noxious weed-free mulch and straw bales for temporary erosion and sediment control.

5) 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.

6) Keystone will implement Best Management Practices (BMPs) for conducting vegetation control where necessary before and/or after construction.

7) 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 noxious 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 by a state-licensed pesticide applicator.

8) 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 within Keystone's above-ground facilities.

9) Keystone will coordinate with appropriate local, state, and federal agencies to prevent the spread of noxious weeds.

FSEIS

The Project has committed to control the introduction and spread of noxious weeds by implementing the construction and restoration procedures detailed in its CMRP (see above) which is an appendix to the FSEIS.

3.0 PURPOSE and OBJECTIVES

The purpose of this weed management plan is to present strategies to prevent and/or control the spread of noxious weeds during and following construction of the Project. The weed management plan is part of overall Project mitigation. Keystone and its contractors will be responsible for implementing the practices described in this Plan. Monitoring during the

construction and post-construction phases will ensure that weed management objectives are achieved.

The objectives of noxious weed control on the Keystone XL Pipeline Project include the following:

- acquire information on the occurrence, distribution and abundance of noxious weeds in the Project area prior to construction;

- prevent the establishment of new populations of noxious weeds in previously uninfested areas within the Project and limit the spread of existing infestations via the Project to the extent feasible;

- ensure any populations of rare flora or fauna within the Project area are not negatively impacted by control activities;

- coordinate and consult with designated federal (where applicable), State, and County weed personnel regarding noxious weed control activities conducted by Keystone to ensure compatibility with existing weed control protocols; and

- respond to landowner and/or land-regulating agency reports of weeds during the post-construction period.

This Plan addresses all Project lands disturbed by construction activities, including the right-of-way, pump stations, mainline valves, additional temporary workspace, pipe storage and contractor yards and access roads.

4.0 PRE-CONSTRUCTION SURVEYS

Several pre-construction noxious weed pedestrian surveys were conducted where access was granted on perennially-vegetated land (i.e., non-cultivated) that would be disturbed by the Project. Surveys were conducted by biologists who are familiar with the taxonomic characteristics and typical habitats of noxious weeds. The results of the pre-construction surveys in Nebraska are presented in Attachment B. Post-construction surveys will be conducted as described in Section 6.0.

5.0 NOXIOUS WEED MANAGEMENT

Weeds are spread by a variety of means that may include construction equipment, construction and reclamation materials, livestock, wildlife, and wind. The risk of establishing weeds increases with ground-disturbing activities (Sheley et al. 1999). This weed management plan emphasizes: 1) preventing the establishment of new populations of noxious weeds via the Project in lands that are currently weed-free; and 2) limiting the spread of existing populations of

noxious weeds via the Project as feasible. The following section presents strategies to manage noxious weeds during the pre-construction, construction and post-construction phases of the Project.

5.1 Preventive Measures

Measures that have been or will be implemented to prevent the spread of noxious weeds prior to and during Project construction, operations and maintenance phases follow.

- Pre-construction noxious weed surveys were conducted on the pipeline right-of-way prior to vegetative clearing. Supplemental pre-construction noxious weed surveys will be conducted on other Project-related disturbances prior to vegetative clearing as necessary (e.g. pipe yards). Existing infestations have been or will be described (species, density, and extent) and recorded on a map. Noxious weeds that occur adjacent to the right-of-way have been or will be similarly documented.

- Keystone will implement weed treatment prior to construction on a site-specific basis. Pre-construction treatments may include mechanical means (mowing, clearing) or herbicides, depending on the species present and size of the population.

- All Contractor vehicles and equipment will arrive at the work site clean and free of noxious weed seeds or parts. Equipment will be cleaned using high-pressure washing devices if necessary. An EI will inspect and verify that vehicles and equipment are free of soil and debris capable of transporting noxious weed seeds or parts prior to being allowed access to the right-of-way.

- Horizontal Directional Drilling (HDD) will be utilized at major water crossings which will avoid the disturbance and potential spread of weeds, including aquatic nuisance species, in these areas.

- In areas where noxious weeds have been identified, the Contractor will stockpile cleared vegetation and salvaged topsoil adjacent to the area from which they were stripped. Stockpiles containing noxious weed seed or plant parts will be separated from abutting, uninfested stockpiles. During reclamation, the Contractor will return topsoil and vegetative material from infested sites to the areas from which they were originally stripped.

- In certain situations, the Contractor will remove soil and debris potentially containing seeds, roots, and rhizomes from construction equipment prior to transport from a weed-infested area. The Project will utilize equipment cleaning stations on a limited basis at locations shown on the Construction Drawings or as directed by the EI. Where equipment cleaning stations are required they may be either: 1) wash stations to remove vegetative material using water under high pressure (see Equipment Wash Station Detail, Attachment C); or 2) cleaning stations where the tracks, tires and blades of all equipment will be either cleaned manually (shovel) and/or air-cleaned using

compressed air (see Equipment Cleaning Station Detail, Attachment D) as determined by the EI.

- The Contractor will implement revegetation activities as promptly as possible following construction and during the optimal seeding and planting window. An adequate vegetative cover greatly reduces the opportunity for invasion by noxious weeds.

- The Contractor will only apply fertilizer to reclaimed areas as directed by the jurisdictional land management agency, EI, or if requested by the landowner. Fertilizer is known to enhance the growth of noxious weeds.

- The Contractor must identify the source of straw/hay bales and mulch used for erosion control to verify that it is noxious weed-free.

- All seed will be certified noxious weed-free.

- Imported gravel and fill material will be source-identified by the Contractor and approved by Keystone to ensure that the originating site is noxious weed-free.

5.2 Treatment Methods

Noxious weed treatment will be in accordance with the Nebraska Department of Agriculture, County regulations, and jurisdictional land management agency or landowner agreements. Post-construction control measures may include one or more of the methods listed below.

- Mechanical methods will include hand-pulling, mowing or discing weeds. If these methods are used, subsequent seeding may be conducted to re-establish a desirable vegetative cover that will stabilize soils and slow the potential re-invasion of noxious weeds.

- County, State, and Federally-approved herbicides will be utilized to control noxious weed populations at select sites. Applications will typically be controlled to minimize impacts on surrounding vegetation (i.e., specific plants will be targeted). In areas of dense infestation, a broader application will be used and a follow-up seeding program implemented if needed. The timing of subsequent revegetation efforts will be based on the life of the selected herbicide and appropriate seeding windows. Herbicide application is discussed in greater detail in Section 6.0.

- In the event an area is not seeded until the spring following construction because of weather or scheduling constraints, all annual weed species and undesirable vegetation that have become established may be mechanically removed (e.g. disking, harrowing) as part of the seedbed preparation.

- Keystone will respond to landowner reports of post-construction noxious weeds on or adjacent to the right-of-way or above-ground facilities. Where it is determined that new populations have become established, or weed density or extent exceeds that which occurred in pre-construction circumstances, Keystone will either treat directly, treat via county or private contractor, or reimburse the landowner for reasonable costs associated with the treatment of documented weeds. Mechanical/cultural control methods or herbicide treatments will be considered.

- Under certain circumstances it may be necessary or desirable to clear herbaceous and woody vegetation in advance of grading operations (i.e., pre-clearing). Depending on site conditions, pre-clearing could have the potential to contribute to noxious weed dispersal due to soil disturbance and/or the spreading of plant parts. Keystone will implement the following measures to avoid or minimize the spread of weeds during pre-clearing:

    - All pre-clearing equipment will arrive on site clean and free of noxious weed seeds or parts;

    - Vegetation will be cut as close to the ground as possible without disturbing the soil surface;

    - Pre-clearing operations will be reassessed in the event that soils become muddy (via thawing or rain). Keystone may temporarily suspend pre-clearing until conditions improve or use methods that reduce soil disturbance, e.g., hand-clearing in lieu of mechanized equipment;

    - Depending on site conditions, relevant practices outlined elsewhere in this Weed Management Plan will be implemented per Keystone direction.

Treatment methods will be based on species-specific and site-specific conditions (e.g. plant phenology, proximity to water or riparian areas, agricultural activities, time of year) and will be coordinated with landowners and local regulatory agencies.

5.3 Education

Keystone and the Contractor will provide information to their employees regarding noxious weed identification, reporting, and impacts on agriculture, livestock, and wildlife. The critical importance of preventing the spread of noxious weeds in uninfested areas, and controlling the proliferation of weeds already present will be explained. The importance of adhering to measures to prevent the spread of noxious weeds will be stressed.

6.0 HERBICIDE APPLICATION, HANDLING, SPILLS, and CLEANUP

Herbicides will be utilized on a limited basis during the pre-construction phase and as the primary control method during the post-construction phase. Herbicides used on the Project will first be approved by the county weed supervisor in the county in which they would be used.

6.1 Herbicide Application and Handling

Prior to herbicide application, Keystone or the Contractor will obtain any required permits from the Project area counties. A contractor who is licensed in herbicide application will handle, store, and complete herbicide application in accordance with all applicable laws and regulations.

U.S. Environmental Protection Agency (EPA) herbicide label instructions will be strictly followed. Application of herbicides will be suspended when any of the following conditions exist:

- Wind velocity exceeds 6 miles per hour for application of liquids or 15 miles per hour for application of granular herbicides;
- Snow or ice covers the foliage of noxious weeds; or
- Precipitation is occurring or is imminent.

Vehicle-mounted sprayers (e.g. handgun, boom, injector) will be used primarily in open areas that are readily accessible by vehicle. Hand application methods (e.g. backpack spraying) that target individual plants will be used to treat small, scattered weed populations in rough terrain. Calibration checks of equipment will be conducted at the beginning of spraying and periodically to ensure that proper application rates are being achieved.

Herbicides will be transported to the Project site with the following provisions:

- Concentrate will be transported only in approved containers and in a manner that will prevent tipping or spilling, and in a compartment that is isolated from food, clothing, and safety equipment; and
- Mixing will only be conducted on-site and only at a distance greater than 300 feet from open or flowing water, wetlands, or other sensitive resources.

All herbicide equipment and containers will be inspected daily for leaks.

6.2 Herbicide Spills and Cleanup

All reasonable precautions will be taken to avoid spilling herbicides. In the event of an herbicide spill, cleanup requires immediate action. A spill kit is required in contractor vehicles used for herbicide application and in herbicide storage areas. Items to be included in a spill kit include:

- Protective clothing and gloves;
- Adsorptive clay, “kitty litter,” or other commercial adsorbent;
- Plastic bags and bucket;
- Shovel;
- Fiber brush and screw-in handle;
- Dust pan;
- Caution tape;
- Highway flares (use on established roads only);
- Detergent; and
- Plastic garbage bags.

Response to an herbicide spill will vary with the size and location of the spill, but general procedures include:

- Traffic control;
- Dressing the cleanup team with protective clothing;
- Stopping the leaks;
- Containing the spilled material;
- Cleaning up and removing the spilled herbicide and contaminated adsorptive material and soil; and
- Transporting the spilled pesticide and contaminated material to an authorized disposal site.

6.3 Worker Safety and Spill Reporting

All herbicide contractors will obtain and have readily available copies of the appropriate Material and Safety Data Sheets (MSDS) for the herbicides being used. Herbicide spills will be reported in accordance with all applicable laws and requirements. Herbicide contractors will adhere to protocols set forth in the Keystone XL Spill Prevention, Containment, Countermeasure and Cleanup Plan.

7.0 POST-CONSTRUCTION MONITORING AND TREATMENT

The focus of Keystone’s weed management program is to protect weed-free perennial vegetation types by monitoring and treating new or expanded post-construction weed populations within the Project work area. Monitoring and management of pre-existing noxious weeds in agricultural areas will be conducted on a case-by-case basis in response to landowner reports.

The distribution and density of noxious weeds will be monitored following Project construction in all native vegetation types. In cultivated fields and non-native pastures, monitoring surveys would occur in response to landowner reports. Surveys will be conducted as early in the year as feasible to identify and control noxious weeds before they produce seed. Noxious weeds, if

present, will be documented on separate noxious weed inventory forms (Attachment E). Percent cover, phenology, infested area and density (stems/0.01-acre) of weed species will be ocularly estimated. Estimates will be made for the entire problem area, comparing disturbed and adjacent areas, and may include a range of species cover and density values. Noxious weed populations within the Project will be located with a GPS unit.

Weed monitoring will be conducted in conjunction with overall revegetation monitoring for two growing seasons in native uplands and three growing seasons in wetlands consistent with the CMRP. Treatment of noxious weeds would occur if one or more of the following three criteria are met:

1. A new noxious weed population is confined to the right-of-way;
2. A noxious weed population is expanding via the right-of-way; and/or
3. A noxious weed population is impeding revegetation establishment.

Weed treatment will be discontinued if weeds are not present for two consecutive years or if adjacent populations are so extensive that continued treatment and monitoring of the right-of-way would be ineffective.

8.0 REPORTING

An annual report will be prepared that details weed control activities during the pre-construction and construction periods. The report will describe baseline conditions (occurrence, distribution, and abundance) of noxious weed species located in the Project area, weed control activities accomplished to date, and anticipated activities for the following year. Subsequent annual reports will: 1) detail the current status of noxious weed occurrence, distribution, and abundance; 2) summarize activities conducted in the Project area during the previous year; and 3) outline projected activities for the following year. Reported data will also include survey dates, herbicide treatments, amount and types of chemicals applied, and a list of participants and their activities.

9.0 REFERENCES

NAC (Nebraska Administrative Code) Title 25, Chapter 10 – Noxious Weed Regulations, Noxious Weed Control Act. 2010. Internet. August 2010. Available: http://www.agr.state.ne.us/regulate/bpi/actbb.htm#957

Sheley, R.L., M. Manoukin, and G. Marks. 1999. *Preventing Noxious Weed Invasion*, pages 69-72 in, R.L. Sheley and J.K. Petroff, editors. Biology and Management of Noxious Rangeland Weeds. Oregon State University Press, Corvallis, OR.

United States Department of State. Final Supplemental Environmental Impact Statement (FSEIS) for the Keystone XL Project. Available: http://keystonepipeline-xl.state.gov/finalseis/index.htm

ATTACHMENT A

Attachment A. Nebraska Designated Noxious Weeds

State Noxious Weeds

Common Name	Scientific Name
Canada thistle	*Cirsium arvense*
Common reed	*Phragmites australis*
Diffuse knapweed	*Centaurea diffusa*
Giant knotweed	*Polygonum sachalinense*
Leafy spurge	*Euphorbia esula*
Japanese knotweed	*Polygonum cuspitadum*
Musk thistle	*Carduus nutans*
Plumeless thistle	*Carduus acanthoides*
Purple loosestrife	*Lythrum salicaria*
Saltcedar	*Tamarix aphylla, T. chinensis, T. gallica, T. parviflora* and *T. ramosissima*
Sericea lespedeza	*Lespedeza cuneata*
Spotted knapweed	*Centaurea maculosa*

County-designated Noxious Weeds

County Name	Common Name	Scientific Name
Antelope	None	-
Boone	None	-
Fillmore	Flodman thistle	*Cirsium flodmanii*
	Tall thistle	*Cirsium altissimum*
Garfield	None	-
Greeley	None	-
Hamilton	None	-
Holt	None	-
Jefferson	None	-
Keya Paha	None	-
Merrick	None	-
Nance	None	-
Rock	Bull thistle	*Cirsium vulgare*
Saline	None	-
Wheeler	None	-
York	None	-

ATTACHMENT B

Attachment B
Noxious Weed Pre-Construction Survey
Keystone XL Pipeline Project
June 2014

COMMON NAME	SCIENTIFIC NAME	MILEPOST START	MILEPOST END
Musk thistle	*Carduus nutans*	604.57	604.62
Musk thistle	*Carduus nutans*	604.85	604.86
Musk thistle	*Carduus nutans*	604.93	604.93
Musk thistle	*Carduus nutans*	605.08	605.08
Musk thistle	*Carduus nutans*	605.51	605.52
Canada thistle	*Cirsium arvense*	605.72	605.73
Musk thistle	*Carduus nutans*	607.37	607.38
Musk thistle	*Carduus nutans*	607.81	607.86
Musk thistle	*Carduus nutans*	607.99	607.99
Musk thistle	*Carduus nutans*	608.08	608.11
Musk thistle	*Carduus nutans*	610.64	610.76
Canada thistle	*Cirsium arvense*	614.69	614.71
Musk thistle / Canada thistle	*Carduus nutans/Cirsium arvense*	614.94	614.96
Musk thistle	*Carduus nutans*	615.01	615.03
Musk thistle	*Carduus nutans*	615.27	615.28
Musk thistle	*Carduus nutans*	615.75	615.77
Musk thistle	*Carduus nutans*	618.58	618.68
Purple Loosestrife	*Lythrum salicaria*	626.14	626.16
Musk thistle	*Carduus nutans*	627.79	627.84
Spotted knapweed	*Centaurea maculosa*	647.52	647.63
Musk thistle	*Carduus nutans*	649.19	649.29
Musk thistle	*Carduus nutans*	649.70	649.73
Musk thistle	*Carduus nutans*	650.53	650.70
Canada thistle	*Cirsium arvense*	654.97	654.98
Spotted knapweed	*Centaurea maculosa*	658.52	658.54
Spotted knapweed	*Centaurea maculosa*	658.65	658.66
Leafy spurge	*Euphorbia esula*	658.72	659.19
Leafy spurge / Spotted knapweed	*Euphorbia esula /Centaurea maculosa*	659.19	659.24
Spotted knapweed	*Centaurea maculosa*	659.54	659.75
Spotted knapweed	*Centaurea maculosa*	659.82	659.86
Musk thistle	*Carduus nutans*	659.87	659.89
Spotted knapweed	*Centaurea maculosa*	659.98	660.01
Spotted knapweed	*Centaurea maculosa*	660.09	660.11
Spotted knapweed	*Centaurea maculosa*	660.13	660.14

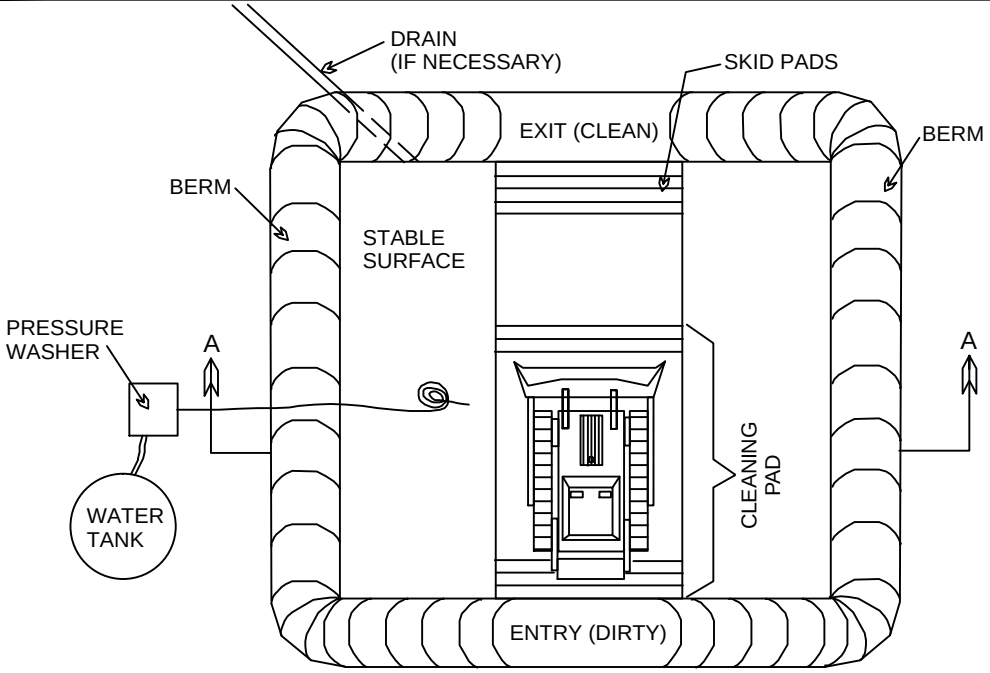
Attachment B
Noxious Weed Pre-Construction Survey
Keystone XL Pipeline Project
June 2014

COMMON NAME	SCIENTIFIC NAME	MILEPOST START	MILEPOST END
Musk thistle	*Carduus nutans*	661.99	662.07
Musk thistle	*Carduus nutans*	665.04	665.09
Spotted knapweed	*Centaurea maculosa*	668.96	668.97
Spotted knapweed	*Centaurea maculosa*	673.58	673.60
Spotted knapweed	*Centaurea maculosa*	674.16	674.18
Spotted knapweed	*Centaurea maculosa*	677.49	677.50
Spotted knapweed	*Centaurea maculosa*	677.50	677.50
Musk thistle	*Carduus nutans*	678.95	678.96
Spotted knapweed / Musk thistle	*Centaurea maculosa/Carduus nutans*	679.00	679.23
Musk thistle	*Carduus nutans*	679.43	679.46
Musk thistle	*Carduus nutans*	679.48	679.67
Leafy spurge	*Euphorbia esula*	682.95	682.96
Leafy spurge	*Euphorbia esula*	684.69	684.69
Musk thistle	*Carduus nutans*	689.65	689.66
Musk thistle	*Carduus nutans*	695.11	695.13
Canada thistle	*Cirsium arvense*	696.63	696.64
Musk thistle	*Carduus nutans*	700.85	700.85
Musk thistle	*Carduus nutans*	705.72	705.78
Musk thistle	*Carduus nutans*	706.06	706.09
Musk thistle / Leafy spurge	*Carduus nutans/Euphorbia esula*	709.17	709.42
Canada thistle	*Cirsium arvense*	709.31	709.32
Musk thistle	*Carduus nutans*	709.96	710.05
Musk thistle	*Carduus nutans*	711.28	711.29
Musk thistle	*Carduus nutans*	711.80	711.82
Leafy spurge	*Euphorbia esula*	713.76	713.83
Leafy spurge	*Euphorbia esula*	715.34	715.35
Leafy spurge	*Euphorbia esula*	715.51	715.51
Leafy spurge	*Euphorbia esula*	715.52	715.52
Musk thistle	*Carduus nutans*	721.50	721.51
Musk thistle	*Carduus nutans*	721.53	721.54
Musk thistle	*Carduus nutans*	723.51	723.51
Leafy spurge	*Euphorbia esula*	724.28	724.28
Musk thistle	*Carduus nutans*	726.56	726.56
Musk thistle / Canada thistle	*Carduus nutans/Cirsium arvense*	726.60	726.99
Musk thistle	*Carduus nutans*	728.57	728.59
Musk thistle	*Carduus nutans*	749.16	749.18

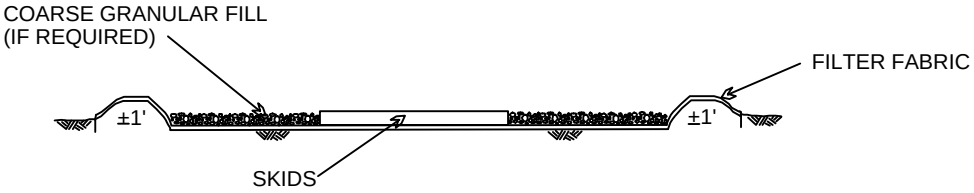
Attachment B
Noxious Weed Pre-Construction Survey
Keystone XL Pipeline Project
June 2014

COMMON NAME	SCIENTIFIC NAME	MILEPOST START	MILEPOST END
Canada thistle	*Cirsium arvense*	749.78	749.79
Musk thistle	*Carduus nutans*	751.92	751.97
Musk thistle	*Carduus nutans*	752.09	752.11
Leafy spurge	*Euphorbia esula*	752.83	752.84
Leafy spurge	*Euphorbia esula*	754.91	754.92
Musk thistle	*Carduus nutans*	758.84	758.85
Musk thistle / Canada thistle	*Carduus nutans/Cirsium arvense*	759.33	759.36
Musk thistle	*Carduus nutans*	759.99	760.01
Musk thistle	*Carduus nutans*	760.03	760.04
Musk thistle	*Carduus nutans*	760.46	760.49
Musk thistle	*Carduus nutans*	761.28	761.30
Leafy spurge	*Euphorbia esula*	761.69	761.71
Leafy spurge	*Euphorbia esula*	761.92	761.93
Leafy spurge	*Euphorbia esula*	761.97	761.98
Musk thistle	*Carduus nutans*	767.88	768.24
Musk thistle	*Carduus nutans*	771.89	771.96
Musk thistle	*Carduus nutans*	772.00	772.03
Musk thistle	*Carduus nutans*	775.02	775.02
Musk thistle	*Carduus nutans*	775.21	775.21
Canada thistle	*Cirsium arvense*	832.80	832.85
Musk thistle	*Carduus nutans*	846.86	846.91
Musk thistle	*Carduus nutans*	849.67	849.67
Musk thistle	*Carduus nutans*	853.96	853.98

ATTACHMENT C



PLAN



SECTION A-A

NOT TO SCALE

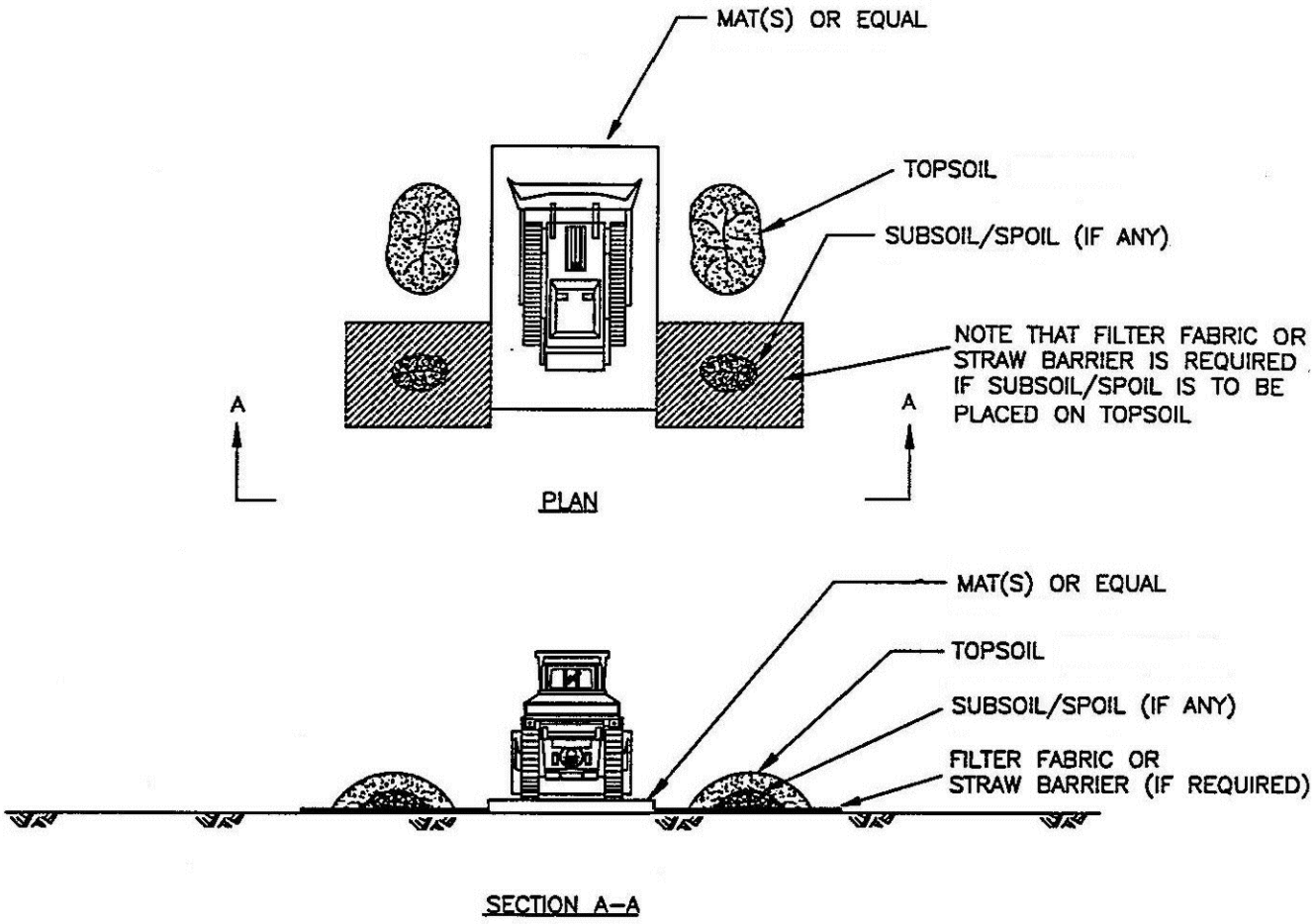
WASH STATION NOTES:

1. All equipment and vehicles are required to be cleaned at wash station locations shown on the Construction Drawings or as directed by the Environmental Inspector. Wash stations will be constructed by the contractor. Washings will be carried out under the supervision and to satisfaction of the Environmental Inspector.
2. Wash water used for cleaning will not be allowed to enter any waterbody, wetland, or irrigation canal/ditch. Any soils contaminated by petroleum-based, or other undesirable materials from wash stations will be removed.
3. The size of station will be adequate to accommodate the maximum size of equipment expected.
4. Equipment will consistently enter the "Dirty End" and exit the "Clean End".
5. Stable drainage from the site will be provided (if necessary). No discharge to streams or wetlands will be allowed.
6. Wash stations will be equipped with skid pads or wash racks to prevent soil form being carried on tracks or tires as equipment and vehicles exit the wash station. Skids are to be cleaned each time a piece of equipment is cleaned.
7. Gravel fill (if required) and filter fabric will be removed and disposed of in an acceptable land fill.
8. The depression will be backfilled with bermed material.
9. Cleaning sites will be monitored during the post construction monitoring program and weeds will be controlled per the Noxious Weed Management Plan.

ATTACHMENT C
KEYSTONE XL PIPELINE PROJECT
EQUIPMENT WASH STATION DETAIL

DATE: 08/26/10
FILE: WASH.DWG

ATTACHMENT D



SECTION A–A

NOT TO SCALE

CLEANING STATION NOTES:

1. All equipment will be required to be cleaned at equipment cleaning stations located as shown on the Construction Drawings or as directed by the Environmental Inspector.
2. Stockpile topsoil/subsoil as shown or in any configuration approved by the Environmental Inspector.
3. Shovels or other hand tools and/or compressed air will be used to remove as much soil as practicable from tracked equipment. Effort will be focused on tracks and blades.
4. If conditions are muddy, wheeled equipment will also be cleaned using hand tools to remove excess soil from tires and wheel wells.
5. Cleaning will be conducted on construction mats or other raised surface to minimize reattachment of soil that has been previously removed.
6. Mats will be cleaned between each piece of equipment.
7. Soil collected during the cleaning process will be stockpiled at a convenient location near the cleaning station and disposed of in an acceptable land fill.
8. If the soil has a significant component of subsoil, it will be placed over the backfilled trench or in the adjacent spoil storage area, and subsequently covered with topsoil. If the land owner does not approve of on-site disposal, the soil will be taken to an approved disposal site.
9. Soils contaminated with oil or grease will be removed and disposed of in accordance with the Project SPCCC Plan.

ATTACHMENT D
KEYSTONE XL PIPELINE PROJECT
EQUIPMENT CLEANING STATION DETAIL

DATE: 08/26/10
FILE: CLEAN.DWG

ATTACHMENT E

NEBRASKA
PRE-CONSTRUCTION NOXIOUS WEED INVENTORY FORM
KEYSTONE XL PIPELINE PROJECT

STATE: **SPREAD:** **Nebraska 7 8 9 10**	**GPS POINT:**	**STATION SEGMENT:** **SITE:**	
Examiners:	Ownership: PRIVATE STATE FEDERAL	Photo #:	Date:

Noxious Weed Species, Cover, Phenological Stage, and Estimated Density within Project

Species	Cover (%)	Phenology	Infested Area (width x length)	Estimated Density (stem/0.01ac)
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50* 50-100* >100*
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50* 50-100* >100*
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50* 50-100* >100*
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50* 50-100* >100*
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50* 50-100* >100*

Noxious Weed Species, Cover, Phenological Stage, and Estimated Density Adjacent to Project

		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50 50-100 >100
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50 50-100 >100
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50 50-100 >100
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50 50-100 >100
		Veg Flwr Seed		<1 1-5 5-10 10-20 20-50 50-100 >100

Site Conditions (adjacent land use; existing disturbance including livestock/wildlife, vehicular, burning, erosion)

Weed Origination, if known (adjacent, elsewhere from project, other)

Comments/Recommendations: No Action _____ Monitor _____

*General Guideline for Preventive Weed Control on ROW only:

If infestation >20 stems/0.01 acre & extends more than 100 feet in length, consider topsoil stripping. Record GPS point above.

Soil Stripping? Y N _____(w) x _____ (l)

Herbicide? Y N

Equipment Cleaning? Y N

Note: Flag/sign site only if control recommended.

Hand-pulled weeds within project during inventory? Y N

Westech, P.O. Box 6045, Helena, MT 59604, Fax: 406-442-9205, Cell: 406-459-9908

ATTACHMENT F

Appendix F. County and State Weed Supervisor Contacts in Nebraska, Revised March, 2013

POSITION	NAME	ADDRESS	CITY	STATE	ZIP CODE	TELEPHONE	CELL	E-MAIL
Keya Paha County								
County Weed Superintendent	Travis Mundorf	PO Box 349	Springview	NE	68778	402-497-3800	-	travismundorf@yahoo.com
Boyd County								
County Weed Superintendent	Terry Krysl	PO Box 141	Butte	NE	68722	402-775-2562	-	terrikrysl@hotmail.com
Holt County								
County Weed Superintendent	Coby Welke	1804 108th Rd.	O'Neill	NE	68763	402-336-3440	-	holtcountyweed.coby@telebeep.com
Antelope County								
County Weed Superintendent	Bruce Ofe	1108 L St.	Neligh	NE	68756	402-887-4659	-	antweed@frontiernet.net
Boone County								
County Weed Superintendent	Russell Stokes	1340 170th Ave.	Petersburg	NE	68652	402-386-5284	-	russellst769@gmail.com
Nance County								
County Weed Superintendent	Kevin Koziol	199 E 1st St.	Fullerton	NE	68638	308-536-2523	-	kjkoziol@q.com
Merrick County								
County Weed Superintendent	Corwin "Cork" Roscoe	2715 19th Ave.	Central City	NE	68826	308-946-5375	-	cork_cc@yahoo.com
Polk County								
County Weed Superintendent	James L. Carlson	PO Box 455	Osceola	NE	68651	402-747-2921	-	carlsonjl@live.com
York County								
County Weed Superintendent	Doug Deprez	725 E 25th St.	York	NE	68467	402-362-0506	-	dgdeprez@yahoo.com
State Offices								
NE Department of Agriculture	Mitch Coffin	301 Centennial Mall South, PO Box 94947	Lincoln	NE	68509	402-471-6844	-	mitch.coffin@nebraska.gov

APPENDIX F – Construction/Reclamation (Con/Rec) Units

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: CROP
KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**CROPLAND**
UNIT CODE:	**CROP**
UNIT DESCRIPTION:	Farmed cropland includes areas of agricultural production that are tilled either annually or occasionally. Agricultural products include wheat, corn, milo, oats, soybeans, and alfalfa.
UNIT LOCATION:	Cropland occurs on all spreads throughout the Keystone XL Steele City Project. Primary areas include central Montana, central and southern South Dakota, and southern Nebraska.

UNIT GOALS:	• Maintain soil productivity and prevent accelerated erosion. • Complete all work to standards specified in the CMR Plan, contract documents and Details, applicable permits, easement descriptions, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	**1.** Agricultural terraces may be present within this Con/Rec Unit and will be reconstructed as directed by Keystone. **2.** Seeding will be completed by the Landowner unless otherwise directed by Keystone.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone. **B.** The typical topsoil salvage depth is 6 – 12 inches.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW.

RECLAMATION

SEEDBED PREPARATION:	Prepare seedbed as specified in the CMRP. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 3-4 inches in diameter to aid in wind and water erosion control, and if not being seeded by Keystone.
SEEDING METHOD, SEED MIX AND RATE:	Seeding will be completed by the Landowner unless otherwise directed by Keystone. If the potential for erosion is high, an annual cover crop may be seeded as directed by Keystone.
SEEDING DATE:	Not applicable.
MULCHING AND MATTING:	Mulching and matting will typically not be completed within this Con/Rec Unit. If the potential for erosion is high, an annual cover crop or mulching may be required as directed by Keystone.
SLOPE AND TRENCH BREAKERS:	Slope breakers will typically not be constructed within this Con/Rec Unit. Trench breakers will be constructed where directed by Keystone. ADDITIONAL REQUIREMENTS: **A.** Reconstruct agricultural terraces as described in the CMRP and as directed by Keystone.

MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner if necessary**.**
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor soil stability post construction.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: CRP
KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**CONSERVATION RESERVE PROGRAM**
UNIT CODE:	**CRP**
UNIT DESCRIPTION:	Lands enrolled in the Conservation Reserve Program (CRP) under contract with the USDA Farm Service Agency. Landowners convert erodible or environmentally sensitive acreage to native grasses or introduced grasses and forbs, wildlife plantings, trees, or riparian buffers per the terms of a multi-year contract.

UNIT LOCATION:	Scattered throughout Project. Refer to Alignment Sheets and/or Keystone field verification for specific locations.
RECLAMATION GOALS:	• Restore topography similar to adjacent conditions. • Insure that lands enrolled in the CRP program are reseeded with appropriate seed mix and that lands remain eligible for enrollment in the CRP program. • Prevent erosion. • Adequately decompact soil. • Complete all work to standards specified by CMR Plan, contract documents and details, applicable permits, Keystone's satisfaction, and per the FSA/Landowner contract.
CONSTRUCTION	
ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW.
RECLAMATION	
SEEDBED PREPARATION:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 2-3 inches diameter. **B.** Topsoil should be as firm as practicable prior to seeding. **C.** The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately one-half inch.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: CRP
KEYSTONE XL STEELE CITY

01/10/13

SEEDING METHOD, SEED MIX AND RATE:	As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment. ADDITIONAL REQUIREMENTS: **A.** Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed a dry, secure location. **B.** The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location. **C.** Cover crop: To reduce erosion, an annual cover crop may be seeded per Keystone direction. **D.** Approved Seed Mix: The seed mix for each CRP tract may vary depending on each CRP contract with the Farm Service Agency. The Contractor will seed the mix provided by, or specified by, Keystone at each CRP tract.
NRCS RECOMMENDED SEEDING DATES:	August 1 to June 15, depending on climatic conditions. These dates may be altered at Keystone direction. Seeding outside these dates may be allowed with Keystone approval.
MULCHING AND MATTING:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting and Detail 47 for straw mulch. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
SLOPE AND TRENCH BREAKERS:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 3 for slope breakers and Detail 7 for trench breakers. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.

ADDITIONAL PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan.
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction.
4. Monitor and control noxious weeds as specified in the state Noxious Weed Management Plans.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: FOR KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**FOREST**
UNIT CODE:	**FOR**
UNIT DESCRIPTION:	Forest areas are dominated by native and introduced trees. Typical species include green ash, boxelder, plains cottonwood, elm, oak, mulberry, and eastern red cedar.
UNIT LOCATION:	In northern areas this unit is primarily located on floodplains, in deep draws, and on steeper slopes. In southern areas of the project the unit may also occur on flat topography and along roads and fencelines.

UNIT GOALS:	• Prevent damage to vegetation adjacent to the ROW when removing trees. • Restore native grass understory. • Stabilize slopes to prevent erosion. • Adequately decompact soil. • Complete all work to standards specified in the CMR Plan, contract documents and details, applicable permits, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	**1.** Dispose of excess wood debris as specified in the CMR Plan or as agreed to with local landowners per Keystone direction.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet in Montana and Nebraska. 85 feet in South Dakota.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Salvage timber if directed by landowner. **B.** Fell and clear trees in a manner that avoids injuring adjacent trees. **C.** Tree stumps shall be removed for 5 feet either side of the trench line, where necessary for safe and level construction, and to allow feathering out spoil. **D.** Where necessary on living trees with overhanging branches, cut broken branches at the fork; preserve the branch collar on the standing tree. **E.** Dispose of woody debris according to landowner direction as approved by Keystone; otherwise chip and incorporate with subsoil (amount not to inhibit revegetation) or remove to designated site approved by Keystone.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW.

RECLAMATION

SEEDBED PREPARATION:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 2-3 inches diameter. **B.** Topsoil should be as firm as practicable prior to seeding.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: FOR KEYSTONE XL STEELE CITY

01/10/13

SEEDING METHOD, SEED MIX AND RATE:	As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment. ADDITIONAL REQUIREMENTS: **A.** Forested areas will be seeded with the native grass species that occur in forest openings and understories unless otherwise requested by the landowner. The appropriate seed mix for each FOR Con/Rec Unit is shown in the Revegetation Band on the Alignment Sheets. **B.** The FOR Con/Rec Unit will be drill seeded unless slopes are too steep or soils are too rocky to safely operate seeding equipment, in which case, broadcast seeding will be conducted. Broadcast seed will be applied at twice the drill seed PLS/acre rate. **C.** Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed a dry, secure location. **D.** The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location. **E.** Cover crop: To reduce erosion, an annual cover crop may be seeded per Keystone direction.
NRCS RECOMMENDED SEEDING DATES:	As appropriate for the specified mix, for example, if seeding the TG seed mix utilize the TG seeding dates.
MULCHING AND MATTING:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting, Detail 47 for straw mulch, and Detail 64 for wood mulch.
SLOPE AND TRENCH BREAKERS:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 3 for slope breakers and Detail 7 for trench breakers. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.

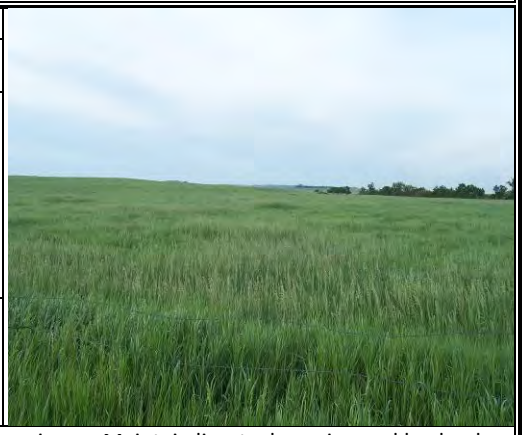
MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan.
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction.
4. Monitor and control noxious weeds as specified in state Noxious Weed Management Plans.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: IPH
KEYSTONE XL STEELE CITY

02/04/13

UNIT NAME:	**IMPROVED PASTURE AND HAYLAND**
UNIT CODE:	**IPH**
UNIT DESCRIPTION:	Improved pastures and haylands are managed grasslands that have typically been planted with grasses for livestock forage or hay production. Improved pastures and haylands are often dominated by crested wheatgrass, smooth brome and legumes in various combinations, or seeded native tall grasses, depending on Project location.
UNIT LOCATION:	Improved pastures and haylands occur on all spreads throughout the Keystone XL Steele City Project area.



UNIT GOALS:	• Re-establish vegetation and prevent accelerated erosion. • Maintain livestock grazing and hayland production. • Complete all work to standards specified in the CMR Plan, contract documents and Details, applicable permits, easement descriptions, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	None unless otherwise directed by Keystone.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW.

RECLAMATION

SEEDBED PREPARATION:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 2-3 inches diameter. **B.** Topsoil should be as firm as practicable prior to seeding. **C.** The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately one-half inch.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: IPH
KEYSTONE XL STEELE CITY

SEEDING METHOD, SEED MIX AND RATE:

As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment.

ADDITIONAL REQUIREMENTS:

A. Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed a dry, secure location.

B. The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location.

C. Cover crop: To reduce erosion, an annual cover crop may be seeded per Keystone direction.

D. The seed mix will vary depending on the pasture's location. The appropriate seed mix will be seeded at locations shown on the Alignment Sheets, unless otherwise directed by the landowner, or as directed by Keystone. One of four seed mixes will typically be drill-seeded as shown below:

Improved Pasture and Hayland Seed Mixture
Brome (BR)

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Bromus inermis	Smooth brome	AC Rocket, AC Knowles hybrid, Carlton, Signal, Magna, Manchar, Badger, Radisson, Rebound, Barton, Baylor, Saratoga, Lincoln, Cottonwood, Bravo, Jubilee, Polar, Elsberry	8.00	-	24
		TOTAL	**8.00**	**-**	**24**

[1]Based on a drill seeding rate of 24 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.
[2]Other species such as crested wheatgrass, alfalfa, yellow sweetclover, or clover may be present in the field adjacent to the ROW and are expected to spread to the ROW in a relatively short period.
NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

Improved Pasture and Hayland Seed Mixture
Crested Wheatgrass (CW)

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron cristatum	Crested wheatgrass	Fairway (Ephraim, Ruff, Parkway, NU-ARS-AC2, RoadCrest, Douglas) Hybrid (HyCrest, HyCrest II)	8.00	-	32
		TOTAL	**8.00**	**-**	**32**

[1]Based on a drill seeding rate of 32 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.
[2]Other species such as smooth brome, alfalfa, or sweetclover may be present in the field adjacent to the ROW and are expected to spread to the ROW in a relatively short period.
NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: IPH
KEYSTONE XL STEELE CITY

02/04/13

Improved Pasture and Hayland Seed Mixture
Introduced Pasture (IP)

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron cristatum	Crested wheatgrass	Fairway (Ephraim, Ruff, Parkway, NU-ARS-AC2, RoadCrest, Douglas) Hybrid (HyCrest, HyCrest II)	2.00	-	6
Agropyron intermedium	Intermediate wheatgrass	Manifest, Haymaker, Beefmaker, Reliant, Clarke, Slate, Chief, Oahe, Rush, Amur, Greendar, Tegmar	2.00	-	4
Bromus inermis	Smooth brome	AC Rocket, AC Knowles hybrid, Carlton, Signal, Magna, Manchar, Badger, Radisson, Rebound, Barton, Baylor, Saratoga, Lincoln, Cottonwood, Bravo, Jubilee, Polar, Elsberry	2.00	-	6
Dactylis glomerata	Orchardgrass	Chinook, Kay, Potomac, Baridana, Barula	0.25	-	4
Medicago sativa[3]	Alfalfa	Many varieties	1.00	-	5
Melilotus officinalis	Yellow sweetclover	Many varieties	0.25	-	2
		TOTAL	**7.50**	-	**27**

[1]Based on a drill seeding rate of 27 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.
[2]This may not be a complete list; other named varieties listed by USDA-NRCS in Montana and South Dakota are acceptable.
[3]Alfalfa must be planted by mid-August to ensure survival, otherwise, delete from mix.
NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

Improved Pasture and Hayland Seed Mixture
Tall Grassland Seed Mixture (TG)

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron smithii	Western wheatgrass	Rodan, Walsh, Flintlock, Rosana	4.00	-	10
Andropogon gerardii	Big bluestem	Sunnyview, Bison, Bonilla, Champ, Rountree, Bonanza	5.00	-	15
Bouteloua curtipendula	Sideoats grama	Pierre, Butte	3.00	-	14
Panicum virgatum	Switchgrass	Forestburg, Nebraska 28, Pathfinder, Summer, Trailblazer	0.75	-	7
Schizachyrium scoparium	Little bluestem	Camper, Blaze, Pastura	2.00		12
Sorghastrum nutans	Indiangrass	Chief, Tomahawk, Holt, Nebraska 54	3.00	-	12
		TOTAL	**17.75**	-	**70**

[1]Based on a drill seeding rate of 88 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.
[2]This may not be a complete list; other named varieties listed by USDA-NRCS in South Dakota and Nebraska are acceptable.
NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

NRCS RECOMMENDED SEEDING DATES:	August 1 to June 15, depending on climatic conditions. These dates may be altered at Keystone direction. Seeding outside these dates may be allowed with Keystone approval.
MULCHING AND MATTING:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting and Detail 47 for straw mulch. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
SLOPE AND TRENCH BREAKERS:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 3 for slope breakers and Detail 7 for trench breakers. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.

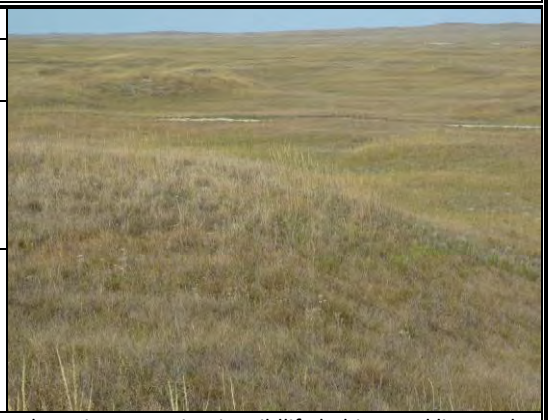
MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan.
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction.
4. Monitor and control noxious weeds as specified in the state Noxious Weed Management Plans.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: MG
KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**MIXED GRASSLANDS**
UNIT CODE:	**MG**
UNIT DESCRIPTION:	Mixed grasslands are dominated by native perennial grasses such as western wheatgrass, needle-and-thread, blue grama, Sandberg bluegrass, prairie junegrass, little bluestem, prairie sandreed, green needlegrass and bluebunch wheatgrass.
UNIT LOCATION:	Mixed grasslands are the most extensive native vegetation type on the Keystone XL Project and occur primarily south of the Missouri River in Montana and throughout South Dakota.



UNIT GOALS:	• Re-establish native vegetation and prevent accelerated erosion. • Maintain wildlife habitat and livestock grazing production. • Complete all work to standards specified in the CMR Plan, contract documents and Details, applicable permits, easement descriptions, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	None unless otherwise directed by Keystone.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW.

RECLAMATION

SEEDBED PREPARATION:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 2-3 inches diameter. **B.** Topsoil should be as firm as practicable prior to seeding. **C.** The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately one-half inch.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: MG
KEYSTONE XL STEELE CITY

01/10/13

SEEDING METHOD, SEED MIX AND RATE:

As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment.

ADDITIONAL REQUIREMENTS:

A. Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed a dry, secure location.

B. The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location.

C. One of three MG seed mixes will be applied at locations shown on the Alignment Sheets, unless otherwise directed by the landowner, or as directed by Keystone. The MG seed mix will be drill seeded unless slopes are too steep or soils are too rocky to safely operate seeding equipment, in which case, broadcast seeding will be conducted.

D. Cover crop: To reduce erosion, an annual cover crop may be seeded per Keystone direction.

Mixed Grassland Seed Mixture MG-1

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron smithii	Western wheatgrass	Rosana, Rodan	3.00	-	8
Agropyron spicatum	Bluebunch wheatgrass	Goldar	1.50	-	5
Agropyron trachycaulum	Slender wheatgrass	Pryor	1.00	-	3
Bouteloua gracilis	Blue grama	Bad River	0.30	-	6
Calamovilfa longifolia	Prairie sandreed	Goshen, Bowman	0.75	-	5
Koeleria cristata	Prairie junegrass	VNS	0.10	-	5
Poa sandbergii	Sandberg bluegrass	VNS, High Plains	0.25	-	5
Schizachyrium scoparium	Little bluestem	Badlands, Itasca	0.50	-	3
Stipa comata	Needle-and-thread	VNS	2.00	-	5
	TOTAL		**9.4**	-	**45**

VNS: Variety not specified

[1]Based on a drill seeding rate of 45 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.

[2]This may not be a complete list; other named varieties listed by USDA-NRCS in Montana are acceptable.

NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

Mixed Grassland Seed Mixture MG-2

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron smithii[3]	Western wheatgrass	Rosana, Rodan, Walsh	2.50	-	6
Agropyron trachycaulum	Slender wheatgrass	Pryor	1.00	-	3
Bouteloua gracilis	Blue grama	Bad River	0.30		6
Buchloe dactyloides	Buffalograss	Tatanka, Bismarck ecotype	3.00	-	4
Calamovilfa longifolia	Prairie sandreed	Goshen, Pronghorn	0.50	-	3
Distichlis spicata	Inland saltgrass	VNS	0.25	-	3
Koeleria cristata	Prairie junegrass	VNS	0.10	-	5
Poa sandbergii	Sandberg bluegrass	VNS, High Plains	0.20	-	4
Schizachyrium scoparium	Little bluestem	Badlands, Itasca	0.50	-	3
Stipa comata	Needle-and-thread	VNS	2.00	-	5
Stipa viridula	Green needlegrass	Lodorm, AC Mallard Ecovar	0.75	-	3
	TOTAL		**11.10**	-	**45**

VNS: Variety not specified

[1]Based on a drill seeding rate of 45 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.

[2]This may not be a complete list; other named varieties listed by USDA-NRCS in Montana and South Dakota are acceptable.

[3]If western wheatgrass is unavailable, thickspike wheatgrass (*Agropyron dasystachyum* var. Critana, Bannock, or Elbee) may be substituted at a rate of 2.0 PLS pounds per acre.

NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: MG
KEYSTONE XL STEELE CITY

01/10/13

Mixed Grassland Seed Mixture MG-3

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron smithii[3]	Western wheatgrass	Rosana, Rodan, Walsh	3.00	-	7
Agropyron trachycaulum	Slender wheatgrass	Pryor	1.00	-	3
Andropogon gerardii	Big bluestem	Sunnyview, Bison, Bonilla, Bonanza	1.50	-	4
Bouteloua curtipendula	Sideoats grama	Butte, Pierre, Trailway	1.25	-	6
Bouteloua gracilis	Blue grama	Bad River	0.20	-	4
Calamovilfa longifolia	Prairie sandreed	Goshen, Pronghorn	1.00	-	6
Koeleria cristata	Prairie junegrass	VNS	0.10	-	5
Schizachyrium scoparium	Little bluestem	Blaze, CamperBadlands, Itasca	1.00	-	6
Stipa viridula	Green needlegrass	Lodorm, AC Malard Ecovar	1.00	-	4
		TOTAL	**10.05**	**-**	**45**

VNS: Variety not specified

[1]Based on a drill seeding rate of 45 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.

[2]This may not be a complete list; other named varieties listed by USDA-NRCS in South Dakota and Nebraska are acceptable.

[3]If western wheatgrass is unavailable, thickspike wheatgrass (*Agropyron dasystachyum* var. Critana, Bannock, or Elbee) may be substituted at a rate of 2.0 PLS pounds per acre.

NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

NRCS RECOMMENDED SEEDING DATES:	August 1 to June 15, depending on climatic conditions. These dates may be altered at Keystone direction. Seeding outside these dates may be allowed with Keystone approval.
MULCHING AND MATTING:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting, Detail 47 for straw mulch, and Detail 64 for wood mulch. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
SLOPE AND TRENCH BREAKERS:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 3 for slope breakers and Detail 7 for trench breakers. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.

MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan**.**
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction.
4. Monitor and control noxious weeds as specified in the Montana and South Dakota Noxious Weed Management Plans.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: RIP
KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**RIPARIAN**
UNIT CODE:	**RIP**
UNIT DESCRIPTION:	Riparian woodlands include forested and shrub dominated areas around streams and rivers. Common trees and shrubs include plains cottonwood, green ash, box elder, Russian olive, sandbar willow, Wood's rose, snowberry, and silver sagebrush. Herbaceous understories are often dominated by Kentucky bluegrass, western wheatgrass, and redtop.
UNIT LOCATION:	Primarily located on floodplains and terraces along streams and rivers. This Con/Rec Unit is relatively limited on the Keystone XL Steele City Project.

UNIT GOALS:	• Prevent damage to vegetation adjacent to the ROW when removing trees. • Restore native grass understory. • Stabilize slopes to prevent erosion. • Adequately decompact soil. • Complete all work to standards specified in the CMR Plan, contract documents and details, applicable permits, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	**1.** Note that this type may be adjacent to or associated with wetlands and stream crossings. **2.** Implement wetland and stream crossing procedures as shown on Alignment Sheets or directed by Keystone. **3.** Wetland or stream crossing procedures will take precedent over this Con/Rec Unit should discrepancies occur.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Salvage timber if directed by landowner. **B.** Fell and clear trees to avoid injuring adjacent trees. **C.** Tree stumps shall be removed for 5 feet either side of the trench line and where necessary for safe and level construction. **D.** Where necessary on living trees with overhanging branches, cut broken branches at the fork; preserve the branch collar on the standing tree. **E.** Dispose of woody debris according to landowner direction as approved by Keystone; otherwise chip and incorporate with subsoil (amount not to inhibit revegetation) or remove to designated site approved by Keystone. **F.** Mow shrubby vegetation to ground level and leave rootstock intact unless grading is necessary.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW. ADDITIONAL REQUIREMENTS: **A.** Insure adequate erosion control is in place during construction to prevent sediment from reaching any associated streams or rivers.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: RIP
KEYSTONE XL STEELE CITY

01/10/13

RECLAMATION

SEEDBED PREPARATION:

As specified in the CMR Plan.

ADDITIONAL REQUIREMENTS:

A. Dirt clods should typically be smaller than 2-3 inches diameter.

B. Topsoil should be as firm as practicable prior to seeding.

SEEDING METHOD, SEED MIX AND RATE:

As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment.

ADDITIONAL REQUIREMENTS:

A. Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed a dry, secure location.

B. The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location.

C. The RIP seed mix will be applied at locations shown on the Alignment Sheets or as directed by Keystone. The RIP seed mix will be drill seeded unless slopes are too steep or soils are too rocky to safely operate seeding equipment, in which case, broadcast seeding will be conducted.

D. Cover crop: To reduce erosion, an annual cover crop may be seeded per Keystone direction.

Riparian Seed Mixture (RIP)

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron smithii	Western wheatgrass	Rosanna, Rodan, Walsh	5.00	-	13
Agropyron trachycaulum	Slender wheatgrass	Pryor	1.00	-	3
Bouteloua gracilis	Blue grama	Bad River	0.20		4
Elymus canadensis	Canada wildrye	VNS	3.00	-	8
Stipa viridula	Green needlegrass	Lodorm	2.50	-	10
		TOTAL	**11.70**	-	**38**

VNS: Variety not specified

[1]Based on a drill seeding rate of 38 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.

[2]This may not be a complete list; other named varieties listed by USDA-NRCS in Montana and South Dakota are acceptable.

[3]In Spreads 4-6, big bluestem and switchgrass will be added to the mix at the rates shown below:
Panicum virgatum-Switchgrass, (Varieties Forestburg, Nebraksa 28, Pathfinder, Summer, Trailblazer), at 2.00 pounds PLS/acre
Andropogon gerardii-Big bluestem, (Varieties Sunnyview, Bison, Bonilla, Champ, Rountree, Bonanza), at 3.00 pounds PLS/acre

NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

NRCS RECOMMENDED SEEDING DATES:

August 1 to June 15, depending on climatic conditions. These dates may be altered at Keystone direction. Seeding outside these dates may be allowed with Keystone approval.

MULCHING AND MATTING:

As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting, Detail 47 for straw mulch, and Detail 64 for wood mulch.

ADDITIONAL REQUIREMENTS:

A. Respread wood debris may negate the need for straw mulch per Keystone direction.

SLOPE AND TRENCH BREAKERS:

As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 3 for slope breakers and Detail 7 for trench breakers.

ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.

MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan.
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction. Monitor and control noxious weeds per the Noxious Weed Plan.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SB
KEYSTONE XL STEEL CITY

01/10/13

UNIT NAME:	**SHELTERBELT**
UNIT CODE:	**SB**
UNIT DESCRIPTION:	Planted tree and shrub shelterbelts and windbreaks. Common northern species are: plains cottonwood, Chinese elm, American elm, Austrian pine, Siberian peashrub, and lilac. Common southern species are: Osage orange, eastern red cedar, locust, and hawthorne.
UNIT LOCATION:	Typically located at field margins, near roadsides, or around residences. Refer to Alignment Sheets and/or Keystone field verification for specific locations.

RECLAMATION GOALS:	• Prevent damage to vegetation adjacent to the ROW when removing trees. • Restore grass understory. • Provide non-vegetated windbreaks. • Adequately decompact soil. • Complete all work to standards specified by CMR Plan, contract documents and details, applicable permits, and Keystone's satisfaction.

CONSTRUCTION

ROW WIDTH:	110 feet in Montana and Nebraska, 50 feet in South Dakota unless otherwise directed by Alignment Sheets and/or Keystone.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Salvage timber if directed by landowner. **B.** Fell and clear trees in a manner that avoids injuring adjacent trees. **C.** Tree stumps shall be removed for 5 feet either side of the trench line, where necessary for safe and level construction, and to allow feathering out spoil. **D.** Where necessary on living trees with overhanging branches, cut broken branches at the fork; preserve the branch collar on the standing tree. **E.** Dispose of woody debris according to landowner direction as approved by Keystone; otherwise chip and incorporate with subsoil (amount not to inhibit revegetation) or remove to designated site approved by Keystone.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW.

RECLAMATION

SEEDBED PREPARATION:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 2-3 inches diameter. **B.** Topsoil should be as firm as practicable prior to seeding.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SB
KEYSTONE XL STEEL CITY

01/10/13

SEEDING METHOD, SEED MIX AND RATE:	As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment. ADDITIONAL REQUIREMENTS: **A.** Shelterbelts will be seeded with seed mixes using in surrounding areas. The appropriate seed mix for each SB Con/Rec Unit is shown in the Revegetation Band on the Alignment Sheets. **B.** The SB Con/Rec Unit will be drill seeded unless impracticable due to a small area, in which case, broadcast seeding will be conducted. Broadcast seed will be applied at twice the drill seed PLS/acre rate. **C.** Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed a dry, secure location. **D.** The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location. **E.** Cover crop: To reduce erosion, an annual cover crop may be seeded per Keystone direction.
NRCS RECOMMENDED SEEDING DATES:	As appropriate for the specified mix, for example, if seeding the TG seed mix utilize the TG seeding dates.
PLANTING:	Replace trees as directed by Keystone.
PERMANENT EROSION CONTROL:	Install permanent slope and trench breakers, mulching, and matting as directed by CMR Plan, SWPPP, and Keystone.

MANAGEMENT PRACTICES

1. Install windfence across the ROW in areas where trees and/or shrubs have been removed as directed by Keystone.
2. Avoid mixing topsoil and subsoil through rutting per the CMR Plan.
3. Construction and reclamation practices may be modified per Keystone.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SBP
KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**SUBIRRIGATED PASTURE**
UNIT CODE:	**SBP**
UNIT DESCRIPTION:	The Subirrigated Pasture type includes subirrigated plains and hay meadows. Soils are typically fine sands, with narrow clay bands in some areas. Topography is typically flat. The water table within this Con/Rec Unit is often within six feet of the surface. Native grasses include big bluestem, switchgrass, and little bluestem; introduced grasses include timothy, orchardgrass, and Kentucky bluegrass . Wetlands may occur adjacent to, but not part of, this Con/Rec Unit.
UNIT LOCATION:	Subirrigated Pastures occur in southern South Dakota and portions of Nebraska, primarily in Tripp, Keya Paha, Rock, Holt, Antelope, and Nance counties.

UNIT GOALS:	• Maintain soil structure and stability to the greatest extent practicable. • Restore native grass species. • Maintain wildlife habitat and hay and livestock grazing production. • Complete all work to standards specified in the CMR Plan, contract documents and Details, applicable permits, easement descriptions, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	**1.** Anticipate trench wall instability **2.** Anticipate trench water management procedures to be employed throughout construction. **3.** Do not decompact the ROW unless specifically directed by Keystone. **4.** Backfilling, final cleanup, erosion control, and reseeding must be conducted progressively with the minimal time practicable between procedures. **5.** The ROW will not be utilized for access or project traffic following final cleanup within this Con/Rec Unit.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Do not clear more than 110 feet of ROW unless directed by Keystone. **B.** Leave root crowns and root structures in place to the maximum extent practicable. **C.** Minimize clearing equipment on the ROW.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil from the entire work area except under topsoil storage piles (Detail 53). **B.** Stabilize topsoil salvage piles with bio-degradable tackifier as directed by Keystone and maintain until topsoil replacement. **C.** Salvage topsoil horizon at depths as shown on Alignment Sheets or as directed by Keystone. **D.** Additional topsoil salvage may be necessary outside of the 110 foot Right-of-way, if additional workspace is needed to accommodate a wide trench and additional spoil.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Anticipate substantial trench instability. **B.** Insure that topsoil (salvaged or unsalvaged) is not lost to trench caving. **C.** Trench dewatering or other construction procedures, such as floating the pipe, that are suitable for use in saturated or flooded conditions may be necessary. The actual methods used to construct the trench, dewater the trench, and lay the pipe will be approved by Keystone.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SBP KEYSTONE XL STEELE CITY	01/10/13
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench and match adjacent topography. ADDITIONAL REQUIREMENTS: **A.** Do not decompact the ROW (subsoil or topsoil) unless specifically directed by Keystone. **B.** Avoid scalping undisturbed topsoil when redistributing stockpiled topsoil. **C.** Backfilling, final cleanup, erosion control, and reseeding must be conducted progressively with the minimal time practicable between procedures.
TEMPORARY and PERMANENT EROSION CONTROL:	As specified in the CMR Plan to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW. ADDITIONAL REQUIREMENTS: **A.** Implement procedures to prevent anticipated sediment from saturated spoil and topsoil from flowing outside the ROW boundaries. **B.** RoW stabilization measures must be carried out immediately following any topsoil replacement activities. This will consist of; straw mulch application across the entire RoW, installation of erosion control matting on slopes as specified by Keystone, use of NRCS recommended cover crops, and application of tackifiers or hydromulch in place of matting if approved by Keystone. **C.** Maintain and/or reinstall erosion control features to ensure proper function at all times.
RECLAMATION	
SEEDBED PREPARATION:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 2-3 inches diameter. **B.** Topsoil should be as firm as practicable prior to seeding. **C.** The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately one-half inch.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SBP
KEYSTONE XL STEELE CITY

01/10/13

SEEDING METHOD, SEED MIX AND RATE:

As specified in the CMR Plan. See Detail 70 for descriptions of seeding procedures and approved equipment.

ADDITIONAL REQUIREMENTS:

Due to seasonal constraints relative to successful re-establishment seeding must be conducted prior to July 15th to allow for adequate length of growing season to avoid winter-kill. Any areas unable to be re-seeded by this date will need to be deferred until after Oct 1 to ensure seed germination does not occur until after frost conditions to avoid winter-kill.

A. Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed in a dry, secure location.

B. The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location.

C. A seed mix of native species will be used in areas designated MA on the Revegetation Band of the Alignment Sheets. The seed mix will be drill seeded unless slopes are too steep or soils are too rocky to safely operate seeding equipment, in which case, broadcast seeding will be conducted.

D. Cover crop: To aid in managing wind and water erosion potential, an annual cover crop (perennial ryegrass (var. Linn), a Keystone-approved annual grass/crop, QuickGuard), or Proso millet may be seeded to those areas planted prior to the October 1st date as per Keystone direction.

Subirrigated Pasture (SBP) Seed Mixture

SCIENTIFIC NAME	COMMON NAME	DRILL SEEDING RATE[1] Pounds PLS/ Acre	DRILL SEEDING RATE[1] PLS/ sq.ft.	Percent in Mix	NRCS Allowable Percentage Range	Listed Varieties by Preference
GRASSES:						
Agropyron smithii	Western wheatgrass	2.50	6	9.0%	0 - 20	1. Rodan; 2. Rosana; 3. Barton
Andropogon gerardii	Big bluestem	6.00	23	34.3%	30 – 40	1. Pawnee; 2. Champ; 3. Bonanza
Elymus Canadensis	Canada wildrye	1.25	3	4.4%	0 – 5	1. Mandan
Panicum virgatum	Switchgrass	1.00	9	13.4%	5 – 20	1. Nebraska 28; 2. Pathfinder; 3. Forestburg
Schizachyrium scoparium	Little bluestem	1.75	10	14.9%	10 – 20	1. Camper; 2. Pastura; 3. Blaze
Sorghastrum nutans	Indiangrass	4.00	16	23.9%	15 – 30	1. Holt; 2. Nebraska 54
	TOTAL	**16.50**	**67**	**100**		

[1]Based on a drill seeding rate of 67 Pure Live Seed (PLS) per square foot. Where broadcast seeding is used, the rate will be doubled.
NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

NRCS RECOMMENDED SEEDING DATES:

October 1 to July 15, depending on climatic conditions. These dates may be altered at Keystone direction. Seeding outside these dates may be allowed with Keystone approval.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SBP
KEYSTONE XL STEELE CITY

01/10/13

MULCHING AND MATTING:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting, Detail 47 for weed free native hay or straw mulch. Cornstalks may be used for mulch with Keystone approval. ADDITIONAL REQUIREMENTS: **A.** All portions of the Project within this Con/Rec Unit will receive a companion crop for those areas seeded prior to July 15th. No companion crops will be applied with those areas seeded on or after Oct 1. **B.** All portions of the project within this Con/Rec Unit will receive and either straw mulch, cornstalk mulch, and/or erosion control matting at locations shown on Alignment Sheets or as directed by Keystone. **C.** RoW stabilization measures of all topsoils will consist of; straw mulch application across the entire RoW, installation of erosion control matting on slopes as specified by Keystone, and application of tackifiers or hydromulch may be used in place of matting if approved by Keystone. **D.** Erosion control matting may be applied over native hay or straw mulch as directed by Keystone. **E.** Biodegradable pins approved by Keystone will be used in place of metal staples to anchor erosion control matting within this Con/Rec Unit. **F.** Areas where erosion control matting has been installed will be fenced to prevent livestock access as directed by Keystone.
SLOPE AND TRENCH BREAKERS:	Slope breakers are not required in this Con/Rec Unit unless specifically directed by Keystone. Trench breakers will be installed as directed by Keystone.

MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan.
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction. Areas of failed reclamation will be repaired.
4. Monitor and control noxious weeds as specified in the Nebraska and South Dakota Noxious Weed Management Plans.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SP
KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**SANDY PRAIRIE**
UNIT CODE:	**SP**
UNIT DESCRIPTION:	Native prairie on sandy soils dominated primarily by warm- season grasses such as little bluestem, sand bluestem, prairie sandreed, and switchgrass. Topography is typically flat to gently rolling.
UNIT LOCATION:	The Sandy Prairie unit occurs in southern South Dakota and northern Nebraska, primarily in Tripp, Rock, Keya Paha, and Holt counties. The unit is interspersed with hay meadows and crop land.

UNIT GOALS:	• Maintain soil structure and stability. • Restore native grass species. • Maintain wildlife habitat and livestock grazing production. • Complete all work to standards specified in the CMR Plan, contract documents and Details, applicable permits, easement descriptions, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	**1.** Incorporate supplementary construction and reclamation procedures that may be provided by Keystone. **2.** Stabilize topsoil salvage piles with bio-degradable tackifier. **3.** Apply straw or native hay mulch for erosion control after clean-up as directed by Keystone. **4.** Install erosion control matting after regrading as specified by Keystone. Install erosion control matting over native hay mulch as specified by Keystone. In some areas, tackifier may be used in place of matting if approved by Keystone. **5.** Do not decompact the ROW unless specifically directed by Keystone. **6.** Seed mix will be applied in two procedures with a drill and broadcast seeder in some locations as described under Seeding Method, Seed Mix and Rate.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **1.** Leave root crowns and root structures in place to the maximum extent practicable.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Utilize trench and working salvage (Detail 54) on slopes less than 5% where shown on Alignment Sheets or as directed by Keystone. **B.** Where grading is necessary, salvage topsoil from entire area to be graded (Detail 53). **C.** Salvage topsoil horizon at depths as shown on Alignment Sheets or as directed by Keystone. **D.** Stabilize topsoil salvage piles with bio-degradable tackifier as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Anticipate trenchwall instability. **B.** Insure that topsoil (salvaged or unsalvaged) is not lost to trench caving.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench and match adjacent topography. ADDITIONAL REQUIREMENTS: **A.** Do not decompact the ROW (subsoil or topsoil) unless specifically directed by Keystone. **B.** Avoid scalping of undisturbed topsoil on the ROW when backfilling spoil and redistributing stockpiled topsoil.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW. ADDITIONAL REQUIREMENTS: **A.** Stabilize topsoil salvage piles with biodegradable tackifier as directed by Keystone. **B.** Install other erosion control to prevent erosion within the ROW, and off-ROW impacts as directed by Keystone. **C.** Maintain and/or reinstall erosion control features to ensure proper function at all times.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SP
KEYSTONE XL STEELE CITY

01/10/13

RECLAMATION

SEEDBED PREPARATION:

As specified in the CMR Plan.

ADDITIONAL REQUIREMENTS:

A. Additional seedbed preparation may be necessary within this Con/Rec Unit at Keystone direction.

B. Cultipack or roll ROW to firm topsoil prior to reseeding as authorized by Keystone.

C. Composted manure may be used where and as directed by Keystone. Fresh manure is not acceptable.

SEEDING METHOD, SEED MIX AND RATE:

As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment.

ADDITIONAL REQUIREMENTS:

A. seed will be applied in two applications. The first application will be completed with an approved drill seeder using half the seed mix shown below; the second application will be completed with an approved broadcast seeder using the remaining half.

B. Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed in a dry, secure location.

C. The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location.

D. The SP seed mix will be applied at locations shown on the Alignment Sheets or as directed by Keystone.

E. Use a chain to cover broad-cast seeded areas. Do not use a harrow to cover broadcast-seeded areas in the Sandhills unless directed by Keystone. Use of a harrow may bury seed too deeply.

F. Cover crop: To aid in managing wind and water erosion potential, an annual cover crop (perennial ryegrass (var. Linn), a Keystone-approved annual grass/crop, or QuickGuard) may be seeded per Keystone direction.

Sandy Prairie (SP) Seed Mixture

SCIENTIFIC NAME	COMMON NAME	BROADCAST SEEDING RATE[1] Pounds PLS/ Acre	BROADCAST SEEDING RATE[1] PLS/ sq.ft.	Percent in Mix	NRCS Allowable Percentage Range	Listed Varieties by Preference
GRASSES:						
Agropyron smithii	Western wheatgrass	1.25	3	2.4%	0 – 5	1. Rodan; 2. Rosana; 3. Barton
Andropogon hallii	Sand bluestem	12.00	31	24.4%	20 – 40	1. Goldstrike; 2. Garden County; 3. Champ
Bouteloua gracilis	Blue grama	0.25	5	3.9%	0 – 10	1. Bad River
Calamovilfa longifolia	Prairie sandreed	3.25	20	15.7%	15 – 25	1. Goshen; 2. Pronghorn
Elymus Canadensis	Canada wildrye	1.25	3	2.4%	0 – 5	1. Mandan
Eragrosts trichodes	Sand lovegrass	0.50	15	11.8%	5 – 15	1. Nebraska 27
Panicum virgatum	Switchgrass	1.50	13	10.2%	5 – 15	1. Nebraska 28; 2. Pathfinder
Schizachyrium scoparium	Little bluestem	4.50	27	21.3%	15 – 25	1. Camper; 2. Pastura; 3. Blaze
Sorghastrum nutans	Indiangrass	2.50	10	7.9%	5 – 15	1. Holt; 2. Nebraska 54
	TOTAL	**27.00**	**127**	**100**		

[1]Based on a broadcast seeding rate of approximately 127 Pure Live Seed (PLS) per square foot; total PLS/sq ft does not include perennial ryegrass which is used as a companion crop. Seed rates will be halved where drill seeding is used.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: SP
KEYSTONE XL STEELE CITY

01/10/13

NRCS RECOMMENDED SEEDING DATES:	November 1 to June 30, depending on climatic conditions. These dates may be altered at Keystone direction. Seeding outside these dates may be allowed with Keystone approval.
MULCHING AND MATTING:	As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting, Detail 47 for weed free native hay or straw mulch. Cornstalks may be used for mulch with Keystone approval. ADDITIONAL REQUIREMENTS: **A.** All portions of the Project within this Con/Rec Unit will receive a companion crop specified by the NRCS and Keystone, and straw mulch, cornstalk mulch, and/or erosion control matting at locations shown on Alignment Sheets or as directed by Keystone. **B.** Erosion control matting may be applied over native hay or straw mulch as directed by Keystone. **C.** Biodegradable pins approved by Keystone will be used in place of metal staples to anchor erosion control matting within this Con/Rec Unit.
SLOPE AND TRENCH BREAKERS:	Slope breakers are not anticipated in this Con/Rec Unit unless specifically directed by Keystone since most erosion is caused by wind rather than water. Trench breakers will be installed where directed by Keystone.

MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan**.**
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction. Areas of failed reclamation will be repaired.
4. Monitor and control noxious weeds as specified in the Nebraska and South Dakota Noxious Weed Management Plans.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: TG
KEYSTONE XL STEELE CITY

01/10/13

UNIT NAME:	**TALL GRASSLANDS**
UNIT CODE:	**TG**
UNIT DESCRIPTION:	Tall grasslands are dominated by tall warm-season grass species including big bluestem, switchgrass, Indiangrass, and little bluestem, and shorter warm-season grasses such as blue grama and sideoats grama.
UNIT LOCATION:	Tall grasslands occur in southern South Dakota and throughout Nebraska in areas that are not farmed or a part of the Sandhills. Many of the grass species within the Con/Rec Unit are the same as those occurring within the Sandhills and Marsh Plains Con/Rec Units, but topography, soil type, and hydrology differ between those types and this unit.

UNIT GOALS:	• Re-establish native vegetation and prevent accelerated erosion. • Maintain wildlife habitat and livestock grazing production. • Complete all work to standards specified in the CMR Plan, contract documents and Details, applicable permits, easement descriptions, and Keystone's satisfaction.
SPECIAL CONSIDERATIONS:	None unless otherwise directed by Keystone.

CONSTRUCTION

ROW WIDTH:	Typically 110 feet.
CLEARING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TOPSOIL SALVAGE:	As specified in the CMR Plan to maintain the topsoil resource and reclamation potential. ADDITIONAL REQUIREMENTS: **A.** Salvage topsoil horizon at depths shown on Alignment Sheets or as directed by Keystone.
TRENCHING:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
BACKFILL, DECOMPACTION AND REGRADING:	As specified in the CMR Plan to avoid slumping over the trench, relieve compaction, and match adjacent topography. ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.
TEMPORARY EROSION CONTROL:	As specified in the CMR Plan and authorized by Keystone to limit dust, prevent off-site sedimentation or erosion, and accelerated erosion on the ROW.

RECLAMATION

SEEDBED PREPARATION:	As specified in the CMR Plan. ADDITIONAL REQUIREMENTS: **A.** Dirt clods should typically be smaller than 2-3 inches diameter. **B.** Topsoil should be as firm as practicable prior to seeding. **C.** The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately one-half inch.

CONSTRUCTION/RECLAMATION UNIT SPECIFICATIONS: TG
KEYSTONE XL STEELE CITY

01/10/13

SEEDING METHOD, SEED MIX AND RATE:

As specified in the CMR Plan. See Detail 70 for a description of seeding procedures and approved equipment.

ADDITIONAL REQUIREMENTS:

A. Seed will be provided by Keystone and managed by the Contractor. The Contractor will store seed a dry, secure location.

B. The Contractor will store any unused seed in a dry, secure location and notify Keystone as to the seed's disposition. Keystone may elect to change the storage location.

C. The TG seed mix will be applied at locations shown on the Alignment Sheets, unless otherwise directed by the landowner, or as directed by Keystone. The TG seed mix will be drill seeded unless slopes are too steep or soils are too rocky to safely operate seeding equipment, in which case, broadcast seeding will be conducted.

D. Cover crop: If permanent seeding is delayed to the following growing season, perennial ryegrass (var. Linn) or another annual crop may be seeded per Keystone direction.

Tall Grassland Seed Mixture (TG)

SCIENTIFIC NAME	COMMON NAME	VARIETY[2]	DRILL SEEDING RATE[1] Pounds PLS/ Acre		PLS/ sq.ft.
GRASSES:					
Agropyron smithii	Western wheatgrass	Rodan, Walsh, Flintlock, Rosana	4.00	-	10
Andropogon gerardii	Big bluestem	Sunnyview, Bison, Bonilla, Champ, Rountree, Bonanza	5.00	-	15
Bouteloua curtipendula	Sideoats grama	Pierre, Butte	3.00	-	14
Panicum virgatum	Switchgrass	Forestburg, Nebraska 28, Pathfinder, Summer, Trailblazer	0.75	-	7
Schizachyrium scoparium	Little bluestem	Camper, Blaze, Pastura	2.00	-	12
Sorghastrum nutans	Indiangrass	Chief, Tomahawk, Holt, Nebraska 54	3.00	-	12
		TOTAL	**17.75**	-	**70**

[1]Based on a drill seeding rate of 70 Pure Live Seed (PLS) per square foot excluding perennial ryegrass. Where broadcast seeding is used, the rate will be doubled.
[2]This may not be a complete list; other named varieties listed by USDA-NRCS in South Dakota and Nebraska are acceptable.
NOTE: Species or rates may be revised based on commercial availability or site-specific conditions.

NRCS RECOMMENDED SEEDING DATES:

November 1 to June 30, depending on climatic conditions. These dates may be altered at Keystone direction. Seeding outside these dates may be allowed with Keystone approval.

MULCHING AND MATTING:

As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 4 for erosion control matting, Detail 47 for straw mulch, and Detail 64 for wood mulch.

ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.

SLOPE AND TRENCH BREAKERS:

As specified in the CMR Plan at locations shown on Alignment Sheets or as directed by Keystone. Refer to Detail 3 for slope breakers and Detail 7 for trench breakers.

ADDITIONAL REQUIREMENTS: None unless otherwise directed by Keystone.

MANAGEMENT PRACTICES

1. Provide for livestock and wildlife access across the trench at locations convenient to livestock and the landowner as practicable per the CMR Plan.
2. Construction and reclamation practices may be modified from those presented to suit site conditions or permit requirements with Keystone approval.
3. Monitor revegetation and soil stability post construction.
4. Monitor and control noxious weeds as specified in the South Dakota and Nebraska Noxious Weed Management Plans.

APPENDIX G – Soil and Permeability Study and Distance-to-Groundwater Survey

Since this report was completed in 2014, the proposed pipeline centerline has been adjusted slightly with eight route refinements to further minimize environmental impacts, improve constructability and address agency and landowner requests. The route refinements total approximately 6.0 miles. Thus, the mile posts listed in this report have shifted slightly as a result.

Section 2.0 - Soil Permeability Study

The eight route refinements have not resulted in a change of the soil association or soil series listed for any given mile post.

Section 3.0 - Distance to Groundwater Survey

Data from water wells within 1,500 feet of the centerline were evaluated to provide information representative of local hydrogeological characteristics. The eight route refinements range from 62 feet to a maximum of 338 feet away from the analyzed centerline. Thus, the route refinements which have been incorporated into the Preferred Route all fall within the 1,500-foot study area that was evaluated in the 2014 study for local hydrogeological characteristics. In addition, the report concludes that areas where groundwater is present closest to the ground surface appear to correlate with waterbody crossings. None of the route refinements are adjacent to waterbody crossings.

SOIL PERMEABILITY STUDY AND DISTANCE-TO-GROUNDWATER SURVEY

KEYSTONE XL PIPELINE PROJECT - NEBRASKA PREFERRED ROUTE

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April 2014

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1.0 INTRODUCTION

TransCanada Keystone Pipeline, LP (Keystone) is proposing to construct and operate a crude oil pipeline and related facilities from Hardisty, Alberta, Canada to Steele City, Nebraska, United States. The project, known as the Keystone XL Pipeline Project, consists of approximately 876 miles of pipeline from the Canadian Border to Steele City, of which approximately 275 miles of pipeline will traverse the State of Nebraska along a proposed route known as the preferred route.

This report presents the results of a soil permeability study and distance-to-groundwater survey along the proposed preferred route. The work was performed by Portnoy Environmental, Inc. (PEI), a company certified by the Nebraska Board of Geologists (Certificate of Authorization No. CAG0012), to satisfy selected requirements of Nebraska Administrative Code Title 291 - Nebraska Public Service Commission, Chapter 9 - Natural Gas and Pipeline Rules and Regulations, Section 023.07 (Nebraska Public Service Commission, July 27, 2013):

023.07 Burden of Proof: …the Commission shall evaluate:

023.07B Evidence of the impact due to intrusion upon natural resources and not due to safety of the proposed route of the major oil pipeline to the natural resources of Nebraska, including evidence regarding the irreversible and irretrievable commitments of land areas and connected natural resources and the depletion of beneficial uses of the natural resources. Such evidence may include but not be limited to the following:

0023.07B2 a comprehensive soil permeability study;

0023.07B3 a distance-to-groundwater survey…

Section 2 of this report presents the Soil Permeability Study, while Section 3 presents the Distance-to-Groundwater Survey.

2.0 SOIL PERMEABILITY STUDY

PEI used the following sources for data to determine soil permeabilities along the preferred route:

- SSURGO (Soil Survey Geographic) database,
- The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey,
- Digitized copies of published soil surveys available on the USDA NRCS website, and
- The Nebraska Conservation and Survey Division (University of Nebraska-Lincoln School of Natural Resources).

PEI initially reviewed the data provided in the SSURGO database and the USDA's Web Soil Survey; however, soil permeabilities are not provided in either data source. PEI subsequently ascertained that soil descriptions and permeability data are provided in published county soil surveys; therefore, PEI downloaded available digitized published soil surveys from the USDA NRCS website, which contains published soil surveys for all counties through which the preferred route traverses except for Nance, Polk and Jefferson Counties. PEI contacted the University of Nebraska - Lincoln School of Natural Resources and obtained hard copies of the published soil surveys for the remaining counties.

The published soil surveys include descriptions of the soils and tables that provide attributes for each soil series, which is defined as:

> *a group of soils having horizons* (a layer of soil with distinct characteristics, including permeability) *that are similar in all profile characteristics* (Manhke, *et. al.,* April 1978).

The published soil surveys, with the exception of that for Nance County, also contain a figure depicting the major soil associations. Soil associations are defined as:

> *…a landscape that has a distinctive pattern of soils in defined proportions*. *It typically consists of one or more major soil and at least one minor soil* (Manhke, *et. al.,* April 1978), and
>
> *A group of soils forming a pattern of soil types characteristic of a geographical region* (Allaby, et. al., 1999).

Soil associations are named for the major soil series present within the association (Manhke, *et. al.,* April 1978). For example, the Labu-Sansarc Soil Association is named after the Labu Series and the Sansarc Series; which make up the majority of the soils in the Association; however, it is likely that other soil series are present within the Association area.

As a soil association figure was not available for Nance County, PEI, in coordination with Banks Information Solutions (Banks) of Austin Texas, utilized the SSURGO database and professional judgment to group the Nance County soil series into soil associations based on similar soil associations for other counties in Nebraska.

In addition, the published soil surveys contain multiple figures that depict the individual soil series in the county. A review of these figures showed that individual soil series can change within 50 linear feet of each another; as such, there could be over 100 series changes along a line across the county.

Thus, to provide a meaningful data set, soil permeabilities for the soil series within the named soil associations, rather than for all the individual soils within a specific area along the preferred route centerline, were considered to be sufficiently representative for the purposes of this study. Using all individual soil series would likely result in similar data but with a much more extensive data set.

As previously noted, there are multiple horizons within each soil series, each of which has its own permeability. In addition, permeabilities are measured in ranges (*e.g.*, 0.2-0.6 inches/hour). As such, there is no specific soil permeability associated with any specific point along the preferred route centerline. However, to allow the user of this study to approximate soil permeabilities at 0.1-mile segments along the preferred route centerline, available permeability data was compiled for each soil series that make up each soil association. The results of the compilation are provided on **Table SA-1**. The soil associations through which the preferred route traverses are provided on **Figures SA-1** through **SA-12**; these figures also provide additional details regarding each soil association.

It should be noted that a given soil series in a specific county may be identified by a different name in a published soil survey of adjacent county. Such differences in names result from changes in the concepts of soil classification that occurred since publication. The characteristics of the soil series described in a specific county are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained in each specific published soil survey.

In regard to the figures, some soil boundaries may not match adjoining areas in adjacent counties. These differences result from changes in slope groupings, in combinations of mapping units, or in correlation procedures that occur in soil classification and in mapping guidelines.

3.0 DISTANCE-TO-GROUNDWATER SURVEY

To initiate the distance (depth) to groundwater survey, PEI contracted with Banks in March 2014 to perform a water well search within a one-mile radius of the preferred route centerline (mileposts 601 through 876). Well data for 2,649 registered water wells were provided by Banks, as follows: commercial/industrial (2), irrigation (2,167), livestock (134), domestic (182), injection (39), monitoring/observation (69), public water supply (3), and other (53). Based on the number of wells and extensive data provided, it was determined that the data would be sufficient to complete the depth to groundwater survey and a field survey was not warranted.

It should be noted that only the data for water wells registered with applicable state agencies was provided by Banks. It is possible that there are additional wells present within the one-mile radius of the preferred route centerline; however; as these wells have not been registered, Banks and PEI cannot make any warranties that all water wells within the defined radius have been identified. In addition, it is likely that additional public water supply wells are present within a one-mile radius of the preferred route centerline; however, information regarding these wells was not available (an inquiry was made to the State of Nebraska for information regarding such wells; the State indicated that the information could not be disclosed for security reasons).

The Banks database included the following information for each well:

- State/USGS Well ID,
- Owner Name,
- Purpose,
- Date completed,
- Latitude and Longitude (as UTM Coordinates),
- Total well depth, and
- Static water level (SWL, reported as feet below grade).

PEI performed the following tasks to determine the depth to groundwater along any individual portion of the preferred route centerline:

- Reduced the Banks database to evaluate wells within 1,500 feet of the preferred route centerline (753 wells) to ensure that the depths to water are representative as local hydrogeological characteristics can vary,
- Determined the nearest pipeline mileage marker to each applicable well within a 1/10 of a mile along the preferred route centerline,
- Divided the entire preferred route into one-mile segments (beginning with milepost 601),
- Determined the minimum and average depth to groundwater using the given SWLs for each well located within 1,500 feet of the centerline for each one-mile segment, and
- Calculated the standard deviation from the average for each one-mile segment.

The representative depth to groundwater for each mile segment was determined by PEI to be either the minimum value for the mile segment or the lower limit of the first standard deviation from the average for the segment. For segments with minimal data, wells up to approximately

½-mile (2,600 feet) from the preferred route centerline were added to the analysis for that segment, resulting in an additional 34 wells. For segments without available water well data, depths to groundwater were inferred (interpolated) from adjacent segments. The determination of a representative depth to groundwater was made without regard to the actual elevation of either the preferred route centerline or the elevation of the wells included in the analysis. The representative depth to groundwater reflects the depth from ground surface and is not corrected for the projected depth of the installed pipeline.

The results of the depth-to-water survey are depicted on **Figures GW-01** through **GW-05** and provided in **Table 2a**. The wells and associated data used to perform the survey are provided in **Table 2b**.

The results of the study show that depths to water along the preferred route range from less than 10 feet below ground surface (bgs) to greater than 175 feet bgs. Areas where depths to groundwater are closest to ground surface appear to correlate with water crossings that intersect the preferred route centerline.

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Soil Permeability Study

Tables

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Keya Paha (SA-01)	601.0	607.1	Anselmo-Labu	Anselmo	0-6	0.6-6.0
				Anselmo	6-22	2.0-6.0
				Anselmo	22-60	2.0-6.0
				Labu	0-26	0.06-0.2
				Labu	26-60	-
	607.1	610.5	Labu-Sansarc	Labu	0-26	0.06-0.2
				Labu	26-60	-
				Sansarc	0-14	0.06-0.2
				Sansarc	14-60	-
	610.5	610.9	Inavale-Cass-Verdel	Inavale	0-6	6.0-20.0
				Inavale	6-24	6.0-20.0
				Inavale	24-60	6.0-20.0
				Cass	0-10	0.6-2.0
				Cass	10-40	2.0-6.0
				Cass	40-60	6.0-20.0
				Verdel	0-18	0.2-0.6
				Verdel	18-60	<0.2
	610.9	615.5	Labu-Sansarc	Labu	0-26	0.06-0.2
				Labu	26-60	-
				Sansarc	0-14	0.06-0.2
				Sansarc	14-60	-
	615.5	616.5	Reliance-Ree-Jansen	Reliance	0-11	0.6-2.0
				Reliance	11-27	0.2-0.6
				Reliance	27-48	0.2-2.0
				Reliance	48-60	>20
				Ree	0-13	0.6-2.0
				Ree	13-54	0.6-2.0
				Ree	54-60	2.0-6.0
				Jansen	0-6	2.0-6.0
				Jansen	6-22	0.6-2.0
				Jansen	22-33	6.0-20.0
				Jansen	33-60	>20
	616.5	617.9	Labu-Sansarc	Labu	0-26	0.06-0.2
				Labu	26-60	-
				Sansarc	0-14	0.06-0.2
				Sansarc	14-60	-
Boyd (SA-02)	617.9	618.6	Inavale-Grigston-Cass	Inavale	0-16	2.0-6.0
				Inavale	16-26	6.0-20.0
				Inavale	26-60	6.0-20.0
				Grigston	0-15	0.6-2.0
				Grigston	15-31	0.6-2.0
				Grigston	31-60	0.6-2.0
				Cass	0-12	2.0-6.0
				Cass	12-26	2.0-6.0
				Cass	26-60	6.0-20.0
	618.6	618.8	Labu-Sansarc	Labu	0-34	0.06-0.2
				Labu	34-60	0.06-0.2
				Sansarc	0-16	0.06-0.2
				Sansarc	16-60	0.06-0.2
	618.8	620.0	Dunday-Valentine-Simeon	Dunday	0-15	2.0-6.0
				Dunday	15-60	2.0-20.0
				Valentine	0-11	6.0-20.0
				Valentine	11-60	6.0-20.0
				Simeon	0-5	6.0-20.0
				Simeon	5-60	6.0-20.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Boyd (SA-02)	620.0	625.0	Valentine-Simeon	Valentine	0-11	6.0-20.0
				Valentine	11-60	6.0-20.0
				Simeon	0-5	6.0-20.0
				Simeon	5-60	6.0-20.0
	625.0	625.6	Dunday-Valentine-Simeon	Dunday	0-15	2.0-6.0
				Dunday	15-60	2.0-20.0
				Valentine	0-11	6.0-20.0
				Valentine	11-60	6.0-20.0
				Simeon	0-5	6.0-20.0
				Simeon	5-60	6.0-20.0
	625.6	626.3	Labu-Sansarc	Labu	0-34	0.06-0.2
				Labu	34-60	0.06-0.2
				Sansarc	0-16	0.06-0.2
				Sansarc	16-60	0.06-0.2
Holt, North (SA-03A)	626.3	627.4	Labu-Sansarc-Valentine	Labu	0-5	0.06-0.2
				Labu	5-38	0.06-0.2
				Labu	38-60	-
				Sansarc	0-4	0.6-2.0
				Sansarc	4-12	0.6-2.0
				Sansarc	12-60	-
				Valentine	0-5	6.0-20.0
				Valentine	5-60	6.0-20.0
	627.4	629.0	O'Neill-Anselmo-Pivot	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Anselmo	0-15	0.6-6.0
				Anselmo	15-29	2.0-6.0
				Anselmo	29-60	2.0-6.0
				Pivot	0-16	6.0-20.0
				Pivot	16-21	6.0-20.0
				Pivot	21-28	6.0-20.0
				Pivot	28-60	>20
	629.0	630.1	Wewela-Dunday-Elsmere	Wewela	0-8	2.0-6.0
				Wewela	8-16	0.6-2.0
				Wewela	16-38	<0.2
				Wewela	38-60	-
				Dunday	0-17	6.0-20.0
				Dunday	17-60	6.0-20.0
				Elsmere	0-9	6.0-20.0
				Elsmere	9-60	6.0-20.0
	630.1	630.8	O'Neill-Anselmo-Pivot	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Anselmo	0-15	0.6-6.0
				Anselmo	15-29	2.0-6.0
				Anselmo	29-60	2.0-6.0
				Pivot	0-16	6.0-20.0
				Pivot	16-21	6.0-20.0
				Pivot	21-28	6.0-20.0
				Pivot	28-60	>20

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Holt, North (SA-03A)	630.8	632.5	Wewela-Dunday-Elsmere	Wewela	0-8	2.0-6.0
				Wewela	8-16	0.6-2.0
				Wewela	16-38	<0.2
				Wewela	38-60	-
				Dunday	0-17	6.0-20.0
				Dunday	17-60	6.0-20.0
				Elsmere	0-9	6.0-20.0
				Elsmere	9-60	6.0-20.0
	632.5	633.1	Labu-Sansarc-Valentine	Labu	0-5	0.06-0.2
				Labu	5-38	0.06-0.2
				Labu	38-60	-
				Sansarc	0-4	0.6-2.0
				Sansarc	4-12	0.6-2.0
				Sansarc	12-60	-
				Valentine	0-5	6.0-20.0
				Valentine	5-60	6.0-20.0
	633.1	635.5	Valentine-Simeon-Dunday	Valentine	0-5	6.0-20.0
				Valentine	5-60	6.0-20.0
				Simeon	0-5	6.0-20.0
				Simeon	5-60	6.0-20.0
				Dunday	0-17	6.0-20.0
				Dunday	17-60	6.0-20.0
	635.5	636.7	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	636.7	637.1	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
	637.1	637.6	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	637.6	637.9	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Holt, North (SA-03A)	637.9	638.4	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	638.4	638.8	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
	638.8	639.9	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	639.9	640.8	Elsmere-Ipage-Loup	Elsmere	0-9	6.0-20.0
				Elsmere	9-60	6.0-20.0
				Ipage	0-6	6.0-20.0
				Ipage	6-60	6.0-20.0
				Loup	0-12	2.0-6.0
				Loup	12-60	6.0-20.0
	640.8	643.2	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	643.2	646.6	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Holt, North (SA-03A)	646.6	649.0	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	649.0	655.0	O'Neill-Brunswick-Paka	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Brunswick	0-5	0.6-6.0
				Brunswick	5-21	2.0-20.0
				Brunswick	21-34	2.0-20.0
				Brunswick	34-60	>20
				Paka	0-8	2.0-6.0
				Paka	8-25	0.6-2.0
				Paka	25-41	0.6-2.0
				Paka	41-60	0.6-2.0
	655.0	656.5	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
	656.5	657.0	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	657.0	658.6	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
	658.6	660.8	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Holt, North (SA-03A)	660.8	661.2	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
	661.2	664.3	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	664.3	664.4	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
	664.4	665.9	O'Neill-Meadin-Jansen	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Meadin	0-7	0.6-2.0
				Meadin	7-16	6.0-20
				Meadin	16-60	>20
				Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
	665.9	667.5	Jansen-O'Neill	Jansen	0-15	0.6-2.0
				Jansen	15-25	0.6-2.0
				Jansen	25-30	6.0-20.0
				Jansen	30-60	>20
				O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
	667.5	673.7	Dunday-Pivot-Dunn	Dunday	0-17	6.0-20.0
				Dunday	17-60	6.0-20.0
				Pivot	0-16	6.0-20.0
				Pivot	16-21	6.0-20.0
				Pivot	21-28	6.0-20.0
				Pivot	28-60	>20
				Dunn	0-12	6.0-20.0
				Dunn	12-28	6.0-20.0
				Dunn	28-60	0.06-0.2

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Holt, North (SA-03A)	673.7	676.8	Paka-Anselmo	Paka	0-8	2.0-6.0
				Paka	8-25	0.6-2.0
				Paka	25-41	0.6-2.0
				Paka	41-60	0.6-2.0
				Anselmo	0-15	0.6-6.0
				Anselmo	15-29	2.0-6.0
				Anselmo	29-60	2.0-6.0
Holt, South (SA-03B)	676.8	679.2	Bazile-Trent	Bazile	0-11	0.2-0.6
				Bazile	11-31	2.0-20.0
				Bazile	31-60	>6
				Trent	0-24	0.6-2.0
				Trent	24-40	0.6-2.0
				Trent	40-60	0.6-2.0
	679.2	679.7	O'Neill-Brunswick-Paka	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Brunswick	0-5	0.6-6.0
				Brunswick	5-21	2.0-20.0
				Brunswick	21-34	2.0-20.0
				Brunswick	34-60	>20
				Paka	0-8	2.0-6.0
				Paka	8-25	0.6-2.0
				Paka	25-41	0.6-2.0
				Paka	41-60	0.6-2.0
	679.7	680.1	Bazile-Trent	Bazile	0-11	0.2-0.6
				Bazile	11-31	2.0-20.0
				Bazile	31-60	>6
				Trent	0-24	0.6-2.0
				Trent	24-40	0.6-2.0
				Trent	40-60	0.6-2.0
	680.1	681.1	O'Neill-Brunswick-Paka	O'Neill	0-12	2.0-6.0
				O'Neill	12-26	2.0-6.0
				O'Neill	26-60	>20
				Brunswick	0-5	0.6-6.0
				Brunswick	5-21	2.0-20.0
				Brunswick	21-34	2.0-20.0
				Brunswick	34-60	>20
				Paka	0-8	2.0-6.0
				Paka	8-25	0.6-2.0
				Paka	25-41	0.6-2.0
				Paka	41-60	0.6-2.0
Antelope (SA-04)	681.1	683.1	Bazile-Paka-Thurman	Bazile	0-14	0.6-2.0
				Bazile	14-26	2.0-6.0
				Bazile	26-31	0.6-2.0
				Bazile	31-60	6.0-20.0
				Paka	0-17	0.6-2.0
				Paka	17-35	0.6-2.0
				Paka	35-60	0.6-2.0
				Thurman	0-16	6.0-20.0
				Thurman	16-60	6.0-20.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Antelope (SA-04)	683.1	684.5	Brunswick-Paka-Valentine	Brunswick	0-4	2.0-6.0
				Brunswick	4-17	2.0-6.0
				Brunswick	17-23	6.0-20.0
				Brunswick	23-60	-
				Paka	0-17	0.6-2.0
				Paka	17-35	0.6-2.0
				Paka	35-60	0.6-2.0
				Valentine	0-60	6.0-20.0
	684.5	685.3	Bazile-Paka-Thurman	Bazile	0-14	0.6-2.0
				Bazile	14-26	2.0-6.0
				Bazile	26-31	0.6-2.0
				Bazile	31-60	6.0-20.0
				Paka	0-17	0.6-2.0
				Paka	17-35	0.6-2.0
				Paka	35-60	0.6-2.0
				Thurman	0-16	6.0-20.0
				Thurman	16-60	6.0-20.0
	685.3	685.8	Brunswick-Paka-Valentine	Brunswick	0-4	2.0-6.0
				Brunswick	4-17	2.0-6.0
				Brunswick	17-23	6.0-20.0
				Brunswick	23-60	-
				Paka	0-17	0.6-2.0
				Paka	17-35	0.6-2.0
				Paka	35-60	0.6-2.0
				Valentine	0-60	6.0-20.0
	685.8	687.0	Bazile-Paka-Thurman	Bazile	0-14	0.6-2.0
				Bazile	14-26	2.0-6.0
				Bazile	26-31	0.6-2.0
				Bazile	31-60	6.0-20.0
				Paka	0-17	0.6-2.0
				Paka	17-35	0.6-2.0
				Paka	35-60	0.6-2.0
				Thurman	0-16	6.0-20.0
				Thurman	16-60	6.0-20.0
	687.0	701.4	Thurman-Boelus-Nora	Thurman	0-16	6.0-20.0
				Thurman	16-60	6.0-20.0
				Boelus	0-10	6.0-20.0
				Boelus	10-29	6.0-20.0
				Boelus	29-60	0.6-2.0
				Nora	0-12	0.6-2.0
				Nora	12-21	0.6-2.0
				Nora	21-60	0.6-2.0
	701.4	702.3	Valentine-Thurman	Valentine	0-60	6.0-20.0
				Thurman	0-16	6.0-20.0
				Thurman	16-60	6.0-20.0
	702.3	708.2	Thurman-Boelus-Nora	Thurman	0-16	6.0-20.0
				Thurman	16-60	6.0-20.0
				Boelus	0-10	6.0-20.0
				Boelus	10-29	6.0-20.0
				Boelus	29-60	0.6-2.0
				Nora	0-12	0.6-2.0
				Nora	12-21	0.6-2.0
				Nora	21-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Antelope (SA-04)	708.2	712.3	Nora-Croftan-Moody	Nora	0-12	0.6-2.0
				Nora	12-21	0.6-2.0
				Nora	21-60	0.6-2.0
				Crofton	0-60	0.6-2.0
				Moody	0-8	0.2-0.6
				Moody	8-34	0.2-0.6
				Moody	34-40	0.6-2.0
				Moody	40-60	0.6-2.0
	712.3	713.1	Hord-Cozad	Hord	0-14	0.6-2.0
				Hord	14-39	0.6-2.0
				Hord	39-60	0.6-2.0
				Cozad	0-14	0.6-2.0
				Cozad	14-20	0.6-2.0
				Cozad	20-60	0.6-2.0
	713.1	714.0	Inavale-Elsmere-Ord	Inavale	0-11	6.0-20.0
				Inavale	11-60	6.0-20.0
				Elsmere	0-44	6.0-20.0
				Elsmere	44-60	6.0-20.0
				Ord	0-10	0.6-2.0
				Ord	10-21	2.0-6.0
				Ord	21-60	6.0-20.0
	714.0	714.3	Hord-Cozad	Hord	0-14	0.6-2.0
				Hord	14-39	0.6-2.0
				Hord	39-60	0.6-2.0
				Cozad	0-14	0.6-2.0
				Cozad	14-20	0.6-2.0
				Cozad	20-60	0.6-2.0
	714.3	716.2	Thurman-Boelus-Nora	Thurman	0-16	6.0-20.0
				Thurman	16-60	6.0-20.0
				Boelus	0-10	6.0-20.0
				Boelus	10-29	6.0-20.0
				Boelus	29-60	0.6-2.0
				Nora	0-12	0.6-2.0
				Nora	12-21	0.6-2.0
				Nora	21-60	0.6-2.0
Boone (SA-05)	716.2	725.2	Nora-Croftan-Moody	Nora	0-7	0.2-0.6
				Nora	7-29	0.2-0.6
				Nora	29-60	0.2-0.6
				Crofton	0-60	0.6-2.0
				Moody	0-12	0.2-0.6
				Moody	12-48	0.2-0.6
				Moody	48-60	0.2-0.6
	725.2	725.7	Hobbs	Hobbs	0-18	0.6-2.0
				Hobbs	18-60	0.6-2.0
	725.7	726.2	Nora-Croftan-Moody	Nora	0-7	0.2-0.6
				Nora	7-29	0.2-0.6
				Nora	29-60	0.2-0.6
				Crofton	0-60	0.6-2.0
				Moody	0-12	0.2-0.6
				Moody	12-48	0.2-0.6
				Moody	48-60	0.2-0.6
	726.2	726.6	Hobbs	Hobbs	0-18	0.6-2.0
				Hobbs	18-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Boone (SA-05)	726.6	731.2	Nora-Croftan-Moody	Nora	0-7	0.2-0.6
				Nora	7-29	0.2-0.6
				Nora	29-60	0.2-0.6
				Crofton	0-60	0.6-2.0
				Moody	0-12	0.2-0.6
				Moody	12-48	0.2-0.6
				Moody	48-60	0.2-0.6
	731.2	731.7	Hobbs	Hobbs	0-18	0.6-2.0
				Hobbs	18-60	0.6-2.0
	731.7	739.2	Nora-Croftan-Moody	Nora	0-7	0.2-0.6
				Nora	7-29	0.2-0.6
				Nora	29-60	0.2-0.6
				Crofton	0-60	0.6-2.0
				Moody	0-12	0.2-0.6
				Moody	12-48	0.2-0.6
				Moody	48-60	0.2-0.6
	739.2	741.1	Hobbs	Hobbs	0-18	0.6-2.0
				Hobbs	18-60	0.6-2.0
	741.1	743.6	Nora-Croftan-Moody	Nora	0-7	0.2-0.6
				Nora	7-29	0.2-0.6
				Nora	29-60	0.2-0.6
				Crofton	0-60	0.6-2.0
				Moody	0-12	0.2-0.6
				Moody	12-48	0.2-0.6
				Moody	48-60	0.2-0.6
	743.6	745.0	Leshara-Lamo-Wann	Leshara	0-13	0.6-2.0
				Leshara	13-34	0.6-2.0
				Leshara	34-60	0.6-2.0
				Lamo	0-15	0.2-0.6
				Lamo	15-42	0.2-0.6
				Lamo	42-60	0.2-0.6
				Wann	0-17	0.6-6.0
				Wann	17-22	2.0-6.0
				Wann	22-60	6.0-10.0
	745.0	747.7	Hall-Hord	Hall	0-13	0.6-2.0
				Hall	13-44	0.2-0.6
				Hall	44-60	0.6-2.0
				Hord	0-42	0.6-2.0
				Hord	42-60	0.6-2.0
Nance (SA-06)	747.7	753.4	Nora-Crofton-Moody	Nora	0-6	0.2-0.6
				Nora	6-30	0.2-0.6
				Nora	30-60	0.2-0.6
				Crofton	0-5	0.6-2.0
				Crofton	5-20	0.6-2.0
				Crofton	20-60	0.6-2.0
				Moody	0-20	0.2-0.6
				Moody	20-36	0.2-0.6
				Moody	36-60	0.2-0.6
	753.4	753.4	Hobbs	Hobbs	0-18	0.6-2.0
				Hobbs	18-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Nance (SA-06)	753.4	756.0	Nora-Crofton-Moody	Nora	0-6	0.2-0.6
				Nora	6-30	0.2-0.6
				Nora	30-60	0.2-0.6
				Crofton	0-5	0.6-2.0
				Crofton	5-20	0.6-2.0
				Crofton	20-60	0.6-2.0
				Moody	0-20	0.2-0.6
				Moody	20-36	0.2-0.6
				Moody	36-60	0.2-0.6
	756.0	756.2	Fillmore	Fillmore	0-14	0.6-2.0
				Fillmore	14-54	<0.06
				Fillmore	54-60	0.2-0.6
	756.2	756.3	Nora-Crofton-Moody	Nora	0-6	0.2-0.6
				Nora	6-30	0.2-0.6
				Nora	30-60	0.2-0.6
				Crofton	0-5	0.6-2.0
				Crofton	5-20	0.6-2.0
				Crofton	20-60	0.6-2.0
				Moody	0-20	0.2-0.6
				Moody	20-36	0.2-0.6
				Moody	36-60	0.2-0.6
	756.3	756.4	Fillmore	Fillmore	0-14	0.6-2.0
				Fillmore	14-54	<0.06
				Fillmore	54-60	0.2-0.6
	756.4	756.8	Nora-Crofton-Moody	Nora	0-6	0.2-0.6
				Nora	6-30	0.2-0.6
				Nora	30-60	0.2-0.6
				Crofton	0-5	0.6-2.0
				Crofton	5-20	0.6-2.0
				Crofton	20-60	0.6-2.0
				Moody	0-20	0.2-0.6
				Moody	20-36	0.2-0.6
				Moody	36-60	0.2-0.6
	756.8	756.9	Fillmore	Fillmore	0-14	0.6-2.0
				Fillmore	14-54	<0.06
				Fillmore	54-60	0.2-0.6
	756.9	758.9	Nora-Crofton-Moody	Nora	0-6	0.2-0.6
				Nora	6-30	0.2-0.6
				Nora	30-60	0.2-0.6
				Crofton	0-5	0.6-2.0
				Crofton	5-20	0.6-2.0
				Crofton	20-60	0.6-2.0
				Moody	0-20	0.2-0.6
				Moody	20-36	0.2-0.6
				Moody	36-60	0.2-0.6
	758.9	759.0	Belfore	Belfore	0-11	0.2-2.0
				Belfore	11-50	0.2-0.6
				Belfore	50-60	0.2-0.6

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Nance (SA-06)	759.0	759.5	Nora-Crofton-Moody	Nora	0-6	0.2-0.6
				Nora	6-30	0.2-0.6
				Nora	30-60	0.2-0.6
				Crofton	0-5	0.6-2.0
				Crofton	5-20	0.6-2.0
				Crofton	20-60	0.6-2.0
				Moody	0-20	0.2-0.6
				Moody	20-36	0.2-0.6
				Moody	36-60	0.2-0.6
	759.5	759.5	Hall	Hall	0-16	0.6-2.0
				Hall	16-54	0.2-0.6
				Hall	54-60	0.6-2.0
	759.5	759.8	Muir	Muir	0-28	0.6-2.0
				Muir	28-60	0.6-2.0
	759.8	760.1	Hall-Hobbs	Hall	0-16	0.6-2.0
				Hall	16-54	0.2-0.6
				Hall	54-60	0.6-2.0
				Hobbs	0-18	0.6-2.0
				Hobbs	18-60	0.6-2.0
	760.1	761.2	Nora-Crofton-Moody	Nora	0-6	0.2-0.6
				Nora	6-30	0.2-0.6
				Nora	30-60	0.2-0.6
				Crofton	0-5	0.6-2.0
				Crofton	5-20	0.6-2.0
				Crofton	20-60	0.6-2.0
				Moody	0-20	0.2-0.6
				Moody	20-36	0.2-0.6
				Moody	36-60	0.2-0.6
	761.2	761.5	Hall-Hobbs	Hall	0-16	0.6-2.0
				Hall	16-54	0.2-0.6
				Hall	54-60	0.6-2.0
				Hobbs	0-18	0.6-2.0
				Hobbs	18-60	0.6-2.0
	761.5	761.8	Wann-Cass-Inavale	Wann	0-11	2.0-6.0
				Wann	11-18	2.0-6.0
				Wann	18-60	2.0-6.0
				Cass	0-14	2.0-6.0
				Cass	14-36	2.0-6.0
				Cass	36-60	6.0-20.0
				Inavale	0-7	6.0-20.0
				Inavale	7-15	6.0-20.0
				Inavale	15-60	6.0-20.0
	761.8	762.1	Gothenburg	Gothenburg	0-3	6.0-20.0
				Gothenburg	3-11	6.0-20.0
				Gothenburg	11-60	>20
	762.1	762.2	Valentine	Valentine	0-4	6.0-20.0
				Valentine	4-60	6.0-20.0
	762.2	762.2	Gothenburg	Gothenburg	0-3	6.0-20.0
				Gothenburg	3-11	6.0-20.0
				Gothenburg	11-60	>20
	762.2	762.6	Cass-Inavale	Cass	0-14	2.0-6.0
				Cass	14-36	2.0-6.0
				Cass	36-60	6.0-20.0
				Inavale	0-7	6.0-20.0
				Inavale	7-15	6.0-20.0
				Inavale	15-60	6.0-20.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
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County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Nance (SA-06)	762.6	762.9	Thurman-Valentine	Thurman	0-12	6.0-20.0
				Thurman	12-18	6.0-20.0
				Thurman	18-60	6.0-20.0
				Valentine	0-4	6.0-20.0
				Valentine	4-60	6.0-20.0
	762.9	763.2	Ortello	Ortello	0-12	2.0-6.0
				Ortello	12-30	2.0-6.0
				Ortello	30-60	6.0-20.0
	763.2	763.2	Wann	Wann	0-11	2.0-6.0
				Wann	11-18	2.0-6.0
				Wann	18-60	2.0-6.0
	763.2	763.8	Hord-Hall-Gayville	Hord	0-14	0.6-2.0
				Hord	14-50	0.6-2.0
				Hord	50-60	0.6-2.0
				Hall	0-16	0.6-2.0
				Hall	16-54	0.2-0.6
				Hall	54-60	0.6-2.0
				Gayville	0-2	0.6-2.0
				Gayville	2-14	<0.6
				Gayville	14-22	0.2-0.6
				Gayville	22-28	0.2-2.0
				Gayville	28-60	0.2-2.0
	763.8	763.9	Wann	Wann	0-11	2.0-6.0
				Wann	11-18	2.0-6.0
				Wann	18-60	2.0-6.0
	763.9	764.2	Detroit	Detroit	0-14	0.6-2.0
				Detroit	14-46	0.6-2.0
				Detroit	46-60	0.6-2.0
	764.2	764.5	Hord-Hall-Lamo	Hord	0-14	0.6-2.0
				Hord	14-50	0.6-2.0
				Hord	50-60	0.6-2.0
				Hall	0-16	0.6-2.0
				Hall	16-54	0.2-0.6
				Hall	54-60	0.6-2.0
				Lamo	0-19	0.6-2.0
				Lamo	19-25	0.2-2.0
				Lamo	25-35	0.2-0.6
				Lamo	35-60	0.2-2.0
	764.5	764.7	Ortello	Ortello	0-12	2.0-6.0
				Ortello	12-30	2.0-6.0
				Ortello	30-60	6.0-20.0
	764.7	764.9	Hord	Hord	0-14	0.6-2.0
				Hord	14-50	0.6-2.0
				Hord	50-60	0.6-2.0
	764.9	765.3	Ortello	Ortello	0-12	2.0-6.0
				Ortello	12-30	2.0-6.0
				Ortello	30-60	6.0-20.0
	765.3	765.7	Lamo-Hord	Lamo	0-19	0.6-2.0
				Lamo	19-25	0.2-2.0
				Lamo	25-35	0.2-0.6
				Lamo	35-60	0.2-2.0
				Hord	0-14	0.6-2.0
				Hord	14-50	0.6-2.0
				Hord	50-60	0.6-2.0

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Soil Permeabilities
Nebraska Preferred Route
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County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Nance (SA-06)	765.7	765.9	Gibbon	Gibbon	0-14	0.6-2.0
				Gibbon	14-36	0.6-2.0
				Gibbon	36-48	0.6-2.0
				Gibbon	48-60	6.0-20.0
	765.9	766.0	Ortello	Ortello	0-12	2.0-6.0
				Ortello	12-30	2.0-6.0
				Ortello	30-60	6.0-20.0
	766.0	766.1	Gibbon	Gibbon	0-14	0.6-2.0
				Gibbon	14-36	0.6-2.0
				Gibbon	36-48	0.6-2.0
				Gibbon	48-60	6.0-20.0
	766.1	766.6	Lamo-Loup	Lamo	0-19	0.6-2.0
				Lamo	19-25	0.2-2.0
				Lamo	25-35	0.2-0.6
				Lamo	35-60	0.2-2.0
				Loup	0-12	2.0-6.0
				Loup	12-48	2.0-6.0
				Loup	48-60	6.0-20.0
	766.6	766.7	Cass	Cass	0-14	2.0-6.0
				Cass	14-36	2.0-6.0
				Cass	36-60	6.0-20.0
	766.7	767.3	Loup-Wann	Loup	0-12	2.0-6.0
				Loup	12-48	2.0-6.0
				Loup	48-60	6.0-20.0
				Wann	0-11	2.0-6.0
				Wann	11-18	2.0-6.0
				Wann	18-60	2.0-6.0
	767.3	767.5	Lamo-Wann	Lamo	0-19	0.6-2.0
				Lamo	19-25	0.2-2.0
				Lamo	25-35	0.2-0.6
				Lamo	35-60	0.2-2.0
				Wann	0-11	2.0-6.0
				Wann	11-18	2.0-6.0
				Wann	18-60	2.0-6.0
Merrick (SA-07)	767.5	769.0	Leshara-Lex-Janude	Leshara	0-12	0.6-2.0
				Leshara	12-46	0.6-2.0
				Leshara	46-60	>6
				Lex	0-13	0.6-2.0
				Lex	13-24	0.2-6.0
				Lex	24-60	>20
				Janude	0-30	2.0-6.0
				Janude	30-38	2.0-6.0
				Janude	38-60	0.6-6.0
	769.0	770.4	O'Neill-Brocksburg-Blendon	O'Neill	0-23	2.0-20.0
				O'Neill	23-30	6.0-20.0
				O'Neill	30-60	>20
				Brocksburg	0-20	0.6-2.0
				Brocksburg	20-27	0.6-2.0
				Brocksburg	27-60	>20
				Blendon	0-16	2.0-6.0
				Blendon	16-30	2.0-6.0
				Blendon	30-60	2.0-20.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
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County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Merrick (SA-07)	770.4	771.8	Lamo-Caruso-Gayville	Lamo	0-19	0.6-2.0
				Lamo	19-25	0.2-2.0
				Lamo	25-35	0.2-0.6
				Lamo	35-60	0.2-2.0
				Caruso	0-14	0.6-2.0
				Caruso	14-53	0.2-2.0
				Caruso	53-60	6.0-20.0
				Gayville	0-2	0.6-2.0
				Gayville	2-14	<0.6
				Gayville	14-22	0.2-0.6
				Gayville	22-28	0.2-2.0
				Gayville	28-60	0.2-2.0
	771.8	772.7	Fonner	Fonner	0-20	2.0-6.0
				Fonner	20-26	6.0-20.0
				Fonner	26-60	>20
	772.7	773.2	Gothenburg-Platte-Barney	Gothenburg	0-3	6.0-20.0
				Gothenburg	3-11	6.0-20.0
				Gothenburg	11-60	>20
				Platte	0-7	0.6-2.0
				Platte	7-12	2.0-6.0
				Platte	12-60	>20
				Barney	0-9	0.6-2.0
				Barney	9-18	2.0-20.0
				Barney	18-60	>20
	773.2	775.1	Leshara-Lex-Janude	Leshara	0-12	0.6-2.0
				Leshara	12-46	0.6-2.0
				Leshara	46-60	>6
				Lex	0-13	0.6-2.0
				Lex	13-24	0.2-6.0
				Lex	24-60	>20
				Janude	0-30	2.0-6.0
				Janude	30-38	2.0-6.0
				Janude	38-60	0.6-6.0
	775.1	775.6	Gothenburg-Platte-Barney	Gothenburg	0-3	6.0-20.0
				Gothenburg	3-11	6.0-20.0
				Gothenburg	11-60	>20
				Platte	0-7	0.6-2.0
				Platte	7-12	2.0-6.0
				Platte	12-60	>20
				Barney	0-9	0.6-2.0
				Barney	9-18	2.0-20.0
				Barney	18-60	>20
Polk (SA-08)	775.6	776.3	Platte-Leshara-Alda	Platte	0-16	2.0-6.0
				Platte	16-60	6.0-20.0
				Leshara	0-46	0.6-2.0
				Leshara	46-60	0.6-2.0
				Alda	0-29	2.0-6.0
				Alda	29-60	6.0-20.0
	776.3	777.8	Hord	Hord	0-30	0.6-2.0
				Hord	30-60	0.6-2.0
	777.8	779.3	Coly-Cozad	Coly	0-10	0.6-2.0
				Coly	10-60	0.6-2.0
				Cozad	0-12	0.6-2.0
				Cozad	12-32	0.6-2.0
				Cozad	32-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
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County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Polk (SA-08)	779.3	786.6	Holder	Holder	0-14	0.6-2.0
				Holder	14-31	0.6-2.0
				Holder	31-60	0.6-2.0
	786.6	789.4	Hastings	Hastings	0-12	0.6-2.0
				Hastings	12-39	0.2-0.6
				Hastings	39-60	0.6-2.0
York (SA-09)	789.4	789.6	Hasting-Fillmore	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
				Fillmore	0-13	0.6-2.0
				Fillmore	13-34	<0.06
				Fillmore	34-40	0.2-0.6
				Fillmore	40-60	0.6-2.0
	789.6	790.2	Holder	Holder	0-14	0.6-2.0
				Holder	14-41	0.6-2.0
				Holder	41-60	0.6-2.0
	790.2	797.9	Hasting-Fillmore	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
				Fillmore	0-13	0.6-2.0
				Fillmore	13-34	<0.06
				Fillmore	34-40	0.2-0.6
				Fillmore	40-60	0.6-2.0
	797.9	798.3	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
	798.3	798.8	Hord-Silty Alluvial	Hord	0-16	0.6-2.0
				Hord	16-50	0.6-2.0
				Hord	50-60	0.6-2.0
				Silty Alluvial Land	-	-
				Silty Alluvial Land	-	-
	798.8	799.6	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
	799.6	801.4	Hasting-Fillmore	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
				Fillmore	0-13	0.6-2.0
				Fillmore	13-34	<0.06
				Fillmore	34-40	0.2-0.6
				Fillmore	40-60	0.6-2.0
	801.4	801.8	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
	801.8	802.7	Hasting-Fillmore	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
				Fillmore	0-13	0.6-2.0
				Fillmore	13-34	<0.06
				Fillmore	34-40	0.2-0.6
				Fillmore	40-60	0.6-2.0
	802.7	803.3	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
York (SA-09)	803.3	804.2	Hord-Silty Alluvial	Hord	0-16	0.6-2.0
				Hord	16-50	0.6-2.0
				Hord	50-60	0.6-2.0
				Silty Alluvial Land	-	-
				Silty Alluvial Land	-	-
	804.2	804.6	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
	804.6	809.9	Hasting-Fillmore	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
				Fillmore	0-13	0.6-2.0
				Fillmore	13-34	<0.06
				Fillmore	34-40	0.2-0.6
				Fillmore	40-60	0.6-2.0
	809.9	810.1	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
	810.1	810.7	Hasting-Fillmore	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
				Fillmore	0-13	0.6-2.0
				Fillmore	13-34	<0.06
				Fillmore	34-40	0.2-0.6
				Fillmore	40-60	0.6-2.0
	810.7	812.9	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
	812.9	814.7	Hord-Silty Alluvial	Hord	0-16	0.6-2.0
				Hord	16-50	0.6-2.0
				Hord	50-60	0.6-2.0
				Silty Alluvial Land	-	-
				Silty Alluvial Land	-	-
	814.7	815.4	Hastings	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
	815.4	818.1	Hasting-Fillmore	Hastings	0-6	0.6-2.0
				Hastings	6-48	0.2-0.6
				Hastings	48-60	0.6-2.0
				Fillmore	0-13	0.6-2.0
				Fillmore	13-34	<0.06
				Fillmore	34-40	0.2-0.6
				Fillmore	40-60	0.6-2.0
Fillmore (SA-10)	818.1	818.3	Hastings-Crete	Hastings	0-7	0.6-2.0
				Hastings	7-35	0.2-2.6
				Hastings	35-60	0.6-2.0
				Crete	0-12	0.2-0.6
				Crete	12-33	0.06-0.6
				Crete	33-60	0.2-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Fillmore (SA-10)	818.3	819.1	Hastings-Uly-Geary	Hastings	0-7	0.6-2.0
				Hastings	7-35	0.2-2.6
				hastings	35-60	0.6-2.0
				Uly	0-9	0.6-2.0
				Uly	9-15	0.6-2.0
				Uly	15-60	0.6-2.0
				Geary	0-6	0.2-0.6
				Geary	6-36	0.6-2.0
				Geary	36-60	0.6-2.0
	819.1	819.7	Hastings-Crete	Hastings	0-7	0.6-2.0
				Hastings	7-35	0.2-2.6
				Hastings	35-60	0.6-2.0
				Crete	0-12	0.2-0.6
				Crete	12-33	0.06-0.6
				Crete	33-60	0.2-2.0
	819.7	820.9	Crete-Butler	Crete	0-12	0.2-0.6
				Crete	12-33	0.06-0.6
				Crete	33-60	0.2-2.0
				Butler	0-13	0.6-2.0
				Butler	13-29	0.06-0.2
				Butler	29-34	0.2-0.6
				Butler	34-60	0.6-2.0
	820.9	821.3	Hastings-Crete	Hastings	0-7	0.6-2.0
				Hastings	7-35	0.2-2.6
				Hastings	35-60	0.6-2.0
				Crete	0-12	0.2-0.6
				Crete	12-33	0.06-0.6
				Crete	33-60	0.2-2.0
	821.3	823.1	Crete-Butler	Crete	0-12	0.2-0.6
				Crete	12-33	0.06-0.6
				Crete	33-60	0.2-2.0
				Butler	0-13	0.6-2.0
				Butler	13-29	0.06-0.2
				Butler	29-34	0.2-0.6
				Butler	34-60	0.6-2.0
	823.1	825.5	Olbut-Butler	Olbut	0-7	0.6-2.0
				Olbut	7-32	0.06-0.2
				Olbut	32-40	0.2-0.6
				Olbut	40-60	0.6-2.0
				Butler	0-13	0.6-2.0
				Butler	13-29	0.06-0.2
				Butler	29-34	0.2-0.6
				Butler	34-60	0.6-2.0
	825.5	830.8	Crete-Butler	Crete	0-12	0.2-0.6
				Crete	12-33	0.06-0.6
				Crete	33-60	0.2-2.0
				Butler	0-13	0.6-2.0
				Butler	13-29	0.06-0.2
				Butler	29-34	0.2-0.6
				Butler	34-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Fillmore (SA-10)	830.8	831.7	Hastings-Grete-Geary	Hastings	0-7	0.6-2.0
				Hastings	7-35	0.2-2.6
				Hastings	35-60	0.6-2.0
				Crete	0-12	0.2-0.6
				Crete	12-33	0.06-0.6
				Crete	33-60	0.2-2.0
				Geary	0-6	0.2-0.6
				Geary	6-36	0.6-2.0
				Geary	36-60	0.6-2.0
	831.7	832.3	Muir-Hobbs-Butler	Muir	0-15	0.6-2.0
				Muir	15-60	0.6-2.0
				Hobbs	0-9	0.6-2.0
				Hobbs	9-60	0.6-2.0
				Butler	0-13	0.6-2.0
				Butler	13-29	0.06-0.2
				Butler	29-34	0.2-0.6
				Butler	34-60	0.6-2.0
Saline (SA-11)	832.3	834.5	Crete-Hastings-Geary	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Geary	0-13	0.2-0.6
				Geary	13-38	0.2-0.6
				Geary	38-60	0.6-2.0
	834.5	837.0	Crete-Butler	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Butler	0-12	0.6-2.0
				Butler	12-25	0.06-0.2
				Butler	25-37	0.2-0.6
				Butler	37-60	0.6-2.0
	837.0	837.1	Hastings-Longford-Burchard	Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Longford	0-10	0.6-2.0
				Longford	10-38	0.06-0.2
				Longford	38-60	0.2-0.6
				Burchard	0-10	0.2-0.6
				Burchard	10-36	0.2-0.6
				Burchard	36-60	0.2-0.6
	837.1	837.4	Crete-Butler	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Butler	0-12	0.6-2.0
				Butler	12-25	0.06-0.2
				Butler	25-37	0.2-0.6
				Butler	37-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Saline (SA-11)	837.4	837.9	Hastings-Longford-Burchard	Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Longford	0-10	0.6-2.0
				Longford	10-38	0.06-0.2
				Longford	38-60	0.2-0.6
				Burchard	0-10	0.2-0.6
				Burchard	10-36	0.2-0.6
				Burchard	36-60	0.2-0.6
	837.9	838.4	Crete-Butler	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Butler	0-12	0.6-2.0
				Butler	12-25	0.06-0.2
				Butler	25-37	0.2-0.6
				Butler	37-60	0.6-2.0
	838.4	840.3	Hastings-Longford-Burchard	Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Longford	0-10	0.6-2.0
				Longford	10-38	0.06-0.2
				Longford	38-60	0.2-0.6
				Burchard	0-10	0.2-0.6
				Burchard	10-36	0.2-0.6
				Burchard	36-60	0.2-0.6
	840.3	842.8	Crete-Butler	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Butler	0-12	0.6-2.0
				Butler	12-25	0.06-0.2
				Butler	25-37	0.2-0.6
				Butler	37-60	0.6-2.0
	842.8	843.5	Hastings-Longford-Burchard	Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Longford	0-10	0.6-2.0
				Longford	10-38	0.06-0.2
				Longford	38-60	0.2-0.6
				Burchard	0-10	0.2-0.6
				Burchard	10-36	0.2-0.6
				Burchard	36-60	0.2-0.6
	843.5	844.5	Crete-Butler	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Butler	0-12	0.6-2.0
				Butler	12-25	0.06-0.2
				Butler	25-37	0.2-0.6
				Butler	37-60	0.6-2.0

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
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County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Saline (SA-11)	844.5	845.6	Hastings-Longford-Burchard	Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Longford	0-10	0.6-2.0
				Longford	10-38	0.06-0.2
				Longford	38-60	0.2-0.6
				Burchard	0-10	0.2-0.6
				Burchard	10-36	0.2-0.6
				Burchard	36-60	0.2-0.6
	845.6	846.4	Crete-Butler	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Butler	0-12	0.6-2.0
				Butler	12-25	0.06-0.2
				Butler	25-37	0.2-0.6
				Butler	37-60	0.6-2.0
	846.4	847.1	Hastings-Longford-Burchard	Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Longford	0-10	0.6-2.0
				Longford	10-38	0.06-0.2
				Longford	38-60	0.2-0.6
				Burchard	0-10	0.2-0.6
				Burchard	10-36	0.2-0.6
				Burchard	36-60	0.2-0.6
	847.1	847.5	Crete-Butler	Crete	0-6	0.6-2.0
				Crete	6-19	0.2-0.6
				Crete	19-42	0.06-0.2
				Crete	42-60	0.2-2.0
				Butler	0-12	0.6-2.0
				Butler	12-25	0.06-0.2
				Butler	25-37	0.2-0.6
				Butler	37-60	0.6-2.0
	847.5	847.8	Hastings-Longford-Burchard	Hastings	0-13	0.6-2.0
				Hastings	13-41	0.2-0.6
				Hastings	41-60	0.6-2.0
				Longford	0-10	0.6-2.0
				Longford	10-38	0.06-0.2
				Longford	38-60	0.2-0.6
				Burchard	0-10	0.2-0.6
				Burchard	10-36	0.2-0.6
				Burchard	36-60	0.2-0.6
Jefferson (SA-12)	847.8	848.1	Geary-Hastings	Geary	0-11	0.2-0.6
				Geary	11-42	0.2-0.6
				Geary	42-60	0.2-0.6
				Hastings	0-14	0.6-2.0
				Hastings	14-38	0.2-0.6
				Hastings	38-60	0.6-2.0
	848.1	849.3	Hobbs-Hord-Cass	Hobbs	0-26	0.6-2.0
				Hobbs	26-60	0.6-2.0
				Hord	0-16	0.6-2.0
				Hord	16-60	0.6-2.0
				Cass	0-16	0.6-2.0
				Cass	16-33	2.0-6.0
				Cass	33-60	6.0-20.0

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Soil Permeabilities
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County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Jefferson (SA-12)	849.3	851.4	Morrill-Burchard	Morrill	0-42	0.2-0.6
				Morrill	42-60	0.2-0.6
				Burchard	0-14	0.2-0.6
				Burchard	14-32	0.2-0.6
				Burchard	32-60	0.2-0.6
	851.4	859.4	Crete-Mayberry	Crete	0-6	0.6-2.0
				Crete	6-23	0.06-0.2
				Crete	23-29	0.2-0.6
				Crete	29-60	0.6-2.0
				Mayberry	0-13	0.2-0.6
				Mayberry	13-42	0.06-0.2
				Mayberry	42-60	0.2-0.6
	859.4	860.0	Hobbs-Hord-Cass	Hobbs	0-26	0.6-2.0
				Hobbs	26-60	0.6-2.0
				Hord	0-16	0.6-2.0
				Hord	16-60	0.6-2.0
				Cass	0-16	0.6-2.0
				Cass	16-33	2.0-6.0
				Cass	33-60	6.0-20.0
	860.0	860.9	Morrill-Burchard	Morrill	0-42	0.2-0.6
				Morrill	42-60	0.2-0.6
				Burchard	0-14	0.2-0.6
				Burchard	14-32	0.2-0.6
				Burchard	32-60	0.2-0.6
	860.9	861.5	Hobbs-Hord-Cass	Hobbs	0-26	0.6-2.0
				Hobbs	26-60	0.6-2.0
				Hord	0-16	0.6-2.0
				Hord	16-60	0.6-2.0
				Cass	0-16	0.6-2.0
				Cass	16-33	2.0-6.0
				Cass	33-60	6.0-20.0
	861.5	861.9	Morrill-Burchard	Morrill	0-42	0.2-0.6
				Morrill	42-60	0.2-0.6
				Burchard	0-14	0.2-0.6
				Burchard	14-32	0.2-0.6
				Burchard	32-60	0.2-0.6
	861.9	874.0	Crete-Mayberry	Crete	0-6	0.6-2.0
				Crete	6-23	0.06-0.2
				Crete	23-29	0.2-0.6
				Crete	29-60	0.6-2.0
				Mayberry	0-13	0.2-0.6
				Mayberry	13-42	0.06-0.2
				Mayberry	42-60	0.2-0.6
	874.0	874.5	Lancaster-Hedville	Lancaster	0-10	0.6-2.0
				Lancaster	10-26	0.2-0.6
				Lancaster	26-48	-
				Hedville	0-8	0.6-2.0
				Hedville	8-14	2.0-6.0
				Hedville	14-30	-
	874.5	875.6	Crete-Mayberry	Crete	0-6	0.6-2.0
				Crete	6-23	0.06-0.2
				Crete	23-29	0.2-0.6
				Crete	29-60	0.6-2.0
				Mayberry	0-13	0.2-0.6
				Mayberry	13-42	0.06-0.2
				Mayberry	42-60	0.2-0.6

Table SA-1
Soil Permeabilities
Nebraska Preferred Route
Keystone XL Pipeline Project

County (Report Figure)	From Milepost	To Milepost	Soil Association	Soil Series	Depth from Surface (in)	Permeability (in/hour)
Jefferson (SA-12)	875.6	876.1	Geary-Jansen	Geary	0-11	0.2-0.6
				Geary	11-42	0.2-0.6
				Geary	42-60	0.2-0.6
				Jansen	0-10	0.6-2.0
				Jansen	10-13	0.6-2.0
				Jansen	13-32	0.6-2.0
				Jansen	32-60	>20

Sources:

Plantz, M., and Zink, R., Soil Survey of Keya Paha County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, October 1980.

Indra, O., Soil Survey of Boyd County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, March 1979.

Manhke, C., Hammer, R., Hammond, C., and Schulte, R., Soil Survey of Antelope County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, April 1978.

Hammond, C., Manhke, C., Brown, L., Schulte, R., and Russell, W., Soil Survey of Boone County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, January 1972.

DaMoude, D, Haneman, R., Stecker, J., Ulrich, D., and Morris, C., Soil Survey of Saline County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, October 1990.

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Willard, J., Woods, J., Kollmorgen, H., Soil Survey of Nance County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, July, 1960.

Pollock, R., Knapton, I., and Peterson, M., Soil Survey of Merrick County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, February 1981.

Seevers, V. and Pollock, R., Soil Survey of Polk County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, April 1974.

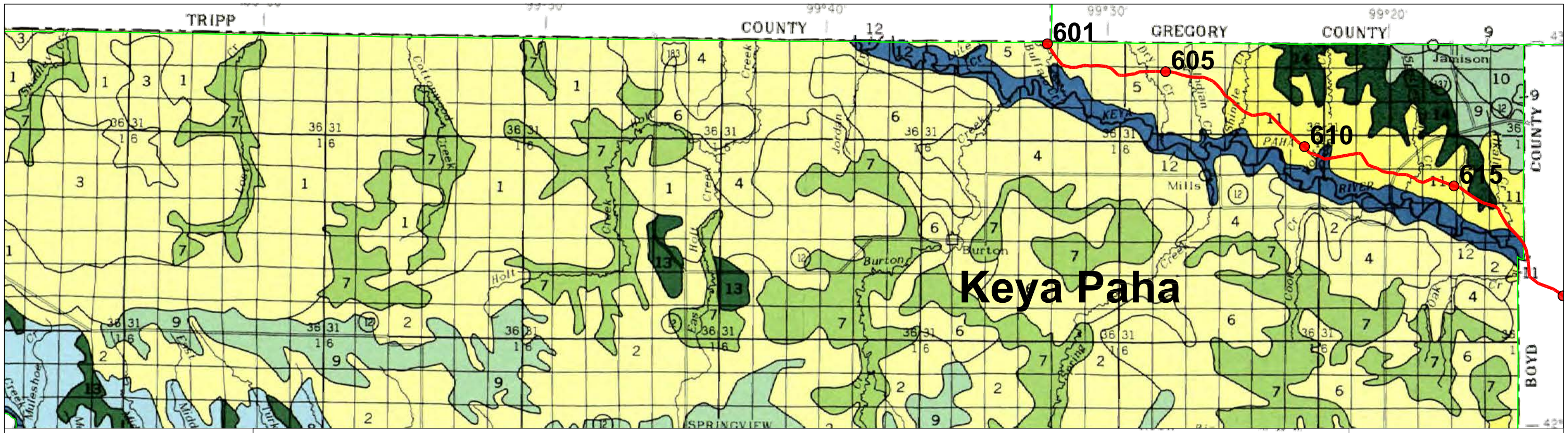
Seevers, V., Soil Survey of York County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, August 1977.

Hammer, R., Pollock, R., Buechle, A., Reardon, M., and Husbands, J., Soil Survey of Fillmore County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, July 1986.

Pollock, R. and Davis, L., Soil Survey of Jefferson County, Nebraska, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, May 1975.

Soil Permeability Study

Figures



DOMINANTLY SANDY AND LOAMY SOILS ON EOLIAN AND RESIDUAL UPLANDS

1 — Valentine–Tassel association: Deep and shallow, gently sloping to steep, excessively drained and well drained sandy soils that formed in windblown material or in residuum of sandstone

2 — Manter–Valentine association: Deep, nearly level to moderately steep, excessively drained and well drained sandy soils that formed in windblown material

3 — Tassel–Duda–Ronson association: Shallow and moderately deep, nearly level to moderately steep, well drained loamy and sandy soils that formed in windblown material or in residuum of sandstone

4 — Wewela–Valentine–Anselmo association: Moderately deep and deep, nearly level to steep, well drained and excessively drained loamy and sandy soils that formed in windblown material or in residuum of shale

5 — Anselmo–Labu association: Deep and moderately deep, gently sloping to steep, well drained loamy and clayey soils that formed in windblown material or in residuum of shale

6 — Valentine association: Deep, gently rolling to hilly, excessively drained sandy soils that formed in windblown material

DOMINANTLY SANDY AND LOAMY SOILS IN BROAD UPLAND VALLEYS

7 — Ipage–Loup–Ord association: Deep, nearly level and very gently sloping, moderately well drained to very poorly drained sandy and loamy soils that formed in windblown and alluvial material

DOMINANTLY SANDY, LOAMY, AND SILTY SOILS ON BREAKS TO THE NIOBRARA RIVER VALLEY

8 — Tassel–Mariaville–Ronson association: Shallow and moderately deep, steep and very steep, well drained sandy, loamy, and silty soils that formed in residuum of sandstone and siltstone

DOMINANTLY LOAMY SOILS UNDERLAIN BY SAND AND GRAVEL; ON UPLANDS

9 — Meadin–Jansen–O'Neill association: Nearly level to steep, well drained and excessively drained loamy soils that are shallow or moderately deep over sand and gravel; these soils formed in loamy and loesslike material

10 — Jansen–Brocksburg–O'Neill association: Nearly level to gently sloping, well drained loamy soils that are moderately deep over sand and gravel; these soils formed in loamy and loesslike material

DOMINANTLY CLAYEY SOILS ON RESIDUAL UPLANDS

11 — Labu–Sansarc association: Moderately deep and shallow, strongly sloping to very steep, well drained clayey soils that formed in residuum of shale

DOMINANTLY SANDY, LOAMY, AND SILTY SOILS ON FLOOD PLAINS AND TERRACES

12 — Inavale–Cass–Verdel association: Deep, nearly level to strongly sloping, well drained and somewhat excessively drained sandy, loamy, and silty soils that formed in deposits of alluvial and colluvial material

DOMINANTLY LOAMY AND SILTY SOILS ON EOLIAN AND RESIDUAL UPLANDS

13 — Vetal–Holt association: Deep and moderately deep, nearly level to strongly sloping, well drained loamy soils that formed in loess and loamy material or in residuum of sandstone

14 — Reliance–Ree–Jansen association: Nearly level to gently sloping, well drained silty and loamy soils that are deep or moderately deep over sand and gravel; these soils formed in silty loesslike material and loamy material

* The texture given in the legend headings is that of the surface layer of the major soils.

KEY:

NORTH

SCALE: 1"- 3 MILES

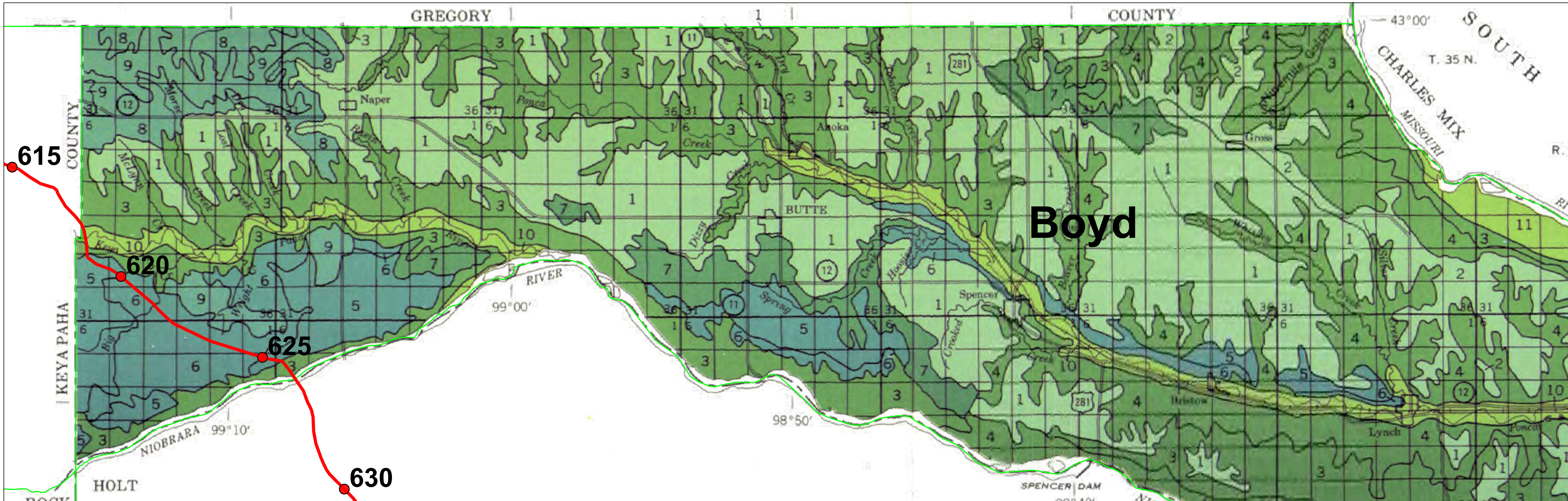
- IFC ROUTE CENTERLINE
- 610 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

After: Plantz, M., and Zink, R., *Soil Survey of Keya Paha County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, October 1980.

PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET 1 of 1	DRAWN BY TLJ	REVIEWED BY MBP	DATE 3-30-2014

PEI

FIGURE SA-01
SOIL ASSOCIATIONS - MILE POST 601-617
KEYA PAHA COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



SOIL ASSOCIATIONS

SILTY SOILS ON UPLANDS

1 — Onita–Reliance–Ree association: Deep, nearly level to strongly sloping, well drained and moderately well drained silty soils formed in loess

2 — Nora–Crofton–Eltree association: Deep, nearly level to moderately steep, well drained silty soils formed in loess

CLAYEY SOILS ON UPLANDS

3 — Labu–Sansarc association: Moderately deep and shallow, strongly sloping to very steep, well drained clayey soils formed in residuum from shale

4 — Bristow–Lynch association: Shallow and moderately deep, gently sloping to very steep, well drained and excessively drained clayey soils formed in residuum from calcareous and gypsiferous chalky shale

SANDY SOILS ON UPLANDS

5 — Dunday–Valentine–Simeon association: Deep, nearly level to moderately steep, well drained and excessively drained sandy soils formed in windblown and outwash sands and gravelly sands

6 — Valentine–Simeon association: Deep, nearly level to steep, excessively drained sandy soils formed in windblown and outwash sands and gravelly sands

LOAMY AND SANDY SOILS ON UPLANDS

7 — Anselmo–Dunday–Blendon association: Deep, nearly level to moderately steep, well drained loamy and sandy soils formed in windblown sandy material

LOAMY SOILS ON UPLANDS UNDERLAIN BY SAND AND GRAVEL

8 — Meadin–Jansen–O'Neill association: Nearly level to moderately steep, well drained and excessively drained loamy soils that are shallow or moderately deep over sand and gravel; on upland divides and along drainageways

9 — Brocksburg–Jansen association: Nearly level to gently sloping, well drained loamy soils that are moderately deep over sand and gravel; on uplands

SOILS ON BOTTOM LANDS

10 — Inavale–Grigston–Cass association: Deep, nearly level to strongly sloping, well drained and somewhat excessively drained sandy, loamy, and silty soils formed in alluvial deposits

11 — Haynie–Albaton–Onawa association: Deep, nearly level, moderately well drained to poorly drained silty and clayey soils formed in recent alluvial deposits

Compiled 1978

KEY:

NORTH

SCALE: 1"- 3 MILES (0 1 2 3)

- IFC ROUTE CENTERLINE
620 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

After: Indra, O., *Soil Survey of Boyd County, Nebraska*, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, March 1979.

PROJECT	14404.01
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LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route

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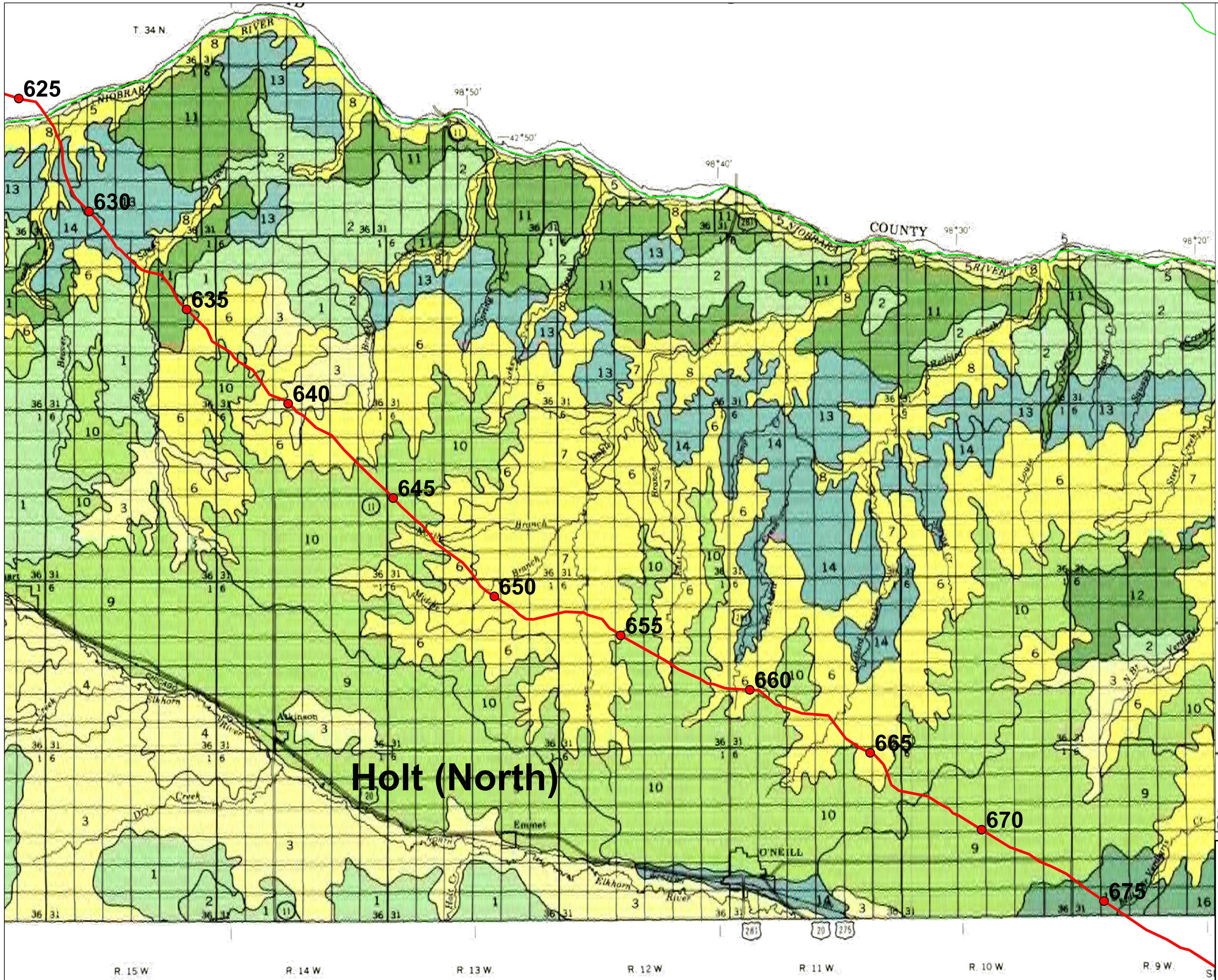
FIGURE SA-02
SOIL ASSOCIATIONS - MILE POST 617-626
BOYD COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



After: Ragon, L., Seevers, V., Indra, O., Belohlavy, R., Lobaugh, S., Carlson, J., and Schultz, H., *Soil Survey of Holt County, Nebraska*, United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, March 1983.

SOIL LEGEND*

NEARLY LEVEL TO VERY STEEP SOILS IN THE SANDHILLS

1 — Els-Valentine-Ipage association: Deep, nearly level to strongly sloping, excessively drained, moderately well drained, and somewhat poorly drained, sandy soils; on uplands and in sandhill valleys

2 — Valentine-Els association: Deep, nearly level to very steep, excessively drained and somewhat poorly drained, sandy soils; on uplands and in sandhill valleys

NEARLY LEVEL AND VERY GENTLY SLOPING SOILS ON BOTTOM LANDS, ON STREAM TERRACES, AND IN SANDHILL VALLEYS

3 — Elsmere-Ipage-Loup association: Deep, nearly level and very gently sloping, moderately well drained to very poorly drained, sandy and loamy soils; on bottom lands, on stream terraces, and in sandhill valleys

4 — Lex-Cass-Lute association: Nearly level, well drained and somewhat poorly drained, loamy soils that are deep and moderately deep over sand; on bottom lands

5 — Inavale-Barney-Boel association: Deep, nearly level, somewhat excessively drained, sandy soils and poorly drained and somewhat poorly drained, silty and loamy soils that are deep and shallow over sand; on bottom lands

GENTLY SLOPING TO VERY STEEP SOILS ON UPLAND BREAKS

6 — O'Neill-Meadin-Jansen association: Gently sloping to steep, excessively drained and well drained, loamy soils that are moderately deep and shallow over sand and gravel; on uplands

7 — O'Neill-Brunswick-Paka association: Deep and moderately deep, gently sloping to steep, well drained, loamy soils; on uplands

8 — Labu-Sansarc-Valentine association: Deep to shallow, moderately steep to very steep, excessively drained and well drained, clayey and sandy soils; on uplands

NEARLY LEVEL TO GENTLY SLOPING SOILS ON TABLELANDS AND STREAM TERRACES

9 — Dunday-Pivot-Dunn association: Deep, nearly level to gently sloping, somewhat excessively drained and moderately well drained, sandy soils; on tablelands and stream terraces

10 — Jansen-O'Neill association: Nearly level, well drained, loamy soils that are moderately deep over sand and gravel; on tablelands

NEARLY LEVEL TO STEEP SOILS ON UPLANDS AND STREAM TERRACES

11 — Valentine-Simeon-Dunday association: Deep, nearly level to steep, excessively drained and somewhat excessively drained, sandy soils; on uplands and stream terraces

12 — Dunday-Valentine-Boelus association: Deep, nearly level to strongly sloping, excessively drained to well drained, sandy soils; on uplands

NEARLY LEVEL TO GENTLY SLOPING SOILS ON UPLANDS, FOOT SLOPES, AND STREAM TERRACES

13 — Wewela-Dunday-Elsmere association: Deep and moderately deep, nearly level to gently sloping, somewhat excessively drained, well drained, and somewhat poorly drained, loamy and sandy soils; on uplands and stream terraces

14 — O'Neill-Anselmo-Pivot association: Nearly level to gently sloping, somewhat excessively drained and well drained, loamy and sandy soils that are deep and moderately deep over sand and gravel; on uplands, foot slopes, and stream terraces

NEARLY LEVEL TO GENTLY SLOPING SOILS ON UPLANDS

15 — Paka-Anselmo association: Deep, nearly level to gently sloping, well drained, loamy soils; on uplands

16 — Bazile-Trent association: Deep, nearly level to gently sloping, well drained and moderately well drained, silty soils; on uplands

KEY:

- IFC ROUTE CENTERLINE
- 650 MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

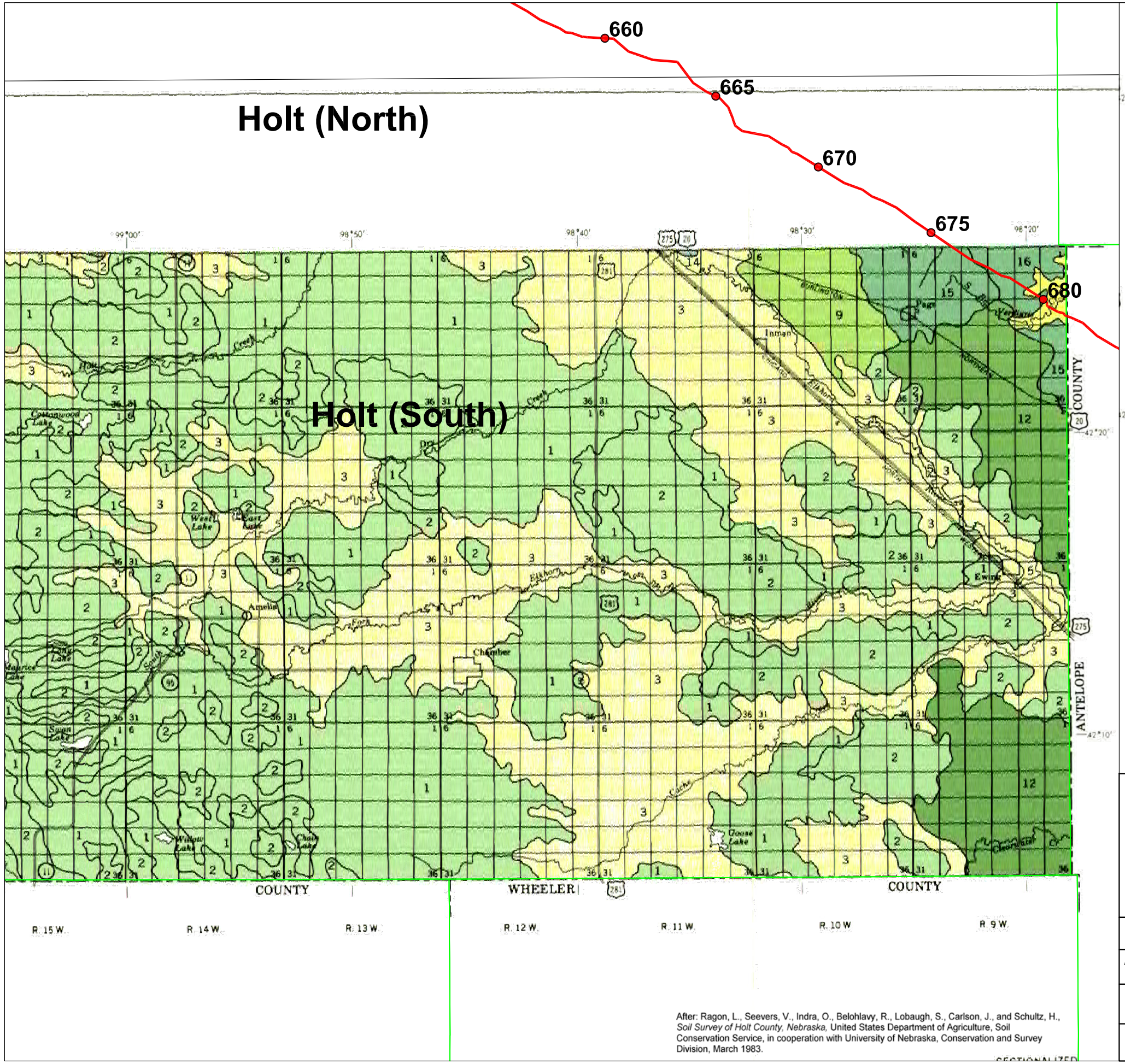
NORTH

SCALE: 1" = 4 MILES

PROJECT	14404.01
PREPARED FOR	exp
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	TLJ	MBP	3-30-2014

FIGURE SA-03A
SOIL ASSOCIATIONS - MILE POST 626-676
HOLT COUNTY (NORTH)
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



After: Ragon, L., Seevers, V., Indra, O., Belohlavy, R., Lobaugh, S., Carlson, J., and Schultz, H., *Soil Survey of Holt County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, March 1983.

SOIL LEGEND*

NEARLY LEVEL TO VERY STEEP SOILS IN THE SANDHILLS

1 — Els-Valentine-Ipage association: Deep, nearly level to strongly sloping, excessively drained, moderately well drained, and somewhat poorly drained, sandy soils; on uplands and in sandhill valleys

2 — Valentine-Els association: Deep, nearly level to very steep, excessively drained and somewhat poorly drained, sandy soils; on uplands and in sandhill valleys

NEARLY LEVEL AND VERY GENTLY SLOPING SOILS ON BOTTOM LANDS, ON STREAM TERRACES, AND IN SANDHILL VALLEYS

3 — Elsmere-Ipage-Loup association: Deep, nearly level and very gently sloping, moderately well drained to very poorly drained, sandy and loamy soils; on bottom lands, on stream terraces, and in sandhill valleys

4 — Lex-Cass-Lute association: Nearly level, well drained and somewhat poorly drained, loamy soils that are deep and moderately deep over sand; on bottom lands

5 — Inavale-Barney-Boel association: Deep, nearly level, somewhat excessively drained, sandy soils and poorly drained and somewhat poorly drained, silty and loamy soils that are deep and shallow over sand; on bottom lands

GENTLY SLOPING TO VERY STEEP SOILS ON UPLAND BREAKS

6 — O'Neill-Meadin-Jansen association: Gently sloping to steep, excessively drained and well drained, loamy soils that are moderately deep and shallow over sand and gravel; on uplands

7 — O'Neill-Brunswick-Paka association: Deep and moderately deep, gently sloping to steep, well drained, loamy soils; on uplands

8 — Labu-Sansarc-Valentine association: Deep to shallow, moderately steep to very steep, excessively drained and well drained, clayey and sandy soils; on uplands

NEARLY LEVEL TO GENTLY SLOPING SOILS ON TABLELANDS AND STREAM TERRACES

9 — Dunday-Pivot-Dunn association: Deep, nearly level to gently sloping, somewhat excessively drained and moderately well drained, sandy soils; on tablelands and stream terraces

10 — Jansen-O'Neill association: Nearly level, well drained, loamy soils that are moderately deep over sand and gravel; on tablelands

NEARLY LEVEL TO STEEP SOILS ON UPLANDS AND STREAM TERRACES

11 — Valentine-Simeon-Dunday association: Deep, nearly level to steep, excessively drained and somewhat excessively drained, sandy soils; on uplands and stream terraces

12 — Dunday-Valentine-Boelus association: Deep, nearly level to strongly sloping, excessively drained to well drained, sandy soils; on uplands

NEARLY LEVEL TO GENTLY SLOPING SOILS ON UPLANDS, FOOT SLOPES, AND STREAM TERRACES

13 — Wewela-Dunday-Elsmere association: Deep and moderately deep, nearly level to gently sloping, somewhat excessively drained, well drained, and somewhat poorly drained, loamy and sandy soils; on uplands and stream terraces

14 — O'Neill-Anselmo-Pivot association: Nearly level to gently sloping, somewhat excessively drained and well drained, loamy and sandy soils that are deep and moderately deep over sand and gravel; on uplands, foot slopes, and stream terraces

NEARLY LEVEL TO GENTLY SLOPING SOILS ON UPLANDS

15 — Paka-Anselmo association: Deep, nearly level to gently sloping, well drained, loamy soils; on uplands

16 — Bazile-Trent association: Deep, nearly level to gently sloping, well drained and moderately well drained, silty soils; on uplands

KEY:

NORTH

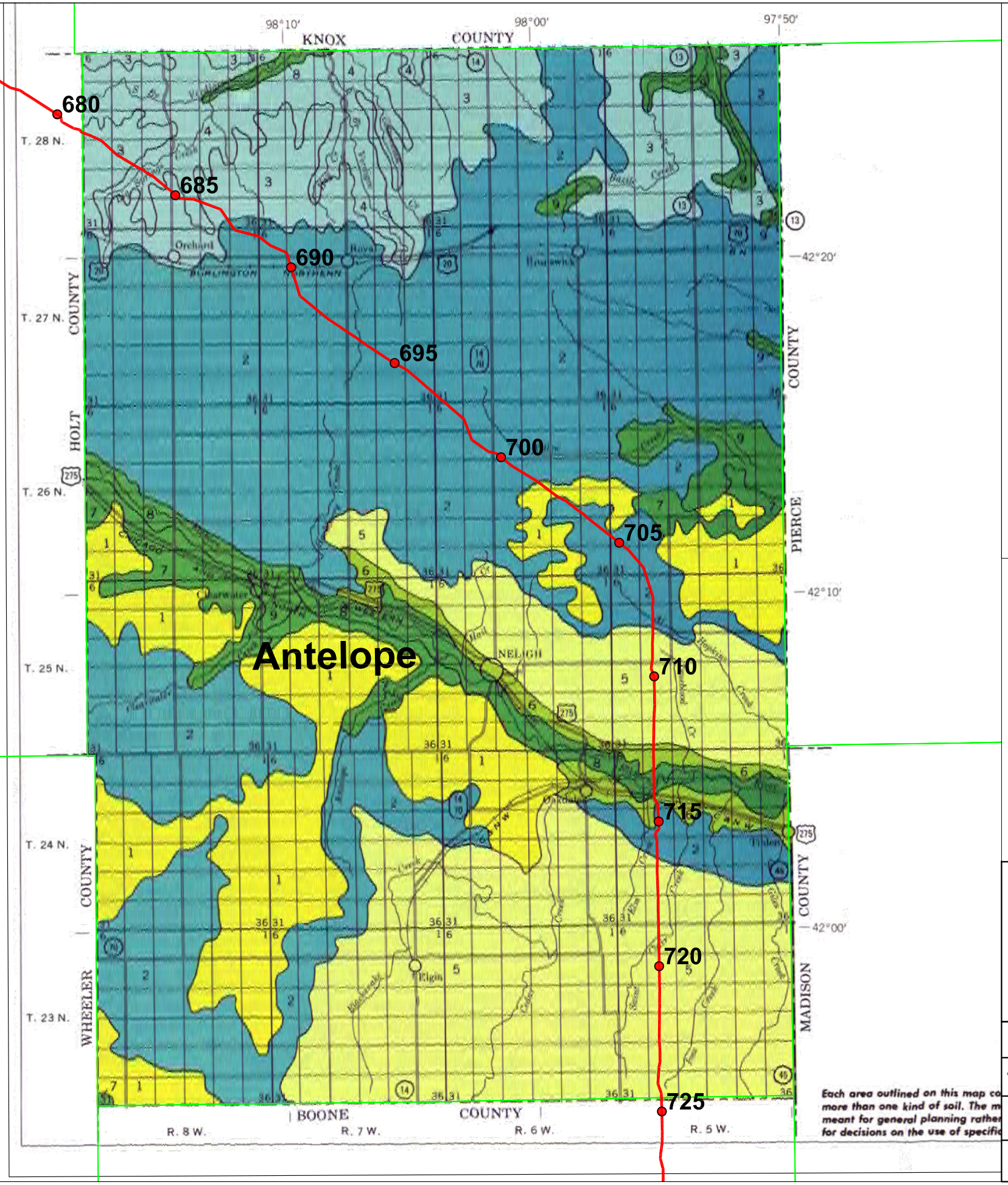
SCALE: 1" = 4 MILES

- IFC ROUTE CENTERLINE
- 680 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET 1 of 1	**DRAWN BY** TLJ	**REVIEWED BY** MBP	**DATE** 3-30-2014

PEI

FIGURE SA-03B
SOIL ASSOCIATIONS - MILE POST 676-681
HOLT COUNTY (SOUTH)
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



SOIL ASSOCIATIONS*

SANDY SOILS ON UPLANDS

1 — Valentine-Thurman association: Deep, nearly level to hilly, sandy soils on uplands

SANDY AND SILTY SOILS ON UPLANDS

2 — Thurman-Boelus-Nora association: Deep, nearly level to strongly sloping, sandy and silty soils on uplands

LOAMY AND SANDY SOILS ON UPLANDS

3 — Bazile-Paka-Thurman association: Deep, nearly level to gently sloping, loamy and sandy soils on uplands

4 — Brunswick-Paka-Valentine association: Moderately deep and deep, gently sloping to steep, loamy and sandy soils on uplands

SILTY SOILS ON UPLANDS

5 — Nora-Crofton-Moody association: Deep, gently sloping to steep, silty soils on loess uplands

SILTY SOILS ON FOOT SLOPES AND STREAM TERRACES

6 — Hord-Cozad association: Deep, nearly level to gently sloping, silty soils on foot slopes and stream terraces

SANDY, LOAMY, AND SILTY SOILS ON BOTTOM LAND AND STREAM TERRACES

7 — Elsmere-Loup association: Deep, nearly level, sandy and loamy soils on bottom land and stream terraces

8 — Inavale-Elsmere-Ord association: Deep, nearly level, sandy and loamy soils on bottom land

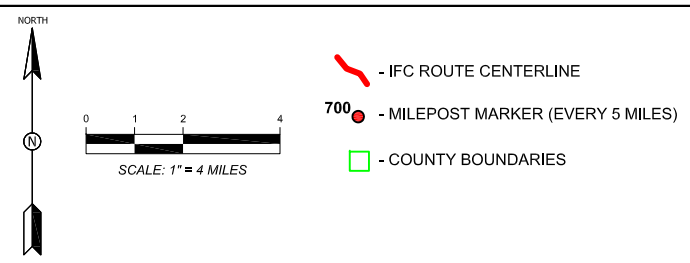
9 — Lawet-Orwet-Gibbon association: Deep, nearly level, silty and loamy soils on bottom land

*Texture in the soil associations refers to the surface layer unless otherwise stated.

Compiled 1977

After: Manhke, C., Hammer, R., Hammond, C., and Schulte, R., *Soil Survey of Antelope County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, April 1978.

KEY:



PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	**DRAWN BY**	**REVIEWED BY**	**DATE**
1 of 1	TLJ	MBP	3-30-2014

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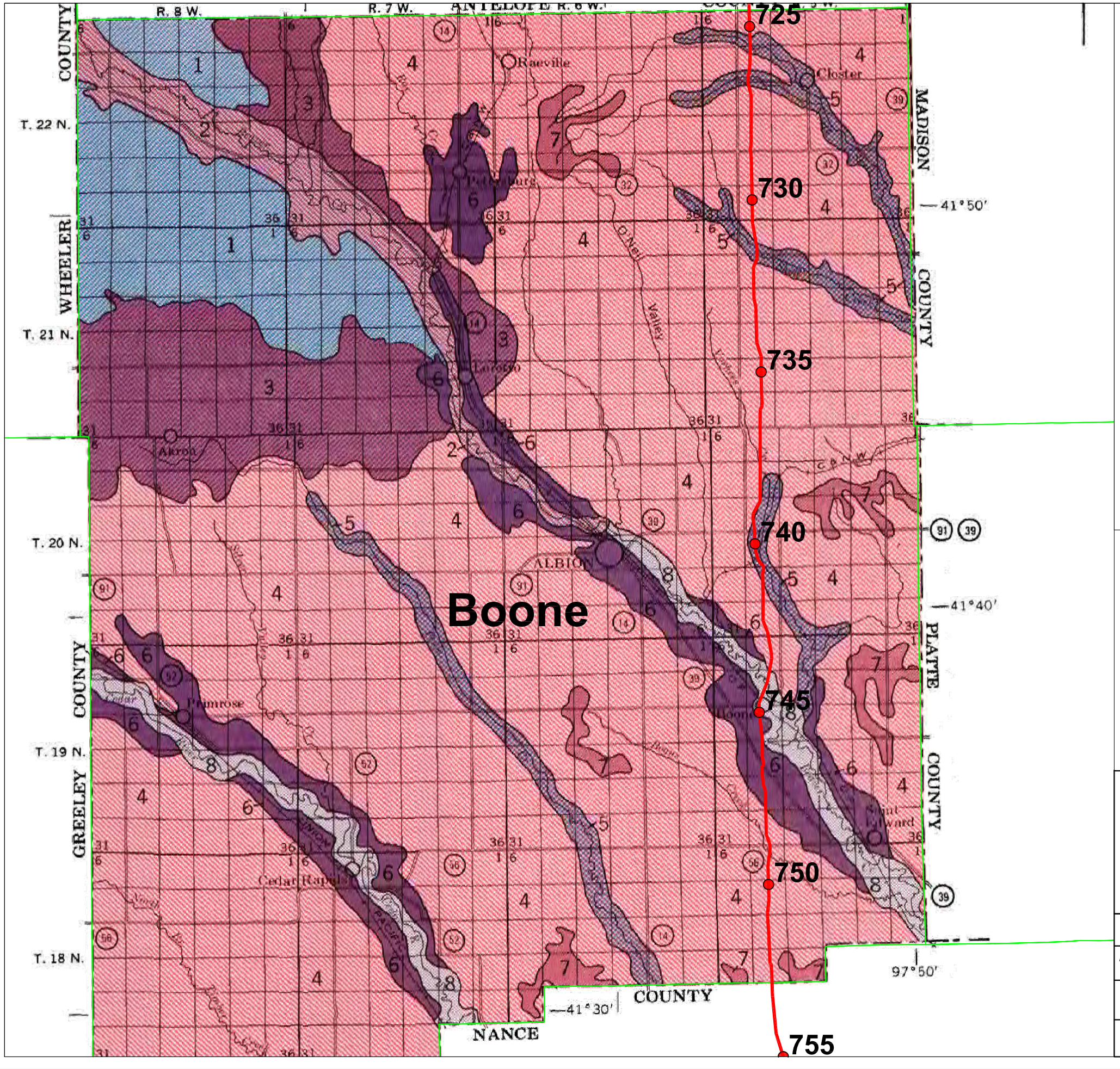
FIGURE SA-04
SOIL ASSOCIATIONS - MILE POST 681-725
ANTELOPE COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



SOIL ASSOCIATIONS *

1. Valentine association: Excessively drained, gently sloping to strongly sloping soils that are sandy throughout; on uplands
2. Elsmere-Wann-Loup association: Somewhat poorly drained and poorly drained, nearly level to gently sloping, sandy and loamy soils on bottom lands and stream terraces
3. Thurman-Hord-Loretto association: Somewhat excessively drained and well drained, nearly level to rolling, sandy and silty soils on uplands
4. Nora-Crofton-Moody association: Well-drained to excessively drained, gently sloping to steep, silty soils on uplands
5. Hobbs association: Well-drained, nearly level, silty soils on bottom lands that are subject to occasional flooding
6. Hall-Hord association: Well-drained, nearly level to gently sloping, silty soils on stream terraces
7. Belfore-Moody association: Well-drained, nearly level and very gently sloping, silty soils on uplands
8. Leshara-Lamo-Wann association: Somewhat poorly drained, nearly level, silty and loamy soils on bottom lands

* Unless otherwise stated texture refers to surface layer.

March 1971

After: Hammond, C., Manhke, C., Brown, L., Schulte, R., and Russell, W., *Soil Survey of Boone County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, January 1972.

KEY:

NORTH

SCALE: 1"- 3 MILES

- IFC ROUTE CENTERLINE
- 740 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	**DRAWN BY**	**REVIEWED BY**	**DATE**
1 of 1	TLJ	MBP	3-30-2014

PEI

FIGURE SA-05
SOIL ASSOCIATIONS - MILE POST 725-753
BOONE COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT

Nance

750

755

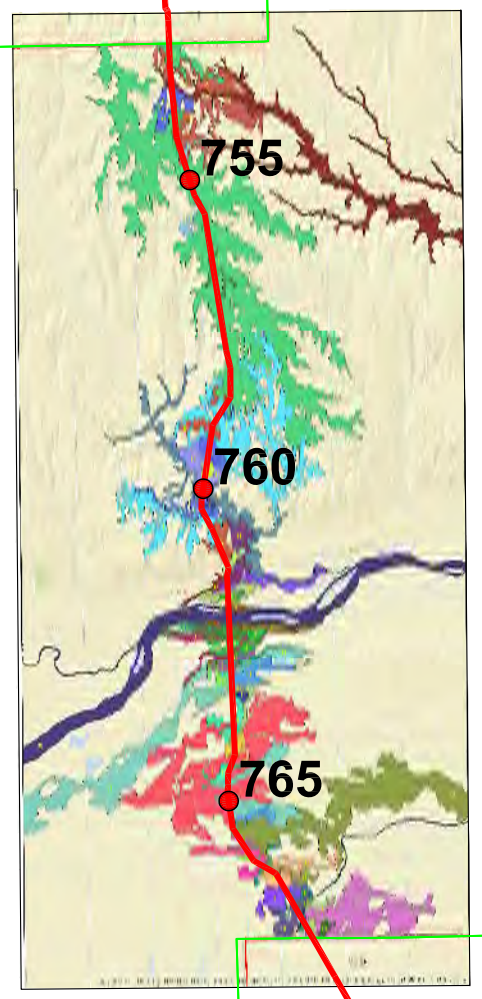
760

765

770

775

780



Map Unit Name

{NAN, <}

- 1: Belfore silt loam, 1 to 3 percent slopes
- 2: Cass fine sandy loam, occasionally flooded
- 3: Cass silt loam, occasionally flooded
- 4: Crofton silt loam, 17 to 30 percent slopes, eroded
- 5: Crofton silt loam, 8 to 17 percent slopes, eroded
- 6: Detroit silt loam, 0 to 1 percent slopes
- 7: Fillmore silt loam, frequently ponded
- 8: Gibbon silt loam, occasionally flooded
- 9: Gothenburg loamy sand, frequently flooded
- 10: Hall-Gayville variant silt loams, 0 to 1 percent slopes
- 11: Hall silt loam, 0 to 1 percent slopes
- 12: Hall silt loam, 1 to 3 percent slopes
- 13: Hall silt loam, 3 to 6 percent slopes, eroded
- 14: Hobbs silt loam, frequently flooded
- 15: Hobbs silt loam, occasionally flooded, cool
- 16: Hord fine sandy loam, 1 to 3 percent slopes
- 17: Hord very fine sandy loam, 0 to 1 percent slopes
- 18: Hord very fine sandy loam, 1 to 3 percent slopes
- 19: Inavale fine sand, occasionally flooded
- 20: Inavale soils, frequently flooded
- 21: Lamo-Saltine complex, occasionally flooded
- 22: Lamo silt loam, moderately saline, occasionally flooded
- 23: Lamo silty clay loam, occasionally flooded
- 24: Leshara silt loam, occasionally flooded
- 25: Loup silt loam, occasionally flooded
- 26: Moody-Nora silt loams, 3 to 6 percent slopes, eroded
- 27: Moody silty clay loam, 1 to 3 percent slopes
- 28: Muir silt loam, 1 to 3 percent slopes
- 29: Nora-Crofton complex, 11 to 17 percent slopes, eroded
- 30: Nora silt loam, 6 to 11 percent slopes, eroded
- 31: Nora silt loam, 6 to 11 percent slopes, severely eroded
- 32: Ortello fine sandy loam, 1 to 3 percent slopes
- 33: Ortello fine sandy loam, 1 to 3 percent slopes, eroded
- 34: Ortello very fine sandy loam, 1 to 3 percent slopes
- 35: Thurman loamy fine sand, 1 to 3 percent slopes
- 36: Thurman loamy fine sand, 1 to 3 percent slopes, eroded
- 37: Valentine fine sand, 3 to 17 percent slopes
- 38: Wann loam, occasionally flooded
- 39: Wann silt loam, occasionally flooded
- 40: Water

SSURGO Soils, Map Unit Names
Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2013

KEY:

NORTH

SCALE: 1"= 3 MILES

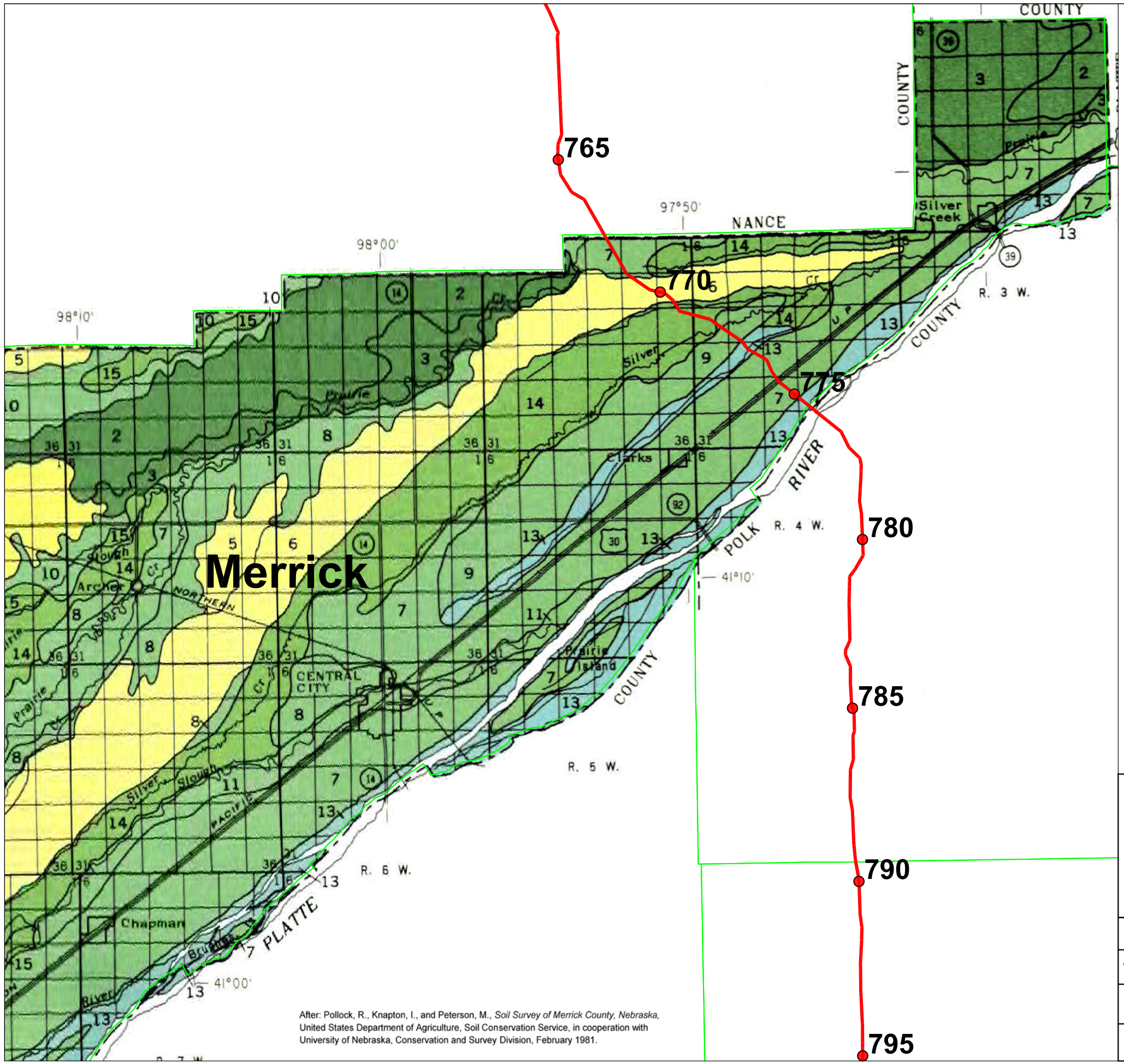
- IFC ROUTE CENTERLINE
- 760 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

After: Willard, J., Woods, J., Kollmorgen, H., *Soil Survey of Nance County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, July, 1960.

PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	***DRAWN BY***	***REVIEWED BY***	***DATE***
1 of 1	*TLJ*	*MBP*	*3-30-2014*

PEI

FIGURE SA-06
SOIL ASSOCIATIONS - MILE POST 753-768
NANCE COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



After: Pollock, R., Knapton, I., and Peterson, M., *Soil Survey of Merrick County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, February 1981.

SOIL LEGEND*

SILTY SOILS ON UPLANDS

1 — Crofton-Nora association: Deep, strongly sloping to steep, well drained and somewhat excessively drained, silty soils formed in loess; on uplands

SANDY SOILS ON UPLANDS AND STREAM TERRACES AND IN SANDHILL VALLEYS

2 — Valentine-Thruman-Boelus association: Deep, nearly level to moderately steep, excessively drained to well drained, sandy soils formed in eolian sand and loess; on uplands and stream terraces

3 — Ipage-Els-Libory association: Deep, nearly level and very gently sloping, moderately well drained and somewhat poorly drained, sandy soils formed in eolian sand, alluvium, and loess; in sandhill valleys and on stream terraces

SANDY, LOAMY, AND SILTY SOILS ON UPLANDS AND STREAM TERRACES

4 — Valentine-Loretto-Kenesaw association: Deep, nearly level to strongly sloping, excessively drained and well drained, sandy, loamy, and silty soils formed in eolian sand, loess, and alluvium; on uplands and stream terraces

SILTY AND LOAMY SOILS ON STREAM TERRACES

5 — Hord-Hall association: Deep, nearly level, well drained, silty soils formed in alluvium and loess; on stream terraces

6 — O'Neill-Brocksburg-Blendon association: Nearly level to gently sloping, well drained, loamy soils that are moderately deep or deep over sand and gravel and formed in alluvium and mixed eolian materials; on stream terraces

LOAMY AND SILTY SOILS ON BOTTOM LANDS

7 — Leshara-Lex-Janude association: Nearly level, somewhat poorly drained and moderately well drained, loamy and silty soils that are deep and moderately deep over sand and gravel and formed in alluvium; on bottom lands

8 — Lockton association: Nearly level, moderately well drained, loamy soils that are moderately deep over sand and gravel and formed in noncalcareous alluvium; on bottom lands

9 — Fonner association: Nearly level, moderately well drained, loamy soils that are moderately deep over sand and gravel and formed in noncalcareous alluvium; on bottom lands

10 — Wann-Novina association: Deep, nearly level, somewhat poorly drained and moderately well drained, loamy soils formed in alluvium; on bottom lands

11 — Cozad association: Deep, nearly level, moderately well drained, loamy soils formed in alluvium; on bottom lands

SANDY AND LOAMY SOILS ON BOTTOM LANDS

12 — Boel-Ingvale association: Deep, nearly level to strongly sloping, somewhat poorly drained and somewhat excessively drained, loamy and sandy soils formed in alluvium; on bottom lands

13 — Gothenburg-Platte-Barney association: Nearly level and very gently sloping, poorly drained and somewhat poorly drained, sandy and loamy soils that are shallow over sand and gravel and formed in recent alluvium; on bottom lands

SILTY AND LOAMY, ALKALINE SOILS ON BOTTOM LANDS

14 — Lamo-Caruso-Gayville association: Deep, nearly level, somewhat poorly drained, loamy and silty soils formed in alkaline alluvium; on bottom lands

15 — Lamo-Gayville Variant association: Deep, nearly level, poorly drained and somewhat poorly drained, silty soils formed in alkaline alluvium; on bottom lands

*Texture named in descriptive headings refers to that of the surface layer of the major soils.

KEY:

NORTH

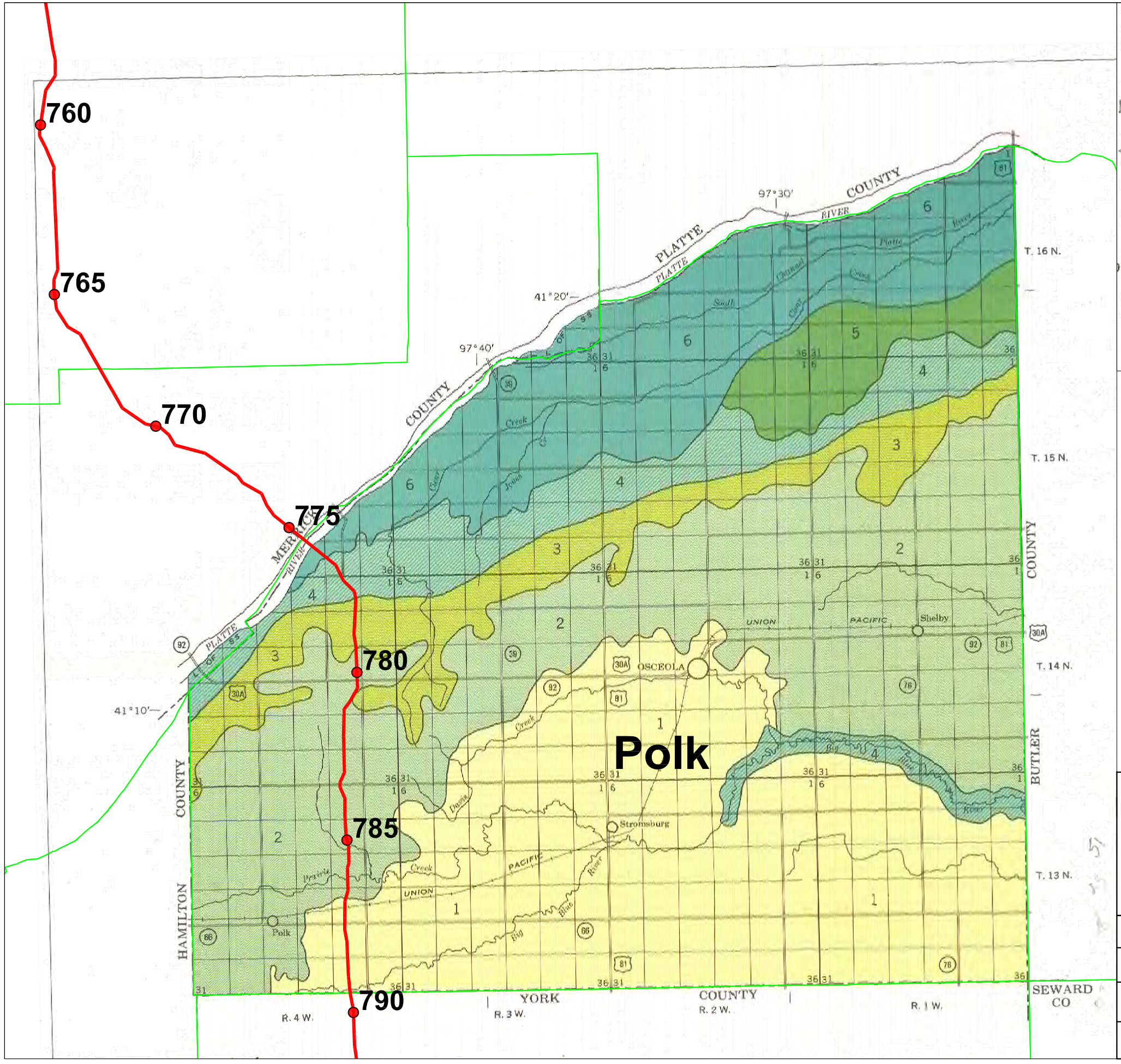
SCALE: 1"= 3 MILES

- IFC ROUTE CENTERLINE
- 770 MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET 1 of 1	**DRAWN BY** TLJ	**REVIEWED BY** MBP	**DATE** 3-30-2014

PEI

FIGURE SA-07
SOIL ASSOCIATIONS - MILE POST 768-776
MERRICK COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



SOIL ASSOCIATIONS *

1. Hastings association: Nearly level to moderately sloping, deep, silty soils on loess-mantled uplands
2. Holder association: Nearly level and very gently sloping, deep, silty soils on loess-mantled uplands
3. Coly-Cozad association: Gently sloping to steep, deep, silty soils on upland breaks to the Platte River Valley
4. Hord association: Nearly level, deep, silty soils on stream terraces
5. Thurman-Meadin association: Nearly level to gently rolling, deep, sandy soils and shallow, sandy soils over mixed sand and gravel on stream terraces
6. Platte-Leshara-Alda association: Nearly level and very gently sloping, shallow to deep, loamy soils over mixed sand and gravel on bottom lands of the Platte River Valley

* Texture refers to surface layer of major soils in each association.

Compiled 1972

After: Seevers, V. and Pollock, R., *Soil Survey of Polk County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, April 1974.

KEY:

NORTH

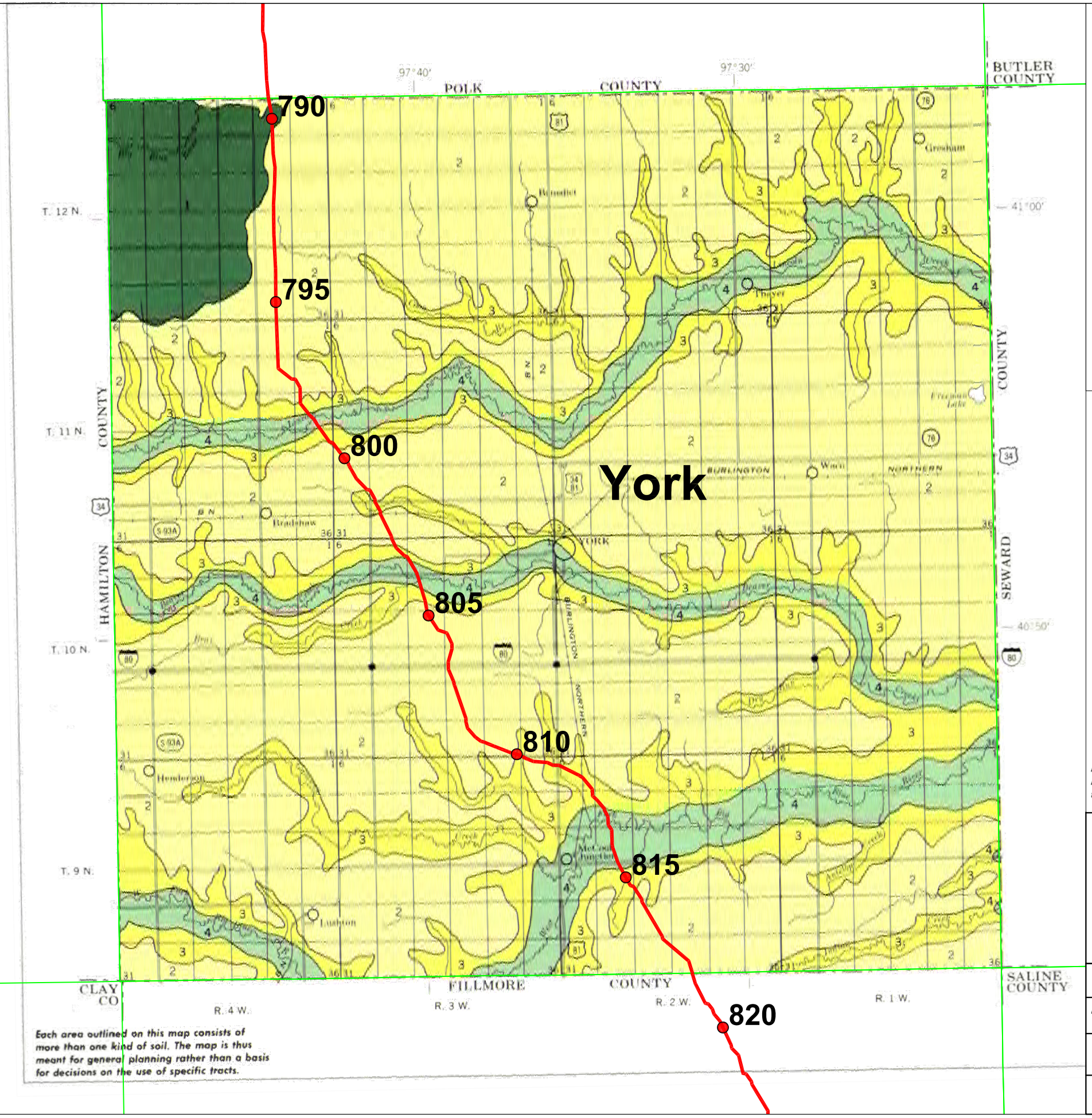
SCALE: 1"= 3 MILES

- IFC ROUTE CENTERLINE
- 780 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET 1 of 1	**DRAWN BY** TLJ	**REVIEWED BY** MBP	**DATE** 3-30-2014

PEI

FIGURE SA-08
SOIL ASSOCIATIONS - MILE POST 776-789
POLK COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



SOIL ASSOCIATIONS *

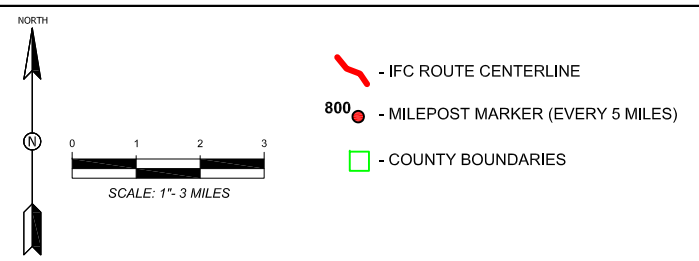
1	Holder association: Deep, nearly level to gently sloping, silty soils; formed in loess on uplands
2	Hastings-Fillmore association: Deep, nearly level to gently sloping, silty soils and deep, nearly level, silty soils that have a claypan subsoil; formed in loess on uplands
3	Hastings association: Deep, gently sloping to strongly sloping, silty soils; formed in loess on uplands
4	Hord-Silty alluvial land association: Deep, nearly level and very gently sloping, silty soils and deep, silty and loamy, frequently flooded soil material; formed in alluvium on stream terraces and bottom land

* Texture in the descriptive heading refers to the surface layer of the major soils unless otherwise stated.

Compiled 1976

After: Seevers, V., *Soil Survey of York County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, August 1977.

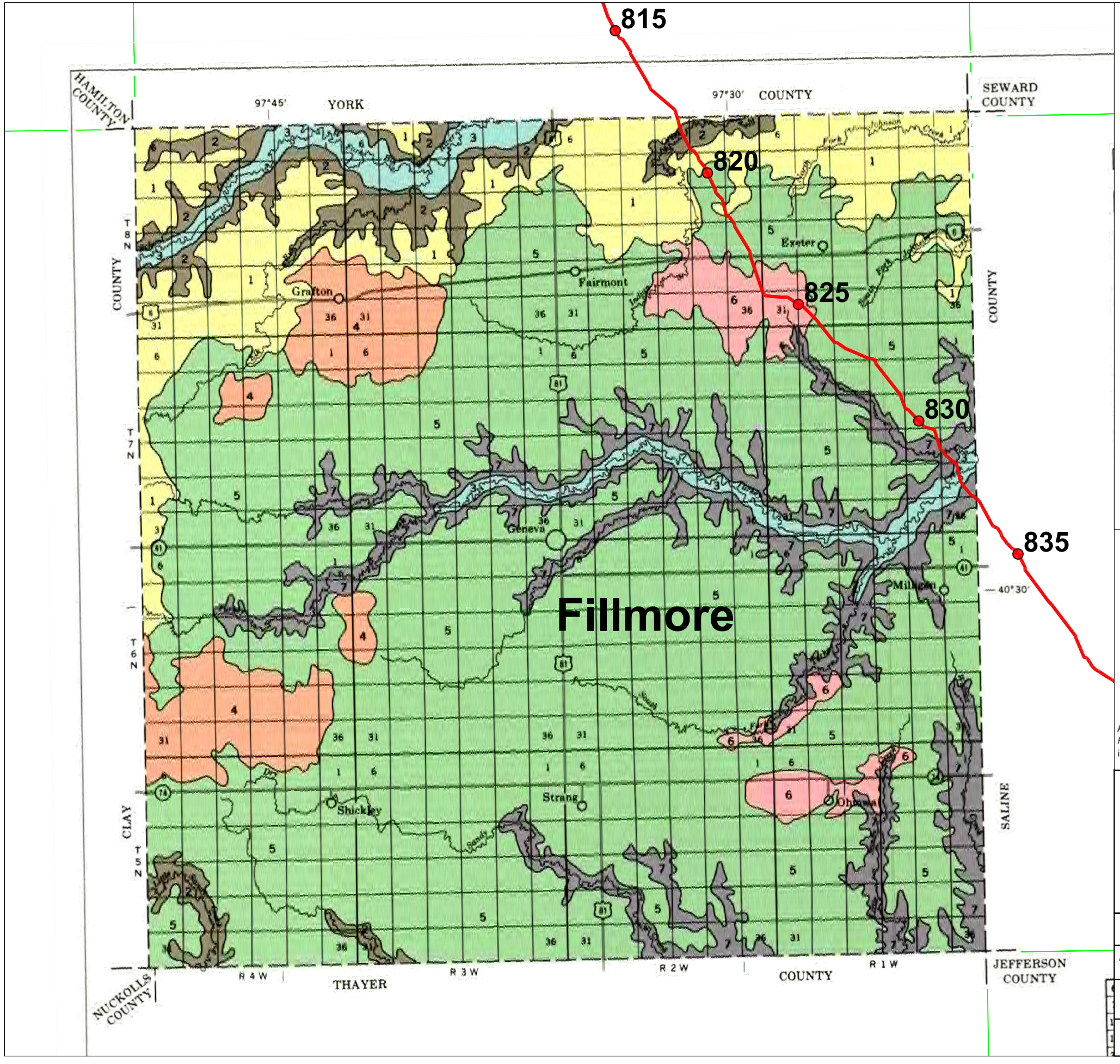
KEY:



PROJECT	14404.01		
PREPARED FOR	EXP		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET 1 of 1	**DRAWN BY** TLJ	**REVIEWED BY** MBP	**DATE** 3-30-2014

PEI

FIGURE SA-09
SOIL ASSOCIATIONS - MILE POST 789-818
YORK COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE EXCEL PIPELINE PROJECT



SOIL LEGEND*

1	HASTINGS-CRETE association: Deep, nearly level to gently sloping, well drained and moderately well drained, silty soils on uplands
2	HASTINGS-ULY-GEARY association: Deep, gently sloping to steep, well drained and somewhat excessively drained, silty soils on uplands
3	MUIR-HOBBS-BUTLER association: Deep, nearly level to gently sloping, well drained and somewhat poorly drained, silty soils on stream terraces, foot slopes, and bottom lands
4	CRETE-HASTINGS-MASSIE association: Deep, nearly level to gently sloping, moderately well drained, well drained, and very poorly drained, silty soils on uplands and in upland depressions
5	CRETE-BUTLER association: Deep, nearly level to gently sloping, moderately well drained and somewhat poorly drained, silty soils on uplands
6	OLBUT-BUTLER association: Deep, nearly level, somewhat poorly drained, silty soils that are dominantly saline; on uplands
7	HASTINGS-CRETE-GEARY association: Deep, gently sloping to steep, well drained, moderately well drained, and somewhat excessively drained, silty soils on uplands

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the associations.

Compiled 1984

After: Hammer, R., Pollock, R., Buechle, A., Reardon, M., and Husbands, J., *Soil Survey of Fillmore County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, July 1986.

KEY:

NORTH

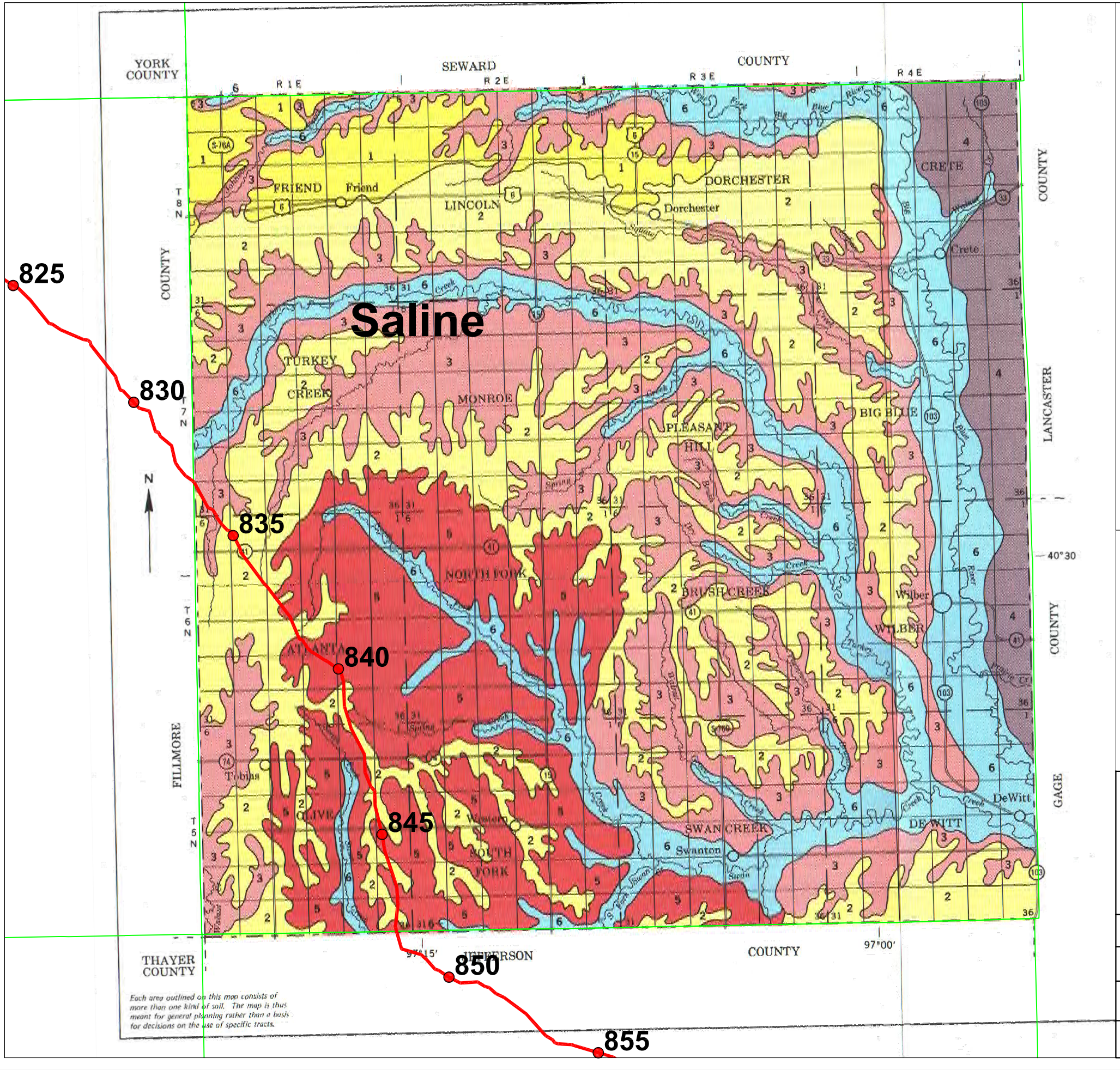
SCALE: 1"- 3 MILES

- IFC ROUTE CENTERLINE
- 820 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

PROJECT	14404.01		
PREPARED FOR	EXP		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	**DRAWN BY**	**REVIEWED BY**	**DATE**
1 of 1	TLJ	MBP	3-30-2014

PEI

FIGURE SA-10
SOIL ASSOCIATIONS - MILE POST 818-833
FILLMORE COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE EXCEL PIPELINE PROJECT



LEGEND*

1 — HASTINGS-CRETE ASSOCIATION: Deep, nearly level to gently sloping, well drained and moderately well drained, silty soils that formed in loess; on uplands

2 — CRETE-BUTLER ASSOCIATION: Deep, nearly level and very gently sloping, moderately well drained and somewhat poorly drained, silty soils that formed in loess; on uplands

3 — CRETE-HASTINGS-GEARY ASSOCIATION: Deep, very gently sloping to steep, moderately well drained to somewhat excessively drained, silty soils that formed in loess and Loveland material; on uplands

4 — CRETE-WYMORE-BURCHARD ASSOCIATION: Deep, nearly level to steep, moderately well drained to somewhat excessively drained, silty and loamy soils that formed in loess and glacial till; on uplands

5 — HASTINGS-LONGFORD-BURCHARD ASSOCIATION: Deep, gently sloping to steep, well drained and somewhat excessively drained, silty and loamy soils that formed in loess, Loveland material, and glacial till; on uplands

6 — MUIR-HOBBS ASSOCIATION: Deep, nearly level to gently sloping, well drained, silty soils that formed in colluvium and alluvium; on foot slopes, stream terraces, and bottom land

*Texture terms in the descriptive headings refer to the surface layer of the major soils in the associations.

Compiled 1986

After: DaMoude, D, Haneman, R., Stecker, J., Ulrich, D., and Morris, C., *Soil Survey of Saline County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, October 1990.

KEY:

NORTH

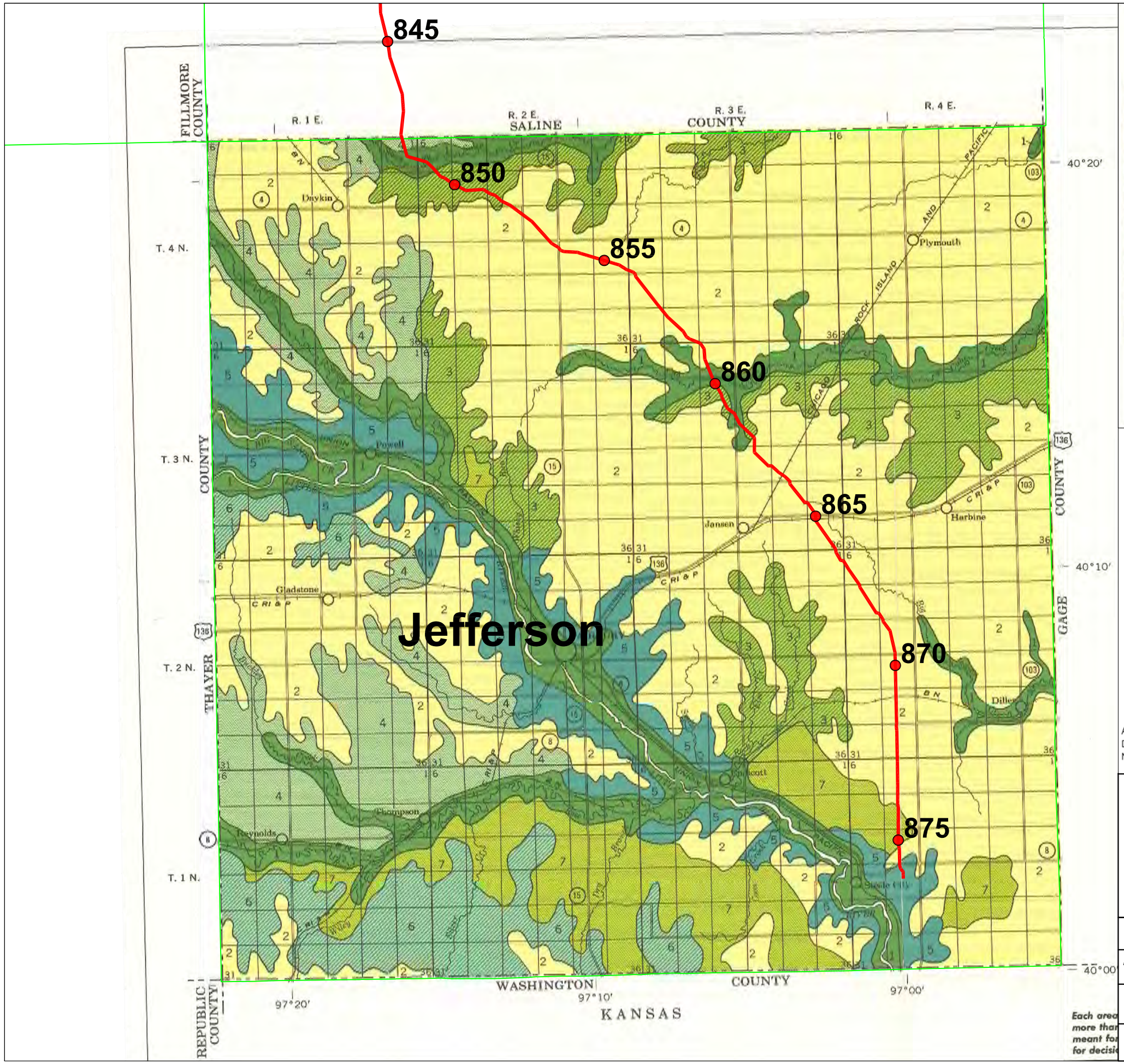
SCALE: 1"- 3 MILES

- IFC ROUTE CENTERLINE
- 845 - MILEPOST MARKER (EVERY 5 MILES)
- COUNTY BOUNDARIES

PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	**DRAWN BY**	**REVIEWED BY**	**DATE**
1 of 1	TLJ	MBP	3-30-2014

PEI

FIGURE SA-11
SOIL ASSOCIATIONS - MILE POST 833-848
SALINE COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



SOIL ASSOCIATIONS *

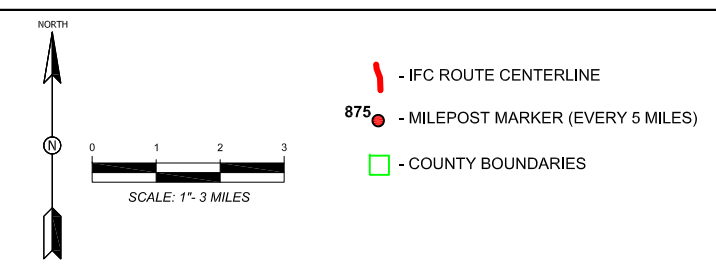
1. Hobbs-Hord-Cass association: Nearly level and gently sloping, deep silty and loamy soils on alluvial benches and bottom land
2. Crete-Mayberry association: Nearly level to strongly sloping, deep soils that have a silty surface layer and a clayey subsoil; on loess and glaciated uplands
3. Morrill-Burchard association: Moderately sloping to steep, deep loamy soils on glaciated uplands
4. Geary-Hastings association: Gently sloping to steep, deep silty soils on loess uplands
5. Geary-Jansen association: Moderately sloping to steep, deep silty and loamy soils that formed in loess, and moderately sloping to steep loamy soils that are moderately deep over gravel; on uplands
6. Benfield-Kipson association: Moderately sloping to steep, moderately deep and shallow silty soils that have a clayey to silty subsoil; on limestone uplands
7. Lancaster-Hedville association: Moderately sloping to steep, moderately deep and shallow loamy soils on sandstone and sandy shale uplands

*Texture refers to the surface layer unless otherwise mentioned.

Compiled 1973

After: Pollock, R. and Davis, L., *Soil Survey of Jefferson County, Nebraska,* United States Department of Agriculture, Soil Conservation Service, in cooperation with University of Nebraska, Conservation and Survey Division, May 1975.

KEY:



PROJECT	14404.01		
PREPARED FOR	exp		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET 1 of 1	DRAWN BY TLJ	REVIEWED BY MBP	DATE 3-30-2014

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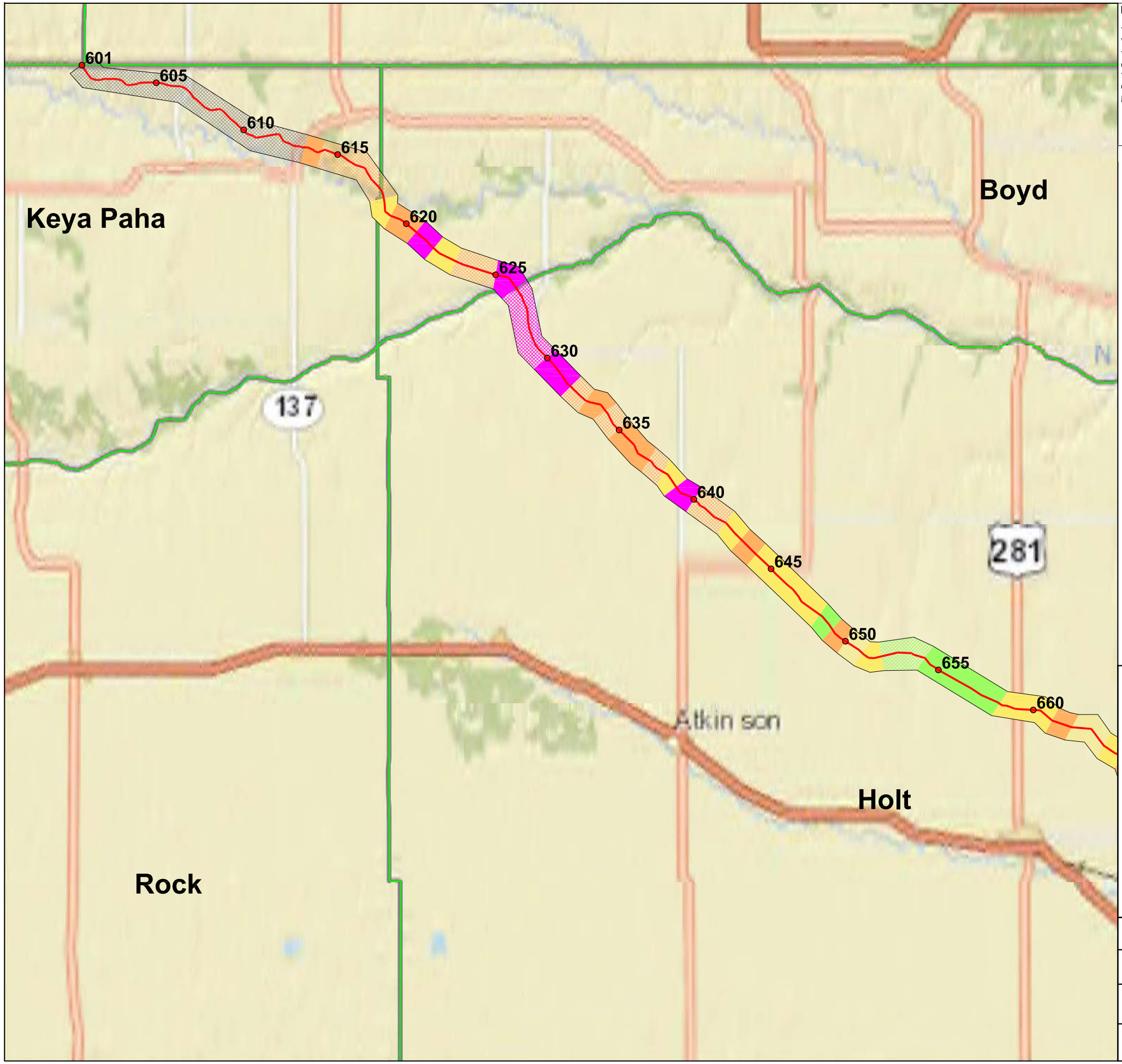
FIGURE SA-12
SOIL ASSOCIATIONS - MILE POST 848-876
JEFFERSON COUNTY
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT

Distance-to-Groundwater Survey

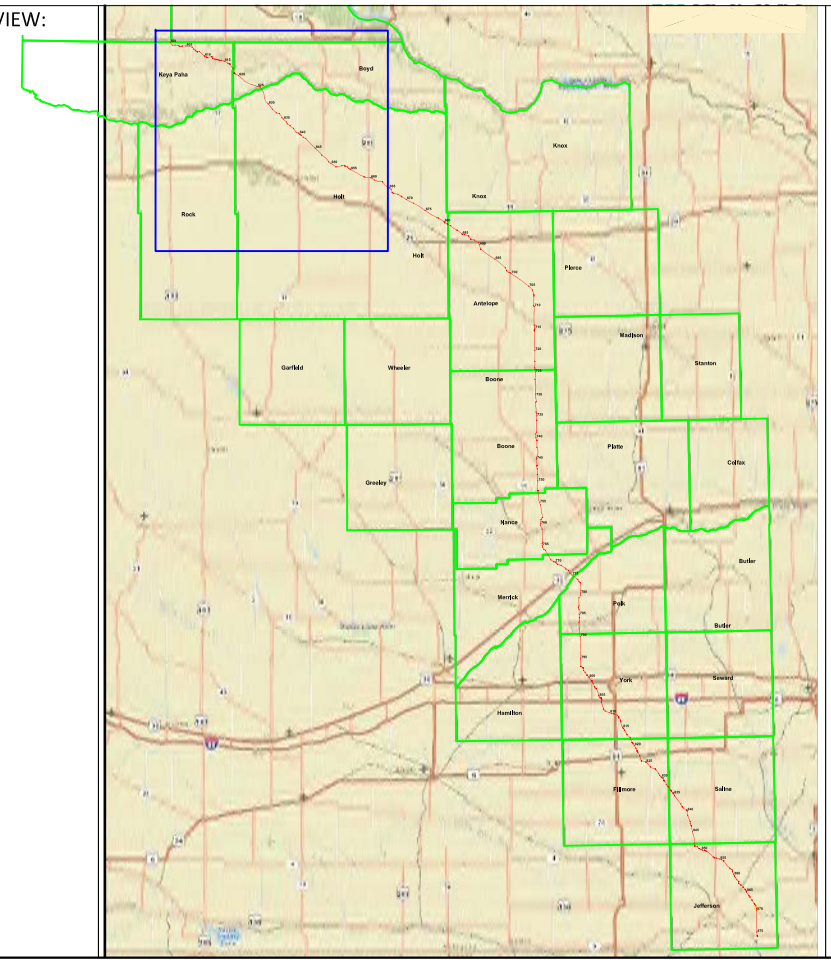
Figures



NOTE:

The segment depth to groundwater was derived from the static water levels provided in the March 2014 Water Well Survey performed by Banks Information Solutions with primary emphasis on wells within 1,500 feet of the IFC Route centerline. The representative depth to groundwater for each mile segment was calculated as either the minimum value for the mile segment or the lower limit of the first standard deviation from the average for the segment. For segments with minimal data, wells up to 2,600 feet from the centerline were added to the analysis for that segment. Depths to groundwater for segments without groundwater data were inferred from adjacent segments.

OVERVIEW:



KEY:

NORTH

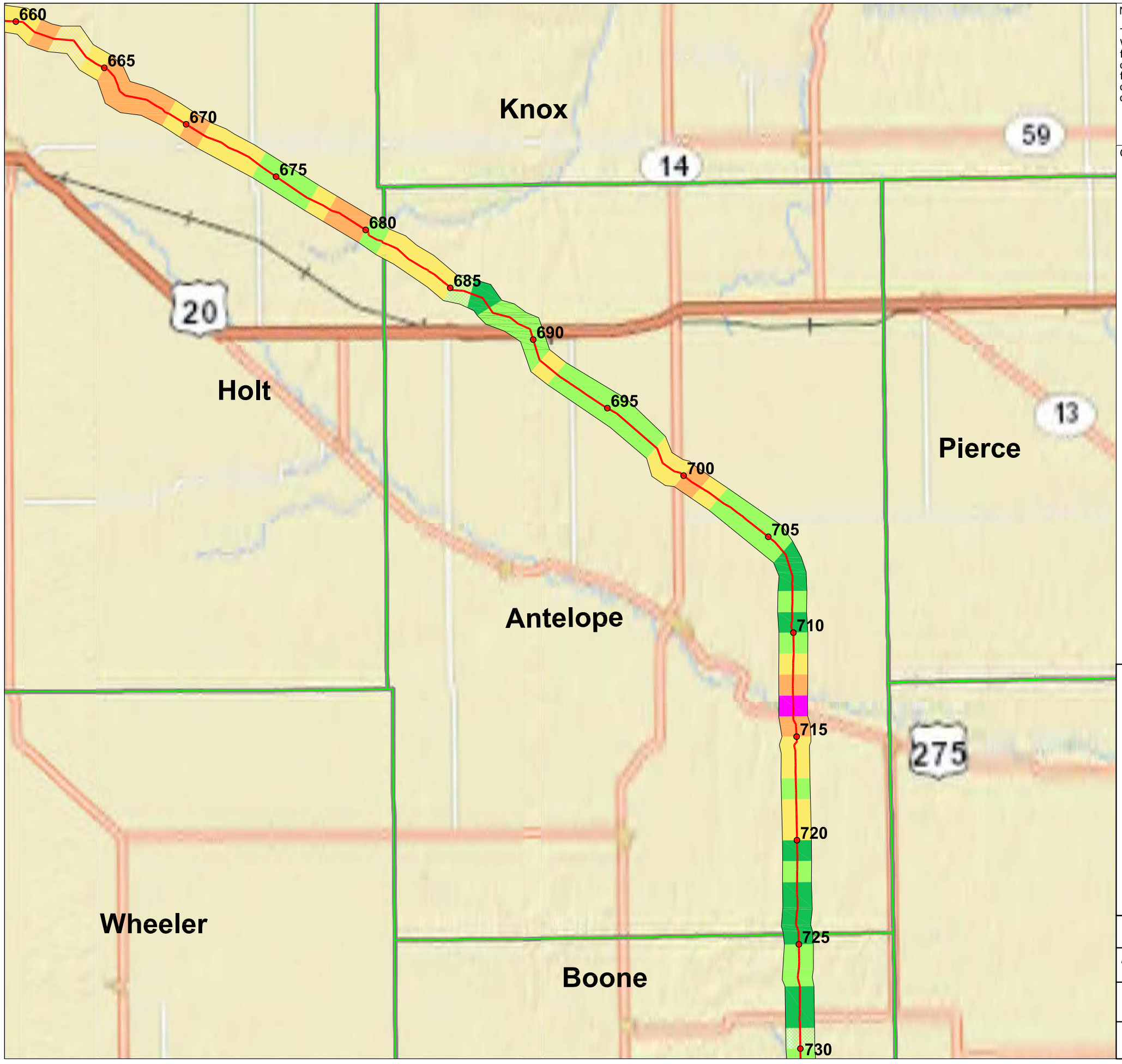
SCALE: 1" = 5 MILES

- IFC ROUTE CENTERLINE
- 650 - MILEPOST MARKER (EVERY 5 MILES)
- SEGMENT WITH DEPTH TO GROUNDWATER ≤ 10 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >10 to 25 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >25 to 50 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >50 to 100 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >100 ft.
- SEGMENT WITH NO DATA AVAILABLE
- SEGMENT WITH INFERRED DATA (HATCHED IN APPLICABLE COLOR)

PROJECT	14404.01		
PREPARED FOR	EXP		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	***DRAWN BY***	***REVIEWED BY***	***DATE***
1 of 1	*TLJ*	*MBP*	*4-7-2014*

PEI

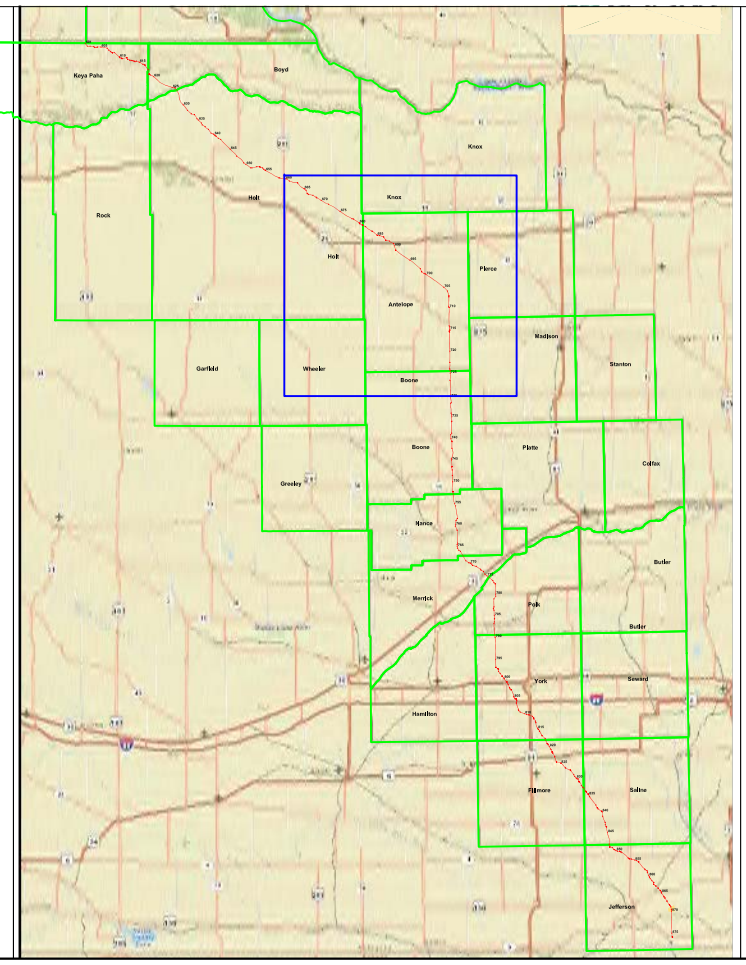
FIGURE GW-01
DEPTH TO GROUNDWATER
MILEPOST 601-660
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



NOTE:

The segment depth to groundwater was derived from the static water levels provided in the March 2014 Water Well Survey performed by Banks Information Solutions with primary emphasis on wells within 1,500 feet of the IFC Route centerline. The representative depth to groundwater for each mile segment was calculated as either the minimum value for the mile segment or the lower limit of the first standard deviation from the average for the segment. For segments with minimal data, wells up to 2,600 feet from the centerline were added to the analysis for that segment. Depths to water for segments without groundwater data were inferred from adjacent segments.

OVERVIEW:



KEY:

NORTH

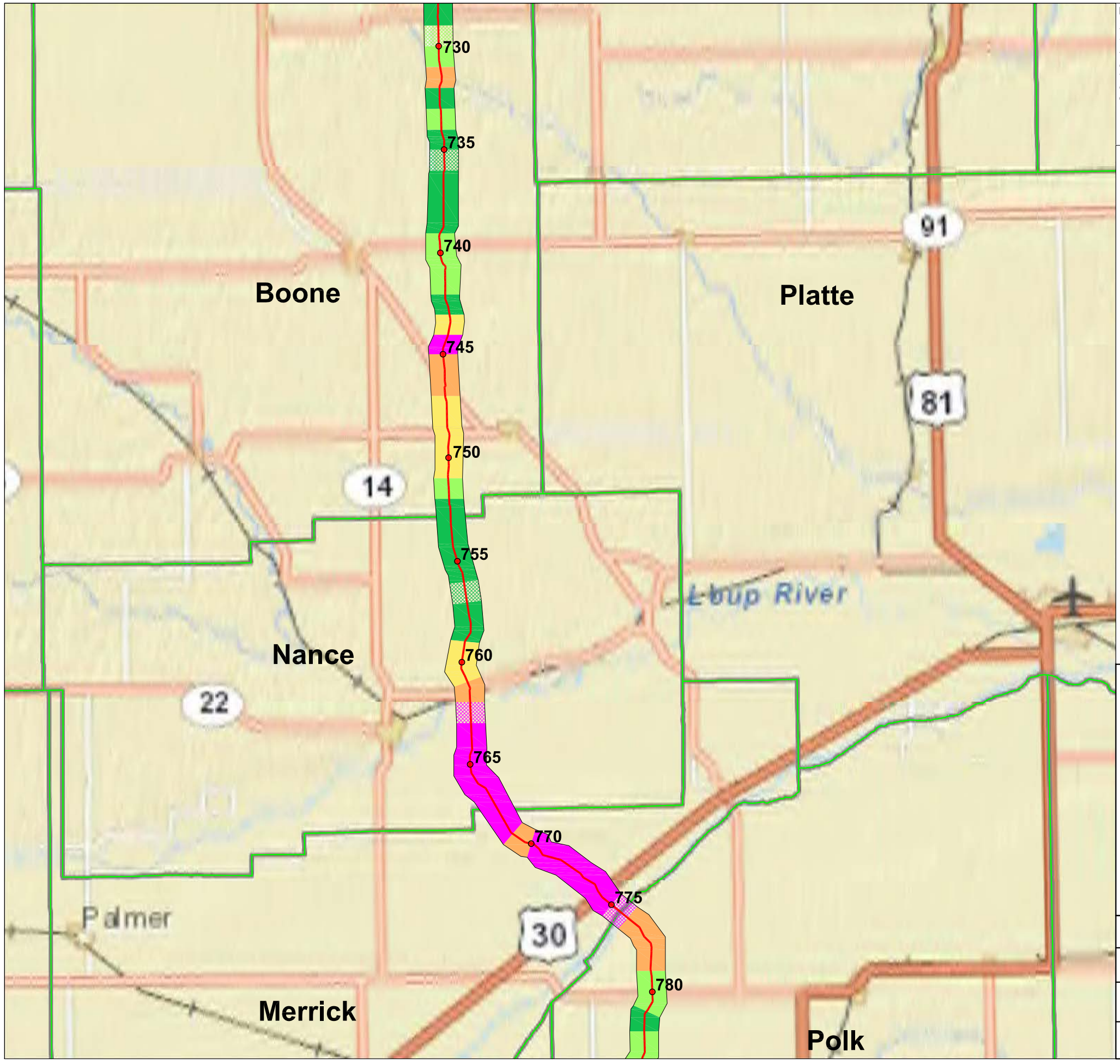
SCALE: 1" = 5 MILES

- IFC ROUTE CENTERLINE
- MILEPOST MARKER (EVERY 5 MILES)
- SEGMENT WITH DEPTH TO GROUNDWATER ≤ 10 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >10 to 25 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >25 to 50 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >50 to 100 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >100 ft.
- SEGMENT WITH NO DATA AVAILABLE
- SEGMENT WITH INFERRED DATA (HATCHED IN APPLICABLE COLOR)

PROJECT	14404.01		
PREPARED FOR	EXP		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	***DRAWN BY***	***REVIEWED BY***	***DATE***
1 of 1	*TLJ*	*MBP*	*4-7-2014*

PEI

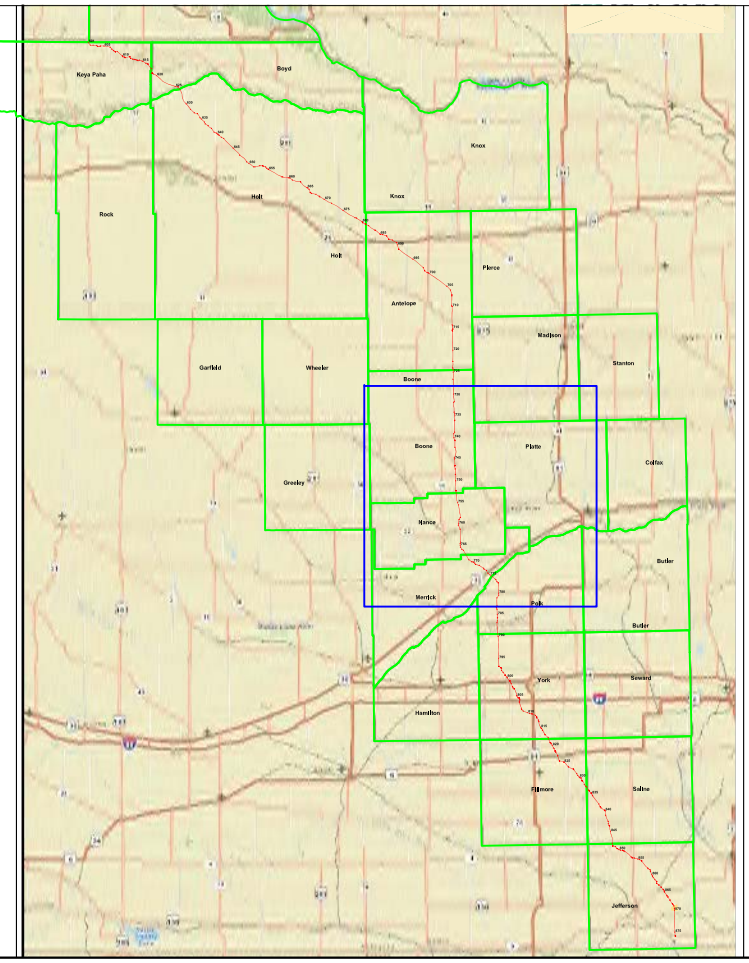
FIGURE GW-02
DEPTH TO GROUNDWATER
MILEPOST 660-730
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



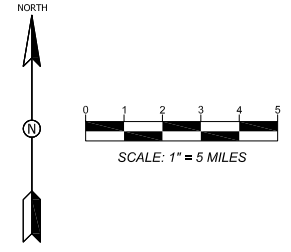
NOTE:

The segment depth to groundwater was derived from the static water levels provided in the March 2014 Water Well Survey performed by Banks Information Solutions with primary emphasis on wells within 1,500 feet of the IFC Route centerline. The representative depth to groundwater for each mile segment was calculated as either the minimum value for the mile segment or the lower limit of the first standard deviation from the average for the segment. For segments with minimal data, wells up to 2,600 feet from the centerline were added to the analysis for that segment. Depths to water for segments without groundwater data were inferred from adjacent segments.

OVERVIEW:



KEY:

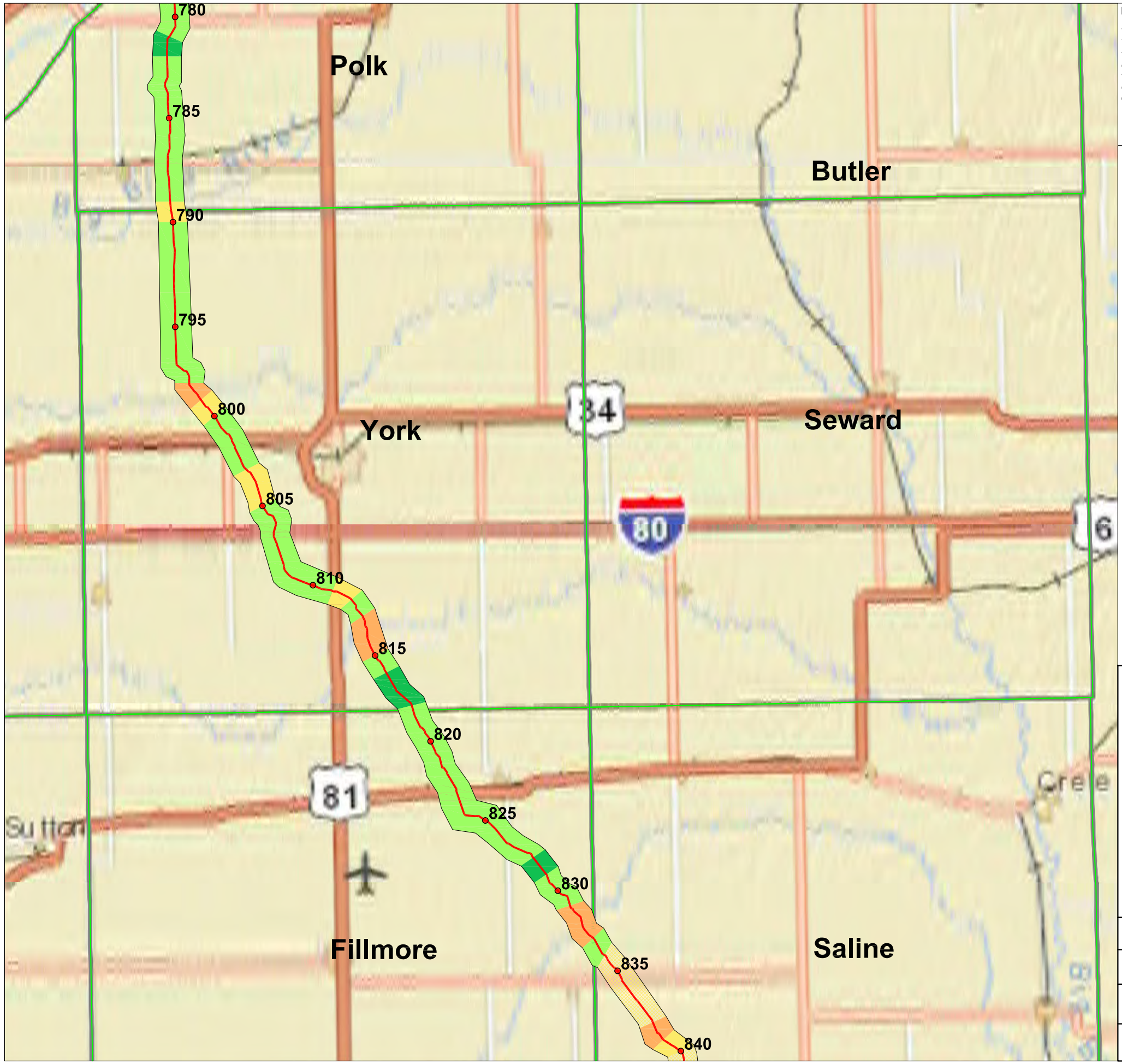


- IFC ROUTE CENTERLINE
750 - MILEPOST MARKER (EVERY 5 MILES)
- SEGMENT WITH DEPTH TO GROUNDWATER ≤ 10 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >10 to 25 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >25 to 50 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >50 to 100 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >100 ft.
- SEGMENT WITH NO DATA AVAILABLE
- SEGMENT WITH INFERRED DATA (HATCHED IN APPLICABLE COLOR)

PROJECT	14404.01		
PREPARED FOR	EXP		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET *1 of 1*	***DRAWN BY*** *TLJ*	***REVIEWED BY*** *MBP*	***DATE*** *4-7-2014*

PEI

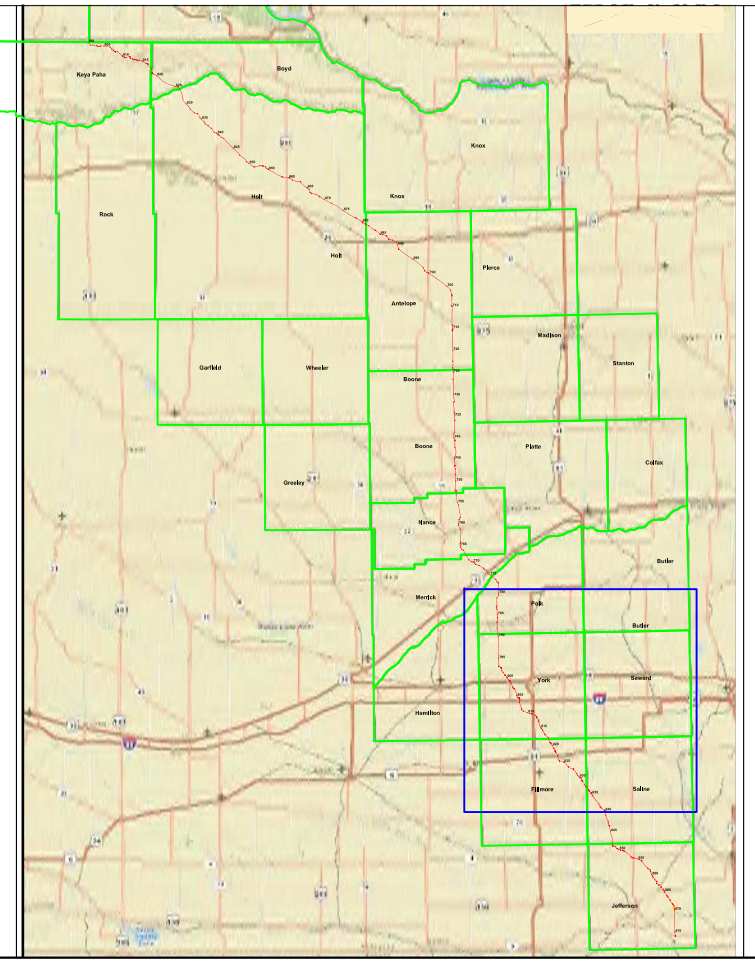
FIGURE GW-03
DEPTH TO GROUNDWATER
MILEPOST 730-780
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



NOTE:

The segment depth to groundwater was derived from the static water levels provided in the March 2014 Water Well Survey performed by Banks Information Solutions with primary emphasis on wells within 1,500 feet of the IFC Route centerline. The representative depth to groundwater for each mile segment was calculated as either the minimum value for the mile segment or the lower limit of the first standard deviation from the average for the segment. For segments with minimal data, wells up to 2,600 feet from the centerline were added to the analysis for that segment. Depths to water for segments without groundwater data were inferred from adjacent segments.

OVERVIEW:



KEY:

NORTH

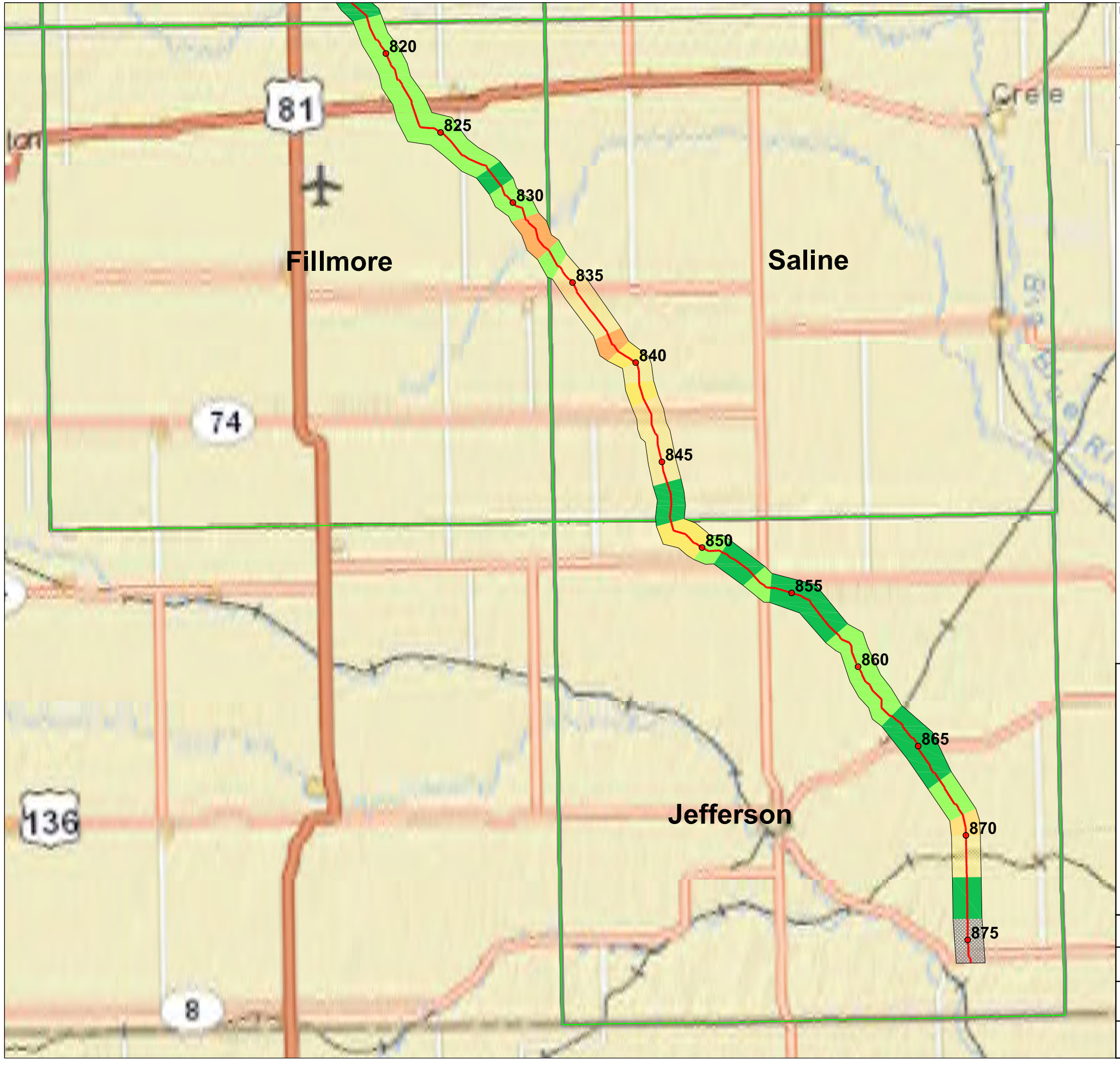
SCALE: 1" = 5 MILES

- IFC ROUTE CENTERLINE
- 800 - MILEPOST MARKER (EVERY 5 MILES)
- SEGMENT WITH DEPTH TO GROUNDWATER ≤ 10 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >10 to 25 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >25 to 50 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >50 to 100 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >100 ft.
- SEGMENT WITH NO DATA AVAILABLE
- SEGMENT WITH INFERRED DATA (HATCHED IN APPLICABLE COLOR)

PROJECT	14404.01		
PREPARED FOR	EXP		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET	***DRAWN BY***	***REVIEWED BY***	***DATE***
1 of 1	*TLJ*	*MBP*	*4-7-2014*

PEI

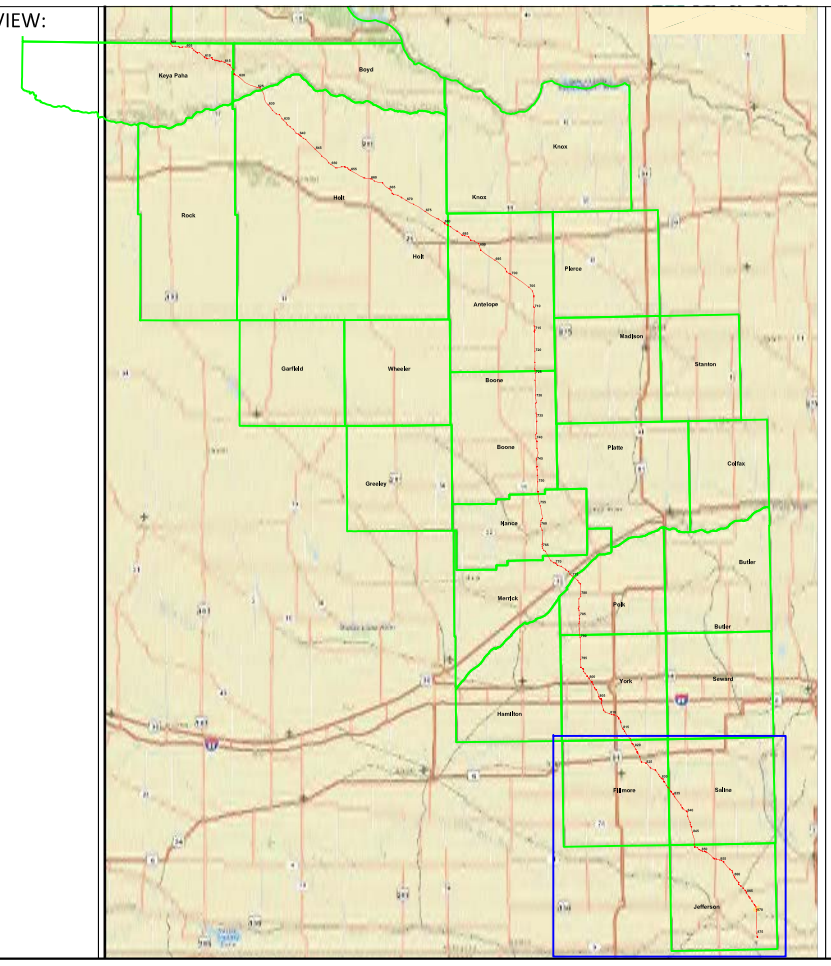
FIGURE GW-04
DEPTH TO GROUNDWATER
MILEPOST 780-840
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT



NOTE:

The segment depth to groundwater was derived from the static water levels provided in the March 2014 Water Well Survey performed by Banks Information Solutions with primary emphasis on wells within 1,500 feet of the IFC Route centerline. The representative depth to groundwater for each mile segment was calculated as either the minimum value for the mile segment or the lower limit of the first standard deviation from the average for the segment. For segments with minimal data, wells up to 2,600 feet from the centerline were added to the analysis for that segment. Depths to water for segments without groundwater data were inferred from adjacent segments.

OVERVIEW:



KEY:

NORTH

SCALE: 1" = 5 MILES

- IFC ROUTE CENTERLINE
- 850 - MILEPOST MARKER (EVERY 5 MILES)
- SEGMENT WITH DEPTH TO GROUNDWATER ≤ 10 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >10 to 25 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >25 to 50 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >50 to 100 ft.
- SEGMENT WITH DEPTH TO GROUNDWATER >100 ft.
- SEGMENT WITH NO DATA AVAILABLE
- SEGMENT WITH INFERRED DATA (HATCHED IN APPLICABLE COLOR)

PROJECT	14404.01		
PREPARED FOR	EXP		
LOCATION	Keystone XL Pipeline Project Nebraska Preferred Route		
SHEET 1 of 1	***DRAWN BY*** TLJ	***REVIEWED BY*** MBP	***DATE*** 4-7-2014

EPEI

FIGURE GW-05
DEPTH TO GROUNDWATER
MILEPOST 840-876
NEBRASKA PREFERRED ROUTE
KEYSTONE XL PIPELINE PROJECT

Distance-to-Groundwater Survey

Tables

Table GW-2
Water Well Summary
Nebraska Preferred Route
Keystone XL Pipeline Project

Nearest Milepost	State/USGS ID	Lateral Distance from PL CL (ft)	Owner	Purpose	Date Completed	Total Depth (ft-bgs)	Static Water Level (ft-bgs)
613.6	205498	379.9	Dewey L & Diane K Peterson	Domestic	6/9/2010	60	25
618.9	194449	985.6	Mertz Mill Ranch LLC	Irrigation	12/1/2008	90	26
619.4	223146	1,786.8	MNS	Irrigation	5/22/2013	100	20
620.3	223149	1,575.0	MNS	Irrigation	5/29/2013	80	18
620.7	220491	1,306.2	MNS	Irrigation	11/21/2012	90	17
620.8	151638	777.2	Scott Land & Cattle LLC	Domestic	6/4/2003	58	14
621.1	215400	1,168.2	MNS	Irrigation	12/22/2011	110	10
621.3	214203	506.9	MNS	Irrigation	12/21/2011	110	17
622.3	110308	1,132.7	Chuck Davis	Livestock	6/4/1997	96	43
622.7	218556	2,346.3	John C Davis	Irrigation	8/18/2012	140	50
625.4	220822	2,512.7	William L Molly & Charles W Hobbs	Livestock	9/18/2012	13	5
630.4	208962	1,746.3	R Wynn & Jill Hipke	Livestock	11/4/2010	45	9
631.0	191059	2,171.8	OK Properties Inc	Domestic	10/3/2007	47	8
633.5	84455	1,176.8	Lonnie A Breiner	Irrigation	4/22/1992	125	28
633.6	149007	406.0	Lonnie A Breiner	Irrigation	4/11/2003	137	32
633.8	73226	722.6	Lonnie A Breiner	Irrigation	12/12/1980	136	34
633.8	73227	1,245.4	Lonnie A Breiner	Irrigation	12/10/1980	131	21
635.6	216324	2,683.5	Richard Kilmurry	Livestock	11/3/2011	90	23
636.5	211716	973.9	Lonnie A Breiner	Livestock	7/8/2011	84	22
636.7	125503	549.0	Brendan J & Andrea Borer	Irrigation	7/7/2000	85	20
638.0	148893	990.7	Roger & Pam Frickel	Irrigation	11/19/2003	90	30
638.4	106373	1,028.5	Roger & Pam Frickel	Irrigation	6/6/1995	90	34
638.5	106372	486.3	Roger & Pam Frickel	Irrigation	6/7/1995	88	34
638.5	106371	1,250.6	Roger & Pam Frickel	Irrigation	4/8/1995	89	32
638.6	157999	355.0	Roger Frickel	Irrigation	3/28/2004	90	42
639.8	116133	990.1	Frank Kilmurry	Domestic	6/3/1998	33	4
642.3	33482	572.3	Alex Frickel	Irrigation	4/3/1967	84	32
643.0	57845	412.8	Alex Frickel	Irrigation	4/6/1976	91	28
643.4	26800	1,381.7	CNBGH Company	Irrigation	4/1/1959	103	15
643.7	30255	406.2	Galyen Land & Cattle Inc	Irrigation	1/12/1965	90	33
644.4	28549	436.3	Riverview LLP	Irrigation	4/21/1962	101	27
644.4	28550	1,354.8	Riverview LLP	Irrigation	8/3/1977	130	35
644.8	124828	1,422.4	Riverview LLP	Irrigation	4/11/2000	202	33
645.1	38247	414.0	CNBGH Company	Irrigation	4/15/1967	200	36
645.8	38249	614.1	CNBGH Company	Irrigation	4/19/1967	196	37
646.2	79548	1,380.9	Donald L & Joi M Oppliger	Irrigation	3/28/1989	180	39
646.4	126966	155.4	Byron Terry Steskal	Irrigation	8/9/2000	60	26
646.4	166278	515.4	Byron Terry Steskal	Irrigation	3/9/2005	150	41

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Keystone XL Pipeline Project

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646.5	164577	587.7	Byron Terry Steskal	Irrigation	2/23/2005	182	37
646.9	161883	405.8	Byron Terry Steskal	Livestock	7/22/2004	43	26
647.4	164576	1,045.2	Byron Terry Steskal	Irrigation	2/26/2005	121	38
647.4	228332	1,125.9	William J & Julie A Tielke	Domestic	8/21/2013	109	39
647.6	216192	502.0	William J & Julie A Tielke	Irrigation	3/13/2012	195	39
647.8	216201	677.1	William J & Julie A Tielke	Irrigation	3/14/2012	195	39
647.8	216200	1,224.4	William J & Julie A Tielke	Irrigation	3/13/2012	195	39
648.0	185960	1,246.7	William J & Julie A Tielke	Livestock	4/25/2007	155	55
649.6	101797	1,026.4	William J & Julie A Tielke	Domestic	7/2/1996	85	20
651.1	211701	1,601.2	Calvin D & Monica Schultz	Irrigation	8/9/2011	340	91
651.3	34357	424.7	Calvin D & Monica Schultz	Irrigation	3/30/1967	224	71
651.7	160245	1,251.8	Constance Myers	Livestock	6/25/2004	117	45
654.4	193508	1,648.8	Larry D Cleary	Livestock	7/2/2008	152	90
654.6	136269	1,753.6	Level 4 LLC	Livestock	10/17/2001	142	94
654.9	178664	736.4	Charles R & Marci J Zegers Revoc Trust	Livestock	7/6/2006	140	88
654.9	128375	1,111.2	Level 4 LLC	Irrigation	1/4/2001	348	84
655.2	162368	1,023.8	Charles R & Marci J Zegers Revoc Trust	Irrigation	10/6/2004	295	86
655.5	76792	1,351.7	Nebraska Board of Educational Lands & Funds	Irrigation	5/20/1977	280	75
655.6	227569	339.9	Nebraska Board of Educational Lands & Funds	Irrigation	10/21/2013	301	84
656.2	141342	1,235.8	Clifford Burival Jr	Irrigation	7/12/2002	287	71
656.3	54569	775.1	Clifford Burival Jr	Irrigation	4/7/1972	250	65
656.7	166547	567.0	Irene L Cleary Trust	Irrigation	5/6/2005	288	51
657.4	46749	256.0	Watts Farms Inc	Irrigation	11/22/1972	273	140
657.4	46748	487.7	Watts Farms Inc	Irrigation	6/1/1973	268	100
657.8	162102	935.7	Donohoe Farms	Irrigation	10/4/2004	263	58
658.1	187418	345.4	Donohoe Farms	Livestock	9/6/2007	120	43
659.2	62979	1,348.1	Lois Donohoe	Irrigation	6/5/1981	206	47
659.7	89186	950.2	Dan Straka	Livestock	11/19/1993	140	33
660.3	198841	666.4	Kenny Sukup	Irrigation	6/17/2009	210	38
660.3	199321	936.9	Kenny Sukup	Irrigation	7/9/2009	210	48
661.5	164300	559.6	Thies Farms North LLC	Livestock	10/25/2004	118	38
661.6	166591	357.8	Calvin D & Monica Schultz	Irrigation	4/19/2005	226	18
661.6	166590	511.4	Calvin D & Monica Schultz	Irrigation	4/20/2005	227	30
664.4	102731	2,068.3	Charles V Molvig	Irrigation	3/28/1997	254	41
665.3	165876	641.0	Dowd Oil Company Inc	Irrigation	3/11/2005	260	41
665.7	85279	1,266.4	Dowd Oil Company Inc	Irrigation	12/18/1992	242	23
665.9	85281	1,207.9	Dowd Oil Company Inc	Irrigation	12/22/1992	255	32
666.0	85280	599.7	Dowd Oil Company Inc	Irrigation	2/4/1993	270	31

Table GW-2
Water Well Summary
Nebraska Preferred Route
Keystone XL Pipeline Project

Nearest Milepost	State/USGS ID	Lateral Distance from PL CL (ft)	Owner	Purpose	Date Completed	Total Depth (ft-bgs)	Static Water Level (ft-bgs)
666.4	32660	361.9	Brown Land Company	Irrigation	3/1/1966	274	18
666.5	110091	751.3	ONeill Farms Inc	Irrigation	2/4/1998	283	20
666.5	83017	1,089.3	ONeill Farms Inc	Irrigation	2/12/1992	295	34
666.9	218877	364.4	Kracl Family Partnership & Marie Kracl	Irrigation	3/1/2013	300	33
667.0	32655	992.5	Brown Land Company	Irrigation	2/10/1966	280	21
667.5	32770	477.0	Brown Land Company	Irrigation	9/26/1966	284	24
667.8	96713	427.9	ONeill Farms Inc	Irrigation	7/18/1995	300	35
667.8	82894	1,289.2	ONeill Farms Inc	Irrigation	1/21/1992	293	32
668.0	192837	557.8	Dowd Oil etal	Irrigation	6/25/2008	240	29
668.0	32766	589.0	Dowd Oil etal	Irrigation	10/4/1966	287	25
668.7	46091	277.3	P & G Realty Inc	Irrigation	3/19/1973	296	22
668.7	62421	277.3	Elkhorn River Holdings LLC	Irrigation	7/26/1973	282	22
668.9	224569	521.2	Elkhorn River Holdings LLC	Irrigation	7/17/1979	283	25
669.1	67276	1,153.6	Nebraska Board of Educational Lands & Funds	Irrigation	4/7/1977	297	35
669.3	67277	957.1	Nebraska Board of Educational Lands & Funds	Irrigation	7/24/1980	301	35
669.4	78342	1,059.7	Nebraska Board of Educational Lands & Funds	Irrigation	3/20/1977	300	35
669.6	77601	633.0	Nebraska Board of Educational Lands & Funds	Irrigation	5/16/1977	321	34
669.9	77602	609.7	Nebraska Board of Educational Lands & Funds	Irrigation	4/8/1977	275	35
670.5	80002	366.5	Elkhorn River Holdings LLC	Irrigation	5/29/1988	347	25
670.5	46105	404.9	P & G Realty Inc	Irrigation	4/10/1973	340	25
670.9	38834	1,015.8	Nichols Family Limited Partnership	Irrigation	3/6/1975	277	30
670.9	38833	1,035.5	Nichols Family Limited Partnership	Irrigation	5/29/1969	68	18
671.3	40356	1,176.9	John L & Janice I McBride	Irrigation	5/1/1970	183	30
671.6	44766	355.9	James A Crumly	Irrigation	5/8/1972	322	30
671.9	77183	1,069.9	Babutzke Farms LLC	Irrigation	9/29/1983	331	40
672.1	205413	1,190.5	Leon M Nichols	Domestic	5/28/2010	124	39
672.4	120911	663.2	Upper Elkhorn Natural Resources District	g (Ground Wate	10/4/1999	70	34
672.4	120912	684.6	Upper Elkhorn Natural Resources District	g (Ground Wate	10/4/1999	120	34
672.4	120913	704.5	Upper Elkhorn Natural Resources District	g (Ground Wate	10/4/1999	211	34
672.4	67158	1,352.5	Hazel V Nichols Revocable Trust	Irrigation	4/5/1977	223	42
672.9	71953	476.7	David W Troester	Irrigation	3/30/1980	110	35
673.1	71952	242.6	David W Troester	Irrigation	3/26/1980	109	42
673.5	53187	1,342.5	Ronald C Crumly	Irrigation	7/18/1975	151	49
673.9	33688	409.3	Larry D Mudloff etal	Irrigation	2/14/1967	135	54
674.6	57228	706.1	Otto L Haman	Irrigation	4/9/1976	185	60
675.0	38268	1,267.4	Boreson Land Inc	Irrigation	5/11/1969	192	60
675.3	46651	918.2	William Miles	Irrigation	6/24/1973	143	70
676.1	37183	731.0	Gene Mudloff	Irrigation	2/26/1968	129	76

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676.1	56540	731.0	Larry D Mudloff	Irrigation	3/11/1976	124	60
676.6	56666	734.2	MTC Properties LLC	Irrigation	1/30/1976	337	54
677.0	56668	1,259.9	MTC Properties LLC	Irrigation	3/29/1976	366	58
677.7	14519	858.4	James R & Patricia J Kennedy	Irrigation	8/5/1957	257	40
677.7	14520	885.2	James R & Patricia J Kennedy	Irrigation	8/7/1973	330	26
678.1	83505	443.3	John W Sojka	Irrigation	4/7/1992	330	51
678.4	53597	371.2	John W Sojka	Irrigation	8/19/1975	332	25
678.4	12938	1,032.7	John W Sojka	Irrigation	4/16/1957	74	19
678.9	166281	1,087.2	Scott Cronk	Irrigation	3/8/2005	335	84
679.8	51752	1,030.4	Fred W Cronk	Irrigation	11/6/1974	310	20
680.0	163732	806.1	Robert H & Joyce E Beelaert Rev Trust	Domestic	11/24/2004	304	55
680.9	209233	947.8	Willowdale Farms LLC	Irrigation	3/25/2011	309	68
681.0	207706	323.5	Willowdale Farms LLC	Irrigation	12/10/1991	312	60
681.2	67052	1,177.2	Willowdale Farms LLC	Irrigation	5/11/1977	308	47
681.3	223549	556.1	Willowdale Farms LLC	Irrigation	11/13/2013	317	67
681.4	63735	296.7	Mark A Winkelbauer	Irrigation	10/6/1976	314	40
681.8	67046	1,130.4	James A Walnofer	Irrigation	12/17/1976	305	39
682.1	148274	887.8	Clarice Heese	Irrigation	9/9/1974	298	50
682.4	69993	936.2	James A & Barbara A Walnofer	Irrigation	7/3/1979	303	67
682.6	44462	182.6	James A & Barbara A Walnofer	Irrigation	8/15/1967	318	22
682.8	227247	1,232.2	Dale L Stelling	Irrigation	3/14/2013	300	65
683.2	52352	259.3	DADS LLC	Irrigation	3/27/1975	272	30
684.3	167936	813.6	Robert E & Darlene Svancara	Irrigation	6/14/2005	290	63
684.6	42399	1,254.0	Ernest Gudenschwager	Irrigation	8/13/1971	292	47
684.8	165851	385.8	Rodney W Deck	Irrigation	3/2/2005	245	79
686.4	192365	324.9	Joshua R Stelling	Irrigation	6/10/2008	380	106
686.4	183609	1,327.8	Joshua R Stelling	Irrigation	2/19/2007	380	111
687.0	55252	1,308.4	Patrick Bergman	Irrigation	11/26/1975	352	90
687.1	215743	198.4	Joshua R Stelling	Irrigation	4/2/2012	373	76
687.6	115387	1,054.5	Todd & Lisa Stelling	Irrigation	12/1/1998	400	100
687.6	214693	1,098.0	Holly D & Patrick L Meuret	Irrigation	12/28/2011	340	79
688.1	164923	429.0	T Bar D Company	Irrigation	5/12/1980	347	84
688.5	74160	618.3	Alexis 2149	Irrigation	5/19/1981	320	39
688.7	124326	371.6	Joshua R Stelling	Irrigation	3/28/2000	360	78
688.9	54522	741.4	Helen Wantz	Irrigation	8/27/1975	262	88
689.2	85655	224.6	Brozek & Sons Inc	Irrigation	4/22/1993	334	72
689.9	211053	1,448.0	Joanne Walmer	Irrigation	9/9/2011	360	81
690.1	212296	1,425.7	Joanne Walmer	Irrigation	9/7/2011	350	84

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690.8	187720	908.8	Cottonwood Ridge LLC	Irrigation	11/7/2007	320	54
691.2	75097	370.2	Germaine G Berry	Irrigation	9/18/1981	358	50
691.5	118370	789.7	Morrison Farms Popcorn	Irrigation	5/7/1999	160	52
691.9	67260	910.8	Nebraska Board of Educational Lands & Funds	Irrigation	4/26/1977	350	58
692.1	177129	285.4	Tim Pellatz	Irrigation	6/23/2006	160	64
692.6	46656	419.0	Wayne L Schwager	Irrigation	3/26/1973	137	77
693.0	226996	233.8	Prairie Gem Company	Irrigation	8/29/2013	389	100
693.1	184007	1,095.7	Prairie Gem Company	Irrigation	4/16/2007	340	78
693.4	59089	782.7	Prairie Gem Company	Irrigation	5/19/1976	366	70
693.9	222966	1,158.2	Uralee Schwager	Irrigation	3/19/2013	400	106
694.0	48715	944.8	Uralee Schwager	Livestock	2/28/1974	290	107
694.4	157658	511.7	O & W Dairy Farms Inc	Irrigation	3/24/2004	410	88
695.5	204249	995.9	W K Hughes LTD	Irrigation	4/6/2010	439	122
695.9	67262	1,059.4	Nebraska Board of Educational Lands & Funds	Irrigation	5/3/1977	390	79
696.2	67264	848.1	Nebraska Board of Educational Lands & Funds	Irrigation	5/5/1977	400	104
696.5	166762	1,142.8	Nebraska Board of Educational Lands & Funds	Irrigation	4/21/2005	375	75
696.9	89485	569.6	Patricia E Blackburn Funnel Tr	Irrigation	2/18/1994	389	111
697.3	63043	1,412.7	Morrison Farms Popcorn	Irrigation	6/1/1971	180	87
697.6	156746	469.7	Donald A Reinke	Irrigation	2/26/2004	310	135
698.3	92506	741.2	Art Tanderup	Irrigation	10/7/1994	134	78
698.7	52293	239.4	William L Hobbs	Irrigation	10/16/1974	124	72
698.7	199001	247.1	William L Hobbs	Livestock	11/20/2008	120	60
698.9	137595	568.2	Henry Graboski	Domestic	10/30/2001	120	35
699.0	42322	235.6	William L Hobbs	Irrigation	4/10/1971	125	70
699.4	79200	483.4	Warren Pellatz	Irrigation	5/6/1987	110	53
699.8	216911	552.4	Gene A & Carol Schacht	Irrigation	5/15/2012	200	49
700.2	54082	2,248.0	John D Hatfield	Irrigation	8/26/1975	282	15
700.6	160317	2,184.8	Ted Hughes	Livestock	5/7/2004	80	22
701.0	45480	1,589.2	Dennis McDonald	Irrigation	3/22/1972	117	37
701.3	80322	796.4	Dennis McDonald	Irrigation	5/9/1989	232	40
701.6	165918	723.0	Kenny D Reinke	Irrigation	3/11/2005	240	47
702.0	62545	1,198.0	Jerry & Char Carpenter	Irrigation	12/14/1976	300	120
702.4	53016	497.0	Judy M Wagner	Irrigation	7/10/1975	324	66
703.0	78068	408.6	Douglas J & Pamela Sue Coulter	Irrigation	3/12/1985	355	95
703.4	82688	1,183.2	Kenny Kallhoff	Irrigation	4/24/1991	329	58
703.8	183153	896.3	David Schrader	Irrigation	3/20/2007	320	89
704.4	184365	1,143.0	Lloyd Forsell	Irrigation	8/10/2007	320	82
704.9	40794	1,042.7	Sunset Farms Inc	Irrigation	9/30/1970	150	78

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Nebraska Preferred Route
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705.0	72425	325.6	Lloyd Forsell	Irrigation	4/13/1979	297	55
705.4	191329	805.9	Allen D & Lucille I Korth	Irrigation	3/18/2009	355	104
705.6	134155	996.0	Allen D & Lucille I Korth	Livestock	6/25/1999	135	58
706.3	176093	521.0	Larry C & Terri R Funk	Irrigation	4/17/2006	351	143
706.4	181635	1,321.5	Larry C & Terri R Funk	Domestic	9/25/2006	310	175
706.6	139456	329.4	Dinsdale Brothers Inc	Irrigation	3/21/2002	390	150
706.6	57794	486.5	Dinsdale Brothers Inc	Irrigation	3/22/1976	342	155
707.7	53861	1,119.3	Frankie Maughan	Irrigation	8/15/1975	324	112
708.2	46961	1,168.7	Charles S Harrison MD	Irrigation	7/13/1973	312	94
708.2	21604	1,459.9	Brian J & LeAnn C Frey et al	Irrigation	12/2/1956	196	56
708.7	218129	985.9	Tedd R Adams	Irrigation	7/26/2012	329	109
708.9	79067	339.6	Tedd R Adams	Irrigation	7/18/1988	340	127
709.5	100466	1,713.9	Tedd R Adams	Livestock	6/1/1996	220	180
710.4	80480	852.0	Lavern & Stacey Mitchell	Irrigation	5/17/1989	315	83
710.7	142063	1,390.9	Richard P & DeAnna Lee Martensen	Livestock	6/5/2002	240	142
711.7	62481	1,643.0	Vincent J Kirby	Irrigation	5/27/1976	342	125
712.4	61609	461.5	Ronald D Weber	Irrigation	11/30/1976	347	54
712.5	16658	1,426.4	Welsh Connection LLC	Irrigation	10/15/1946	202	38
712.7	46015	165.1	William M Cowin	Irrigation	6/6/1971	185	21
713.3	46675	888.9	Ronald R Hanson	Irrigation	6/22/1973	169	4
713.3	225530	890.8	Ronald R Hanson	Irrigation	7/19/2013	290	25
713.5	215822	1,267.3	Ronald R Hanson	Irrigation	4/20/2012	290	8
714.5	105696	251.3	Evans Inc	Irrigation	3/18/1997	290	14
714.6	9419	421.2	Michael C Warneke	Irrigation	3/10/1957	90	26
715.0	42649	328.8	Richard Penne	Irrigation	4/5/1971	327	37
715.0	134332	364.3	Richard Penne	Irrigation	6/25/2001	355	47
715.2	226244	862.8	John Kerkman	Irrigation	8/13/2013	360	60
715.2	112633	984.7	John Kerkman	Irrigation	4/30/1972	304	35
715.8	112635	1,420.0	K D J Farms Inc	Irrigation	4/26/1991	400	86
716.3	59356	1,253.2	Jerry L Hales	Irrigation	6/9/1976	446	95
716.8	69579	1,398.6	Stephanie & Sava Oelsligle	Irrigation	6/4/1979	160	40
717.8	48693	1,290.3	Jerry L Hales	Irrigation	3/22/1974	248	92
718.3	124323	1,421.9	Marjorie C Decker	Irrigation	3/6/2000	200	26
718.8	52405	1,289.6	Richard Penne Jr	Irrigation	10/16/1975	216	92
719.3	77170	1,273.5	Marbu Inc	Irrigation	8/2/1976	221	70
719.3	206482	1,403.2	Marbu Inc	Irrigation	1/18/2011	219	42
719.7	81951	1,433.2	Roger A Loren D Douglas J Broberg	Irrigation	4/20/1991	180	60
719.8	46416	1,331.9	Marbu Inc	Irrigation	5/21/1973	171	70

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720.3	157039	1,284.1	Klamert Farm Trust	Irrigation	3/30/2004	225	124
720.3	65890	1,410.6	Harris Trust	Irrigation	5/15/1977	289	147
720.7	48485	1,394.5	Gerald L Schapmann	Irrigation	5/7/1974	235	130
721.3	195971	1,155.5	Tom & Connie Rutjens	Irrigation	1/20/2009	360	118
721.8	59829	1,158.5	David Schapmann	Irrigation	7/8/1976	330	92
722.3	188737	1,096.4	John L Daly Trust	Irrigation	12/19/2007	330	134
722.7	56131	1,133.9	William K Becker	Irrigation	11/16/1974	245	155
722.9	62680	860.2	Mabel Corkle	Irrigation	1/17/1976	249	150
723.2	56132	1,541.4	William K Becker	Irrigation	5/13/1975	301	155
723.7	56133	1,858.0	William K Becker	Irrigation	5/8/1975	286	195
724.2	181863	1,015.6	Jeffery J Temme	Irrigation	3/23/2007	340	174
725.0	43412	1,394.8	Steve Rasmussen	Irrigation	7/9/1956	204	83
725.2	18191	1,382.5	Steve Rasmussen	Irrigation	7/8/1956	204	83
725.8	195998	1,402.8	Jeffery J Temme	Irrigation	5/15/2009	240	100
725.9	142576	1,313.3	Brian & Amy Moser	Irrigation	11/2/2002	280	147
726.3	114427	337.0	William K & Connie K Becker	Irrigation	7/16/1998	218	95
726.4	18190	993.2	William K & Connie K Becker	Irrigation	11/7/1956	192	80
727.4	82290	1,105.3	Patricia A Knust Grosserode	Irrigation	8/5/1991	391	221
727.4	49168	1,292.3	Patricia A Knust Grosserode	Irrigation	7/16/1974	312	191
728.4	78044	1,176.8	Bruce Werner	Irrigation	3/25/1985	460	188
730.4	82103	1,216.5	Kent N & Mary K Tisthammer	Irrigation	5/15/1991	365	59
731.0	40352	1,503.1	Iver G Bygland	Irrigation	7/24/1970	353	14
731.0	217022	1,762.6	Iver G Bygland	Irrigation	5/16/2012	369	37
731.1	205472	1,110.6	Stephen Bygland	Irrigation	11/9/2010	417	131
732.5	96277	1,254.4	Larry Spomer	Livestock	5/1/1995	270	129
733.4	70296	1,220.8	Curtis J & Kent N Tisthammer	Irrigation	4/17/1979	351	85
733.4	70295	1,253.5	Curtis J & Kent N Tisthammer	Irrigation	6/9/1989	428	94
734.5	130431	1,121.6	Adrian Texley	Domestic	4/10/2000	300	190
736.5	37045	1,798.9	Sever D & Connie Paulson	Irrigation	4/24/1968	192	128
737.2	40165	2,106.7	Dale L & Mary E Urwin	Irrigation	7/9/1970	174	127
737.4	36539	1,212.9	Larry D & Joyce A Erickson	Irrigation	5/16/1968	172	98
737.9	45345	1,183.5	Walter G & Arla M Naber Trusts	Irrigation	7/26/1972	205	126
737.9	37381	1,494.4	Lanny A & Lucinda J Rasmussen	Irrigation	7/29/1968	195	127
738.4	56134	1,165.8	Kenneth D Rankin et al	Irrigation	5/23/1975	194	129
738.9	43350	537.6	Alan T Rasmussen	Irrigation	6/26/1964	175	105
739.0	220810	1,188.8	Rosemary Labenz	Irrigation	1/16/2013	320	104
739.3	107543	475.3	Rosemary Labenz	Domestic	6/5/1997	141	75
739.4	204303	190.4	Rosemary Labenz	Irrigation	11/3/2010	142	61

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740.4	159192	710.1	David & Jane Prothman	Irrigation	11/24/1987	268	76
741.0	157382	1,200.4	Gary E & Patricia L Roberg	Irrigation	3/30/2004	220	72
741.0	62711	1,450.6	J B Farms Inc	Irrigation	4/22/1976	239	161
741.0	62712	1,457.6	J B Farms Inc	Irrigation	6/17/1985	254	149
741.5	49698	1,469.6	Paul A & Susan M Weeder	Irrigation	5/9/1974	182	90
742.0	158097	1,178.2	Judith K Johnson	Irrigation	4/1/2004	190	111
742.0	68190	1,436.5	Paul A & Susan M Weeder	Irrigation	5/6/1978	255	168
742.0	226617	1,457.4	Paul A & Susan M Weeder	Irrigation	8/27/2013	280	170
742.5	45715	760.9	Gary L Choat Testementary Trust & Shirley Choat	Irrigation	8/24/1972	241	170
743.0	46901	461.6	Donald E & Mary E Briese	Irrigation	6/27/1973	185	100
743.9	158101	608.5	Thomas D & Joan A Briese	Irrigation	3/27/2004	148	62
743.9	31852	610.6	Thomas D & Joan A Briese	Irrigation	7/8/1965	121	30
744.6	72368	1,111.7	Donald E & Mary E Briese	Irrigation	8/12/1980	89	16
744.9	212202	791.0	Nebraska Department of Environmental Quality	g (Ground Wate	7/18/2011	13	6
744.9	190447	808.4	Nebraska Department of Environmental Quality	g (Ground Wate	8/16/2007	14	5
744.9	190446	815.8	Nebraska Department of Environmental Quality	g (Ground Wate	8/16/2007	14	6
744.9	190448	828.4	Nebraska Department of Environmental Quality	g (Ground Wate	8/16/2007	14	5
744.9	183797	875.2	Nebraska Department of Environmental Quality	g (Ground Wate	12/18/2006	15	8
744.9	183799	882.9	Nebraska Department of Environmental Quality	g (Ground Wate	12/18/2006	15	8
744.9	183798	893.2	Nebraska Department of Environmental Quality	g (Ground Wate	12/18/2006	15	8
744.9	190445	904.8	Nebraska Department of Environmental Quality	g (Ground Wate	8/16/2007	14	6
744.9	183800	915.9	Nebraska Department of Environmental Quality	g (Ground Wate	12/18/2006	15	8
744.9	190443	917.8	Nebraska Department of Environmental Quality	g (Ground Wate	8/16/2007	14	5
744.9	183801	918.2	Nebraska Department of Environmental Quality	g (Ground Wate	12/18/2006	25	8
744.9	190444	923.2	Nebraska Department of Environmental Quality	g (Ground Wate	8/16/2007	14	5
744.9	210825	1,073.1	Doug Storm	Domestic	5/11/2011	120	8
745.0	55812	712.5	Thomas D & Joan A Briese	Irrigation	4/25/1975	125	30
745.2	49788	585.3	Thomas D & Joan A Briese	Irrigation	6/2/1973	123	10
745.5	77596	1,090.3	Thomas D & Joan A Briese	Irrigation	5/22/1984	120	11
745.6	19872	974.9	Karl Clair & Patricia Kay Koeppen	Irrigation	5/6/1954	140	30
745.7	27781	415.0	Thomas D & Joan A Briese	Irrigation	6/16/1961	160	26
745.9	12643	1,008.3	Nicholas J & Barbara J Gasper	Irrigation	7/1/1947	198	30
746.3	108412	436.1	Nicholas J & Barbara J Gasper	Irrigation	6/6/1997	166	30
746.4	44875	492.0	Glenn O & Gertrude C Wright	Irrigation	6/13/1972	241	25
746.7	21071	647.9	Murphy Fisher Trust	Irrigation	1/1/1948	150	44
747.0	259	377.9	Jerome & Debra Tenski	Irrigation	7/16/1976	207	50
747.4	44660	1,257.8	Jerome & Debra Tenski	Irrigation	6/14/1972	211	30
747.6	146628	1,228.9	Carter Land Company Inc	Irrigation	3/11/2003	140	30

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747.6	118309	1,402.4	David A Merrell et al	Irrigation	3/31/1999	140	54
748.6	40216	968.1	Raymond Merrell Trust	Irrigation	6/23/1970	110	40
749.1	140177	866.6	Ronald Laska Farm	Irrigation	4/19/2002	100	35
749.5	80730	1,169.3	Sylvester C Laska et al	Irrigation	4/2/1990	150	64
749.6	140179	1,140.9	Ronald Laska Farm	Irrigation	4/23/2002	160	70
749.6	140178	1,477.5	Ronald Laska Farm	Irrigation	4/24/2002	170	83
750.1	10787	1,473.1	Donald C & Wanda G Loseke Trusts	Irrigation	4/17/1957	208	150
750.6	99120	1,331.4	Donald C & Wanda G Loseke Trusts	Irrigation	12/21/1995	150	50
750.7	99121	1,327.4	Donald C & Wanda G Loseke Trusts	Irrigation	12/20/1995	173	57
751.1	9438	843.0	Kenneth & Mary Jane Backes	Irrigation	2/19/1957	130	63
751.1	221123	871.6	Kenneth & Mary Jane Backes	Irrigation	1/18/2013	209	51
752.9	79653	460.8	Earl P & Kathleen Stephens Trusts	Irrigation	9/8/1988	344	183
752.9	115016	548.3	Gerald McIntosh	Domestic	4/13/1998	255	175
753.2	133540	617.0	Brad Stephens	Livestock	5/7/2001	310	180
753.7	79656	878.2	Bradley E & Cindy L Stephens Trust	Irrigation	9/12/1988	300	115
754.2	59257	916.4	Thelma C Schumacher	Irrigation	10/20/1972	335	120
754.7	149928	246.2	Ronald E & Mark F Stock	Irrigation	6/28/2003	380	180
755.3	170580	1,513.7	Michael A Laska	Irrigation	9/15/2005	374	179
757.1	51064	1,155.9	James Plebanek	Irrigation	12/2/1974	330	146
757.2	212684	777.9	James Plebanek	Livestock	8/5/2011	265	165
758.3	112660	1,547.0	Pluma Peterson	Livestock	11/13/1997	260	121
759.7	71474	1,458.2	Allen Small	Irrigation	5/29/1979	179	68
759.9	140935	549.4	Allen Small	Irrigation	6/20/2002	145	42
760.0	170230	1,254.5	Joseph M Small	Irrigation	9/23/2005	160	32
760.1	92246	1,431.8	Joseph M Small	Irrigation	5/24/1994	164	38
760.9	206435	1,109.5	Gary Cerny	Livestock	8/8/2010	235	155
761.3	122866	731.2	Mike & Rhonda Carolus	Domestic	8/20/1999	58	24
761.4	192260	454.3	James A & Carol Homolka	Irrigation	12/11/2008	106	50
761.4	113287	1,479.1	Mike Bower	Domestic	4/17/1998	65	30
761.6	182387	1,314.5	Peter Buttero	Livestock	8/2/2006	85	65
761.6	204140	1,657.7	Daniel J & Cassandra Malander	Irrigation	8/2/1990	36	18
761.8	217292	1,494.4	Daniel J & Cassandra Malander	Irrigation	5/29/2012	45	11
763.7	190240	555.9	James J Tarnick	Irrigation	1/1/1979	20	1
763.7	70113	977.2	James J Tarnick	Irrigation	12/1/1967	32	12
763.7	70114	985.3	James J Tarnick	Irrigation	12/1/1967	32	12
763.7	70111	1,056.6	James J Tarnick	Irrigation	12/1/1967	32	12
763.7	70112	1,131.1	James J Tarnick	Irrigation	12/1/1967	32	12
763.8	190238	536.0	James J Tarnick	Irrigation	1/1/1989	22	14

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763.8	171232	544.1	James J Tarnick	Irrigation	4/1/1989	32	12
763.8	190239	580.1	James J Tarnick	Irrigation	1/1/1989	24	16
763.9	149923	978.0	James J Tarnick	Irrigation	4/10/2004	27	20
763.9	157381	1,057.6	James J Tarnick	Irrigation	4/10/2004	30	20
763.9	157380	1,093.1	James J Tarnick	Irrigation	4/10/2004	29	20
764.2	155218	1,348.5	Doris J Tarnick	Domestic	11/18/2003	25	12
764.9	54998	352.1	Doris J Tarnick	Irrigation	5/30/1974	30	8
764.9	54999	352.1	Doris J Tarnick	Irrigation	5/30/1974	30	8
764.9	55000	352.1	Doris J Tarnick	Irrigation	5/30/1974	30	8
764.9	55001	352.1	Doris J Tarnick	Irrigation	5/30/1974	30	8
764.9	55002	352.1	Doris J Tarnick	Irrigation	12/1/1967	30	10
764.9	55003	1,191.9	Doris J Tarnick	Irrigation	12/1/1967	30	10
764.9	55004	1,191.9	Doris J Tarnick	Irrigation	12/1/1967	30	10
764.9	55005	1,191.9	Doris J Tarnick	Irrigation	12/1/1967	30	10
764.9	55006	1,191.9	Doris J Tarnick	Irrigation	12/1/1967	30	10
765.4	133880	1,021.7	Joseph G & Mary A Yrkoski	Irrigation	1/1/1979	--	8
766.1	73440	1,017.7	Clifford F & Marilyn Shotkoski	Irrigation	8/25/1971	26	5
766.1	73441	1,017.7	Clifford F & Marilyn Shotkoski	Irrigation	1/1/1973	26	3
766.1	73443	1,017.7	Clifford F & Marilyn Shotkoski	Irrigation	8/6/1971	26	5
766.3	221102	762.3	Jonathan Swertzic	Livestock	10/1/2012	110	8
766.6	177703	732.1	Clifford F & Marilyn Shotkoski	Irrigation	4/20/2006	30	11
766.7	125406	1,024.2	Clifford F & Marilyn Shotkoski	Irrigation	6/1/2000	30	5
766.7	42330	1,051.8	Clifford F & Marilyn Shotkoski	Irrigation	7/21/1971	40	10
766.7	125403	1,057.3	Clifford F & Marilyn Shotkoski	Irrigation	6/1/2000	40	5
766.8	149221	1,282.8	Clifford F & Marilyn Shotkoski	Irrigation	6/7/2003	30	12
766.9	37327	873.3	Clifford F & Marilyn Shotkoski	Irrigation	2/1/1982	40	6
766.9	42331	873.3	Clifford F & Marilyn Shotkoski	Irrigation	2/1/1982	40	6
767.0	149220	704.0	Clifford F & Marilyn Shotkoski	Irrigation	6/17/2003	30	12
767.0	116594	897.1	Clifford F & Marilyn Shotkoski	Irrigation	2/15/1999	40	9
767.0	37326	905.8	Clifford F & Marilyn Shotkoski	Irrigation	9/23/1968	40	4
767.2	167149	1,312.9	Joseph G & Mary A Yrkoski	Irrigation	4/6/2006	40	10
767.2	107288	1,374.9	Joseph G & Mary A Yrkoski	Irrigation	7/20/1997	40	8
767.6	60681	331.2	Jarecke & Jarecke	Irrigation	7/19/1976	42	7
767.7	65351	427.1	Jarecke & Jarecke	Irrigation	2/25/1977	34	10
767.7	201579	1,098.5	Paul Jarecke	Irrigation	3/2/2010	47	10
767.8	65350	1,175.5	Jarecke & Jarecke	Irrigation	2/25/1977	35	8
768.4	36019	1,240.1	John C & Dianne T Swertzic	Irrigation	7/26/1967	74	7
768.5	28523	732.8	Ed Jarecke	Irrigation	2/2/1963	71	8

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768.5	146724	877.2	Ed Jarecke	Irrigation	4/16/2003	77	17
768.6	154374	590.6	Ed Jarecke	Irrigation	5/2/2004	46	11
768.8	25805	379.4	Ed Jarecke	Irrigation	5/2/1956	33	12
768.9	220048	461.4	Paul & Debra Jarecke	Irrigation	5/31/2013	81	11
768.9	56844	651.9	H Lynn & Leslie D Beck	Irrigation	8/8/1968	56	20
768.9	33458	806.8	Ed Jarecke	Irrigation	1/9/1967	51	12
769.0	33039	533.8	Leslie D Beck	Irrigation	1/12/1966	104	20
769.0	168837	573.2	Leslie D Beck	Irrigation	8/8/2005	105	27
769.3	8146	870.2	Florence Dunn	Irrigation	1/1/1953	65	25
769.4	31073	858.0	Doris Johnson	Irrigation	6/8/1965	55	22
769.4	27413	971.1	Doris Johnson	Irrigation	11/12/1960	68	23
769.5	122433	1,408.0	Doris Johnson	Irrigation	6/25/1964	53	22
769.8	116007	310.4	Robert & Rosella Starostka Rev Trusts	Irrigation	4/29/1999	52	23
769.8	23111	1,480.2	Robert & Rosella Starostka Rev Trusts	Irrigation	4/2/1957	58	16
769.9	27087	587.5	Richard L Johnson	Irrigation	4/29/1960	55	22
770.0	10927	287.4	Thomas J & Teri L Beck	Irrigation	5/9/1956	63	22
770.0	10928	603.1	Donald F Sampson	Irrigation	4/10/1957	56	22
770.0	55322	1,419.6	Thomas J & Teri L Beck	Irrigation	10/31/1975	58	26
770.2	31036	1,083.4	Richard L Johnson	Irrigation	6/25/1964	53	22
770.8	10943	1,128.4	Gordon Franklin Schott	Irrigation	2/19/1957	29	9
770.9	150606	308.0	Gordon Franklin Schott	Irrigation	12/16/2003	30	11
770.9	45029	806.2	Thies Farms Central LLC	Irrigation	8/25/1972	35	5
771.2	72229	1,396.6	Thies Farms Central LLC	Irrigation	4/25/1977	34	4
771.3	222906	737.8	Thies Farms Central LLC	Irrigation	3/21/2013	26	10
771.4	216720	406.8	Thies Farms Central LLC	Irrigation	4/23/2012	26	7
771.4	72230	753.2	Thies Farms Central LLC	Irrigation	4/25/1977	34	4
771.6	23742	703.0	Thies Farms Central LLC	Irrigation	2/22/1957	35	8
771.7	168157	813.0	Thies Farms Central LLC	Irrigation	6/21/2005	27	5
771.7	114704	1,446.5	Thies Farms Central LLC	Irrigation	4/10/1977	30	7
771.8	23741	725.0	David D Buller	Irrigation	1/0/1900	32	10
771.8	185785	746.6	David D Buller	Irrigation	8/6/2007	40	6
771.8	96527	586.2	David D Buller	Irrigation	7/6/1995	40	6
771.8	23744	660.1	David D Buller	Irrigation	2/22/1957	35	6
771.9	23739	1,292.8	David D Buller	Irrigation	1/0/1900	32	10
771.9	65696	1,496.5	David D Buller	Irrigation	4/14/1977	41	8
772.0	96526	727.1	David D Buller	Irrigation	7/5/1995	40	6
772.2	145464	1,004.1	David D Buller	Irrigation	4/25/2003	40	10
772.3	7998	591.4	Timothy L Szatko	Irrigation	5/31/1956	37	10

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772.4	149257	584.6	Timothy L Szatko	Irrigation	2/12/1979	39	9
772.4	149258	672.7	Timothy L Szatko	Irrigation	2/13/1979	39	9
772.4	8000	772.5	Timothy L Szatko	Irrigation	2/4/1957	36	12
772.4	65695	1,428.1	David D Buller	Irrigation	4/14/1977	53	8
772.5	7997	384.1	Timothy L Szatko	Irrigation	9/20/1954	38	9
772.6	201393	520.8	Tim Szatko	Livestock	9/10/2009	21	9
773.3	23187	1,078.4	William H Kohl Jr	Irrigation	6/2/1956	37	8
773.4	75916	749.4	William H Kohl Jr	Irrigation	8/27/1956	37	10
773.5	224927	208.8	Thies Farms Central LLC	Irrigation	6/3/2013	30	7
773.6	224056	670.9	Thies Farms Central LLC	Irrigation	6/3/2013	50	7
773.6	26192	884.3	Donald & Teresa Dush	Irrigation	5/4/1954	31	8
773.6	24171	1,370.1	Thies Farms Central LLC	Irrigation	5/15/1954	27	16
773.7	102450	427.1	Donald & Teresa Dush	Irrigation	10/29/1996	25	5
774.1	26193	515.1	Donald & Teresa Dush	Irrigation	3/5/1954	30	7
774.1	192596	1,210.2	Donald & Teresa Dush	Irrigation	4/8/2009	25	5
774.1	26191	1,265.0	Donald & Teresa Dush	Irrigation	2/2/1954	31	7
774.3	117725	534.8	Thies Farms Central LLC	Irrigation	5/23/1979	78	6
774.3	190507	541.6	Thies Farms Central LLC	Irrigation	11/6/2008	74.599998	4
774.6	140013	646.7	Thomas J Beck	Irrigation	8/12/2002	25	5
774.7	113965	705.2	Thomas J Beck	Irrigation	7/29/1998	30	10
774.8	18522	943.0	Thomas J & Teri L Beck	Irrigation	1/28/1957	82	8
774.8	79580	1,008.9	Thomas J & Teri L Beck	Irrigation	7/20/1988	91	8
774.9	25602	1,396.6	Clifford P & Linda L Yrkoski	Irrigation	4/1/1946	30	8
776.7	11411	780.3	Ronald L Carlson	Irrigation	5/10/1956	82	18
776.8	201467	1,380.8	Terry Feik	Domestic	11/2/2009	92	16
777.0	215257	829.8	Jim Carlson	Domestic	9/8/2011	57	11
777.0	15688	1,097.1	Chris & Margie Hayes	Irrigation	7/2/1980	104	18
777.1	15687	837.6	Chris & Margie Hayes	Irrigation	6/14/1948	93	21
777.2	12097	1,055.5	James D Carlson	Irrigation	1/1/1936	70	35
777.4	11410	952.0	C R C Inc	Irrigation	5/10/1956	125	41
777.7	198489	1,004.1	Hayes Feedyards Inc	g (Ground Wate	4/22/2009	37	29
778.0	12098	2,672.5	James D Carlson	Irrigation	1/1/1938	102	22
778.7	146126	1,738.9	David D & Linda K Walline	Domestic	4/3/2003	133	110
779.0	175334	992.5	Scott F Johnson	Livestock	2/6/2006	170	70
779.2	39158	915.3	Jack Wilhelmey	Irrigation	7/9/1969	249	142
779.5	15912	1,495.5	Marjorie Peterson Trust	Irrigation	9/10/1951	260	138
779.9	139956	683.7	G & M Farms Inc	Irrigation	5/1/2002	300	105
780.1	152619	823.5	Steve W & Sandra K Fredrickson	Domestic	8/1/2003	255	156

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780.2	52591	1,459.5	Ag Products	Irrigation	2/26/1975	288	99
780.6	11867	365.1	Wesley D Jones	Irrigation	8/4/1954	254	113
780.8	59262	1,097.7	Wesley D Jones	Irrigation	6/22/1976	247	108
781.4	61960	860.8	Rex Wieseman	Irrigation	3/13/1972	232	117
781.4	11409	1,150.3	Walter Stohl	Irrigation	1/20/1956	149	110
781.9	8007	295.6	DeVon Johnson	Irrigation	3/21/1957	239	115
781.9	33362	382.8	Harlan S Johnson	Irrigation	12/20/1966	238	114
782.0	53489	727.0	Edythe L Sayer	Irrigation	8/15/1975	247	85
782.1	40358	319.2	Edythe L Sayer	Irrigation	3/23/1970	251	160
782.1	26046	1,372.7	Rex Wieseman	Irrigation	5/15/1956	151	109
782.3	90208	980.4	Harlan S Johnson	Domestic	5/4/1994	153	88
782.7	18211	1,007.8	John Hultman	Irrigation	4/15/1957	155	98
783.1	10833	762.6	Shirley A Nyberg	Irrigation	2/21/1957	156	80
783.3	64629	408.1	Merlin E Nyberg	Irrigation	6/7/1977	221	99
783.4	29677	492.7	Gleim Farms	Irrigation	3/12/1964	151	88
783.6	153912	643.4	Lee Hanson	Irrigation	12/30/2003	240	70
784.3	46720	320.4	Donald D Widga	Irrigation	4/27/1973	225	90
784.9	41626	1,236.4	Kermit L Lindgren	Irrigation	6/30/1966	240	83
785.6	41627	484.5	Kermit L Lindgren	Irrigation	4/12/1971	231	79
785.6	29529	1,192.7	James N & Elaine A Norton	Irrigation	6/4/1964	234	78
786.8	41278	267.1	Dick L Harless et al	Irrigation	2/2/1971	250	80
786.8	13458	1,395.0	Karen A Stevens	Irrigation	3/11/1957	222	76
787.7	21515	836.8	Clyde C Carlson Living Trust	Irrigation	6/7/1984	240	81
788.4	23227	886.6	Bonnie Brauer & Leonard Skoglund	Irrigation	7/11/1954	170	82
788.4	30128	981.6	Shane Lindburg	Irrigation	1/17/1965	260	76
789.0	58197	491.9	Caryl Fossberg	Irrigation	3/25/1976	208	72
789.2	63478	1,475.8	Sherman Wilshusen	Irrigation	3/28/1976	170	70
789.7	176015	1,134.8	Robert C & Marla D Glasser	Irrigation	4/20/2006	210	43
789.7	155705	1,398.5	Bradley J & Susan Kay Sundberg	Irrigation	4/6/2004	225	60
790.0	24627	1,046.3	Noel Kealiher	Irrigation	12/19/1956	156	72
790.4	26283	880.5	Virginia Kealiher Life Estate	Irrigation	9/17/1956	180	78
790.6	33005	1,091.6	Donald & Lloyd Morris	Irrigation	11/11/1966	251	77
791.0	32542	1,073.4	Daniel Graves	Irrigation	5/5/1966	224	84
791.2	16237	923.1	Daniel Graves	Irrigation	2/3/1956	201	83
791.4	79841	506.2	Daniel Graves	Irrigation	11/4/1988	240	93
791.4	8422	1,212.4	Noel Kealiher	Irrigation	4/2/1957	222	85
791.7	34293	296.4	Daniel E Graves	Irrigation	4/4/1967	240	93
792.2	27449	1,109.6	Terri Harrington Trustee	Irrigation	12/11/1959	222	80

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793.1	70190	836.8	S & M Farms Inc	Irrigation	4/23/1979	230	88
793.2	38811	1,143.0	Linda Sandrock	Irrigation	5/27/1969	219	88
793.9	7962	502.3	Herminghaus Farms	Irrigation	4/9/1957	194	80
794.1	19588	362.1	Lela L Eberle	Irrigation	7/9/1955	189	89
794.6	18662	1,346.0	Ron Goertzen	Irrigation	1/1/1943	180	86
794.7	17807	1,000.4	Erma Goertzen	Irrigation	9/1/1955	178	89
794.9	18663	1,129.0	Ron Goertzen	Irrigation	6/24/1971	250	99
795.1	59828	390.1	James &Lynetta &Thomas &Dorren Luethje	Irrigation	5/10/1976	234	83
795.7	29833	981.6	Daniel & Sharon Zierott	Irrigation	7/28/1964	212	92
795.7	195647	1,014.3	Roger L Kaiser	Irrigation	2/25/2009	220	97
796.1	33371	385.3	Roger L Kaiser	Irrigation	2/24/1967	219	81
796.2	48186	927.5	Roger L Kaiser	Irrigation	1/18/1974	236	80
796.6	8182	1,111.1	Leroy Pettey	Irrigation	6/24/1955	180	67
796.7	30499	678.4	Thomas M & Barbara A Budler Revocable Trust	Irrigation	3/6/1965	210	78
796.9	33373	538.5	Thomas M & Barbara A Budler Revocable Trust	Irrigation	2/22/1967	217	77
796.9	40058	1,177.1	Thomas M & Barbara A Budler Revocable Trust	Irrigation	4/27/1970	244	70
797.3	13538	1,038.5	Thomas M & Barbara A Budler Revocable Trust	Irrigation	5/3/1956	74	62
797.6	8180	211.5	Leroy Pettey	Irrigation	4/29/1955	160	64
798.3	21258	1,186.5	Elvin Nichols	Irrigation	8/10/1948	100	25
798.5	153838	804.9	James P Monnier	Irrigation	1/8/2004	120	23
799.1	34554	1,331.4	Edward Schall	Irrigation	7/27/1967	240	52
799.1	154509	1,395.8	Edward Schall	Irrigation	12/17/2003	240	40
799.2	181917	589.0	Scamehorn Land Co LLC	Irrigation	5/28/1975	108	73
799.4	10134	496.0	Terry T Scamehorn	Irrigation	4/1/1956	120	73
799.5	222681	430.0	Andrew T & Amber Scamehorn	Irrigation	8/17/2013	110	46
799.5	164882	1,343.2	Dennis W Scamehorn	Irrigation	3/3/2005	240	90
799.8	78615	800.3	David Scamehorn	Irrigation	6/2/1974	130	85
800.0	81385	1,182.8	Dennis W & Jeannie Scamehorn	Irrigation	1/12/1990	160	80
800.0	7306	1,221.4	Dennis W & Jeannie Scamehorn	Irrigation	5/11/1946	118	80
800.6	86398	1,099.0	Grace Myers Mrs	Irrigation	7/2/1993	120	80
800.8	50627	488.9	Glen Myers	Irrigation	10/30/1974	111	80
800.9	14460	849.1	Glen Myers	Irrigation	8/1/1957	99	68
801.0	82418	1,039.7	Marvin C & Becky S Weber	Irrigation	4/3/1991	120	80
801.0	197470	1,181.3	United States Army Corps of Engineers	Other	9/6/2008	120	55
801.2	33722	41.4	Mandus Sandall	Irrigation	3/5/1967	105	73
801.2	75706	700.9	Victor I Johnson	Irrigation	7/6/1981	110	65
801.4	75707	299.8	Victor I Johnson	Irrigation	7/6/1981	110	65
801.4	104551	627.5	Lloyd I Tracy	Domestic	8/4/1997	110	70

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801.5	101637	997.4	B Rex Weber Trust	Irrigation	6/12/1995	120	70
801.6	100946	584.0	Greg L Quiring	Irrigation	5/13/1996	103	60
801.6	100983	1,228.5	B Rex Weber Trust	Irrigation	5/20/1996	120	62
801.8	108512	685.3	B Rex Weber Trust	Irrigation	10/22/1997	110	73
801.9	108513	420.8	B Rex Weber Trust	Irrigation	10/20/1997	110	73
801.9	127041	1,083.2	Singletree Investments LLC	Irrigation	5/5/1957	97	53
802.0	59843	344.5	Marvin C & Becky S Weber	Irrigation	6/7/1976	120	72
802.0	9652	780.4	Singletree Investments LLC	Irrigation	5/5/1956	106	60
802.3	26513	1,413.9	Logan M Jr Otto	Irrigation	4/13/1959	109	64
802.4	139612	1,197.9	Logan M Jr Otto	Irrigation	4/9/2002	130	80
802.6	11188	553.3	Roland Penner	Irrigation	4/12/1950	108	57
803.0	11190	1,124.6	Roland Penner	Irrigation	3/10/1955	106	58
803.4	16987	591.5	K Creek Farms	Irrigation	8/24/1956	83	35
803.6	60329	397.9	Ronald Lee Janzen	Irrigation	4/23/1976	104	40
803.8	59912	677.7	Ronald Lee Janzen	Irrigation	4/23/1976	104	42
804.0	46890	506.5	G Roger & L Geraldine Burgess	Irrigation	10/11/1972	78	25
804.2	51161	271.6	G Roger & L Geraldine Burgess	Irrigation	7/11/1966	80	35
804.4	153611	215.6	Mary Otto Trusts	Irrigation	10/30/2003	140	71
804.6	153617	1,179.6	Mary Otto Trusts	Irrigation	10/31/2003	120	50
804.8	9552	876.4	Kirkpatrick & Wurst	Irrigation	5/16/1956	138	75
805.0	57180	99.7	Delton G Grotz	Irrigation	3/7/1967	248	80
805.2	57181	610.0	Delton G Grotz	Irrigation	4/3/1961	130	79
805.4	57179	570.7	Delton G Grotz	Irrigation	4/1/1956	128	76
805.4	72963	1,316.5	Daniel L & Dorothy A Kirkpatrick	Irrigation	2/17/1976	238	88
805.8	37499	432.9	Duane C & Brenda M Grotz	Irrigation	5/16/1968	140	80
806.1	37501	591.6	Brent R Grotz	Irrigation	11/17/1965	141	80
806.4	183945	1,146.7	Mary Otto Estate	Irrigation	4/16/2007	160	69
806.5	51761	687.9	Duane C & Brenda M Grotz	Irrigation	2/1/1975	248	88
807.0	27093	500.0	Ardean L Franz	Irrigation	5/24/1960	182	107
807.4	16751	1,013.4	Daniel C Goossen	Irrigation	5/23/1957	141	76
807.9	33021	1,218.7	Otto L Opitz	Irrigation	10/1/1966	158	97
808.0	16754	1,305.3	Otto Ag Enterprises Inc	Irrigation	1/25/1983	162	83
808.2	32376	319.1	Thomas J & Rhonda L Peed Rev Trusts	Irrigation	5/28/1966	150	85
808.6	81435	734.8	Thomas J & Rhonda L Peed Rev Trusts	Irrigation	9/15/1988	161	75
808.8	76938	614.6	Thomas J & Rhonda L Peed Rev Trusts	Irrigation	5/19/1982	185	89
808.9	201276	615.8	Thomas J & Rhonda L Peed Rev Trusts	Domestic	9/14/2009	154	82
808.9	167598	1,393.1	Thomas J & Rhonda L Peed Rev Trusts	Irrigation	6/3/1983	182	82
809.1	9235	153.5	Saddoris Family Trust	Irrigation	10/25/1940	156	72

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809.1	72839	435.6	Saddoris Family Trust	Irrigation	2/14/1976	169	90
809.3	46232	476.0	Marion Michael L & Joann Friesen	Irrigation	4/11/1973	187	82
809.8	69839	1,386.6	Larry Critel	Irrigation	6/1/1966	178	82
810.2	44157	369.1	Marjorie M Johnson Testamentary Trust	Irrigation	3/27/1972	186	96
810.3	82968	1,018.4	Saddoris Family Trust	Irrigation	3/27/1986	185	85
810.4	27994	649.2	Thomas J & Rhonda L Peed Rev Trusts	Irrigation	1/21/1957	180	91
810.6	34269	1,142.7	Carl Buller	Irrigation	6/11/1966	192	87
810.7	34270	836.7	Carl Buller	Irrigation	4/29/1967	206	85
810.9	42653	169.4	Carl Buller	Irrigation	7/22/1971	141	55
811.1	29085	1,383.1	Frank B Stowe	Irrigation	8/14/1963	177	94
811.7	59270	929.7	Calvin Hiebner	Irrigation	3/1/1976	130	40
812.6	170746	423.2	Curtis Norquest	Irrigation	10/12/2005	200	63
813.4	6469	1,067.0	Margaret L Otto	Irrigation	7/13/1956	70	24
813.7	45628	941.8	Darren Carl Grotz	Irrigation	4/23/1971	207	25
814.0	49083	909.0	Delores A Bailey Trustee	Irrigation	5/15/1974	199	29
814.2	51254	646.5	Danielle L Kaliff	Irrigation	2/7/1968	214	26
814.4	7557	469.2	Danielle L Kaliff	Irrigation	8/2/1956	77	38
814.4	79323	910.6	Danielle L Kaliff	Irrigation	1/29/1988	260	26
814.5	72674	206.6	Danielle L Kaliff	Irrigation	8/3/1956	77	26
814.6	33480	1,353.4	Darren Carl Grotz	Irrigation	11/29/1966	214	25
814.9	153843	254.2	Chrisman Brothers Inc	Irrigation	12/8/2003	340	88
815.0	18091	1,258.2	Chrisman Brothers Inc	Irrigation	3/11/1957	120	80
815.1	207098	483.1	Allan Christman	Domestic	9/1/2010	165	80
815.3	8900	1,401.3	Robert E Harry	Irrigation	1/10/1956	271	66
815.4	220166	1,449.5	Barbara J Harris Trust & Sheryl A Schweer	Irrigation	3/28/2013	289	92
815.7	95695	1,077.7	Barbara J Harris Trust & Sheryl A Schweer	Irrigation	6/1/1995	240	105
816.9	88806	463.4	Clinton Volkmer	Domestic	11/16/1993	147	115
816.9	156066	1,023.7	Allen Clark	Irrigation	1/13/2004	312	102
817.3	37318	342.2	Jane Suzanne Johnson	Irrigation	8/10/1968	240	105
818.1	122010	793.7	J Richard Callahan	Irrigation	12/29/1999	255	85
818.2	57037	1,127.0	Duane E Smith	Irrigation	4/20/1975	247	90
818.6	55605	352.6	Glen T Petersen	Irrigation	2/13/1975	260	105
819.1	51285	191.5	Deborah A Petersen	Irrigation	7/3/1974	261	110
819.4	215435	1,327.6	Marion Geiger	Irrigation	1/31/2012	273	84
819.8	19979	566.4	Shane Michael Peed	Irrigation	6/20/1958	264	85
820.4	31513	692.0	Hanson & Swanson	Irrigation	1/10/1966	270	100
820.4	31514	948.3	Hanson & Swanson	Irrigation	7/17/1975	286	140
820.4	168805	959.5	Hanson & Swanson	Irrigation	11/11/2005	300	96

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820.9	31257	526.9	Aarik P Jensen	Irrigation	5/19/1965	280	90
821.2	31384	1,257.0	Louisa L Manning	Irrigation	12/24/1965	320	102
821.3	76468	1,130.7	Donald L Manning	Irrigation	6/28/1982	310	110
821.6	169829	940.4	Cudaback et al	Irrigation	8/22/2005	300	92
822.0	47350	231.3	William F & Judith L Cudaback	Irrigation	4/10/1969	300	105
822.0	129627	319.3	William F & Judith L Cudaback	Irrigation	5/22/2001	307	96
822.4	220804	1,405.4	Doris A Hall	Irrigation	3/7/2013	300	101
822.8	11840	1,369.5	Doris A Hall	Irrigation	8/17/1956	172	100
822.9	173251	1,136.7	Doris A Hall	Domestic	10/13/2005	258	130
823.2	109148	1,093.9	Norma Jean Styskal Trust	Irrigation	5/1/1998	300	66
823.2	41049	1,108.9	Norma Jean Styskal Trust	Irrigation	11/23/1968	300	101
823.6	27735	716.9	Glady J Weber	Irrigation	2/18/1977	292	123
823.8	7636	852.8	Melvin W & Lee Ann Taylor	Other	3/26/1992	297	102
823.9	62851	948.8	SBW Farms Inc	Irrigation	9/30/1976	312	110
823.9	62852	948.8	SBW Farms Inc	Irrigation	7/28/1983	290	152
824.1	7635	926.5	Melvin W & Lee Ann Taylor	Irrigation	8/15/1956	288	90
824.2	168882	986.4	Wasserbauer Farms	Irrigation	7/8/2005	287	143
824.9	187821	905.8	Paul Erdkamp	Domestic	9/27/2007	285	116
825.2	22998	795.2	Sloan Farms	Irrigation	10/23/1956	280	78
825.2	98952	1,054.3	Sloan Farms	Irrigation	2/1/1996	300	100
825.9	99319	1,265.2	Ted Marek	Irrigation	3/1/1996	284	102
826.1	181346	569.7	Ted Marek	Irrigation	12/15/2006	311	99
826.1	50916	1,390.1	Audrey Rose	Irrigation	12/9/1974	273	105
826.9	56057	533.1	Dale D & Janice N Weber	Irrigation	1/21/1976	286	105
827.4	169826	272.4	Sheila M Crays	Irrigation	8/16/2005	329	170
827.7	37674	741.4	John J & Judith M Dinneen	Irrigation	3/1/1968	304	92
827.8	209806	1,271.8	Judith M Dinneen Trustee	Irrigation	3/22/2011	320	94
827.9	9625	432.4	Delmar J & Marjorie Kuska	Irrigation	6/6/1957	270	85
828.1	60133	324.5	Delmer J & Joan T Kuska	Irrigation	10/7/1976	312	110
829.0	66636	458.1	Galen G & Sharon S Kuska	Irrigation	5/9/1977	352	84
829.3	61349	877.0	Chris S Kovanda	Irrigation	10/9/1976	283	121
829.5	19318	840.1	RMJA LLC	Irrigation	1/21/1957	260	87
829.6	139100	1,262.3	RMJA LLC	Irrigation	4/10/2002	260	88
829.9	60670	585.7	Russel J & Melinda K Kovanda	Irrigation	11/30/1976	327	108
830.4	205091	903.1	Leonard Chlup	Domestic	5/26/2010	200	65
830.6	28045	406.0	Agvest LLC	Irrigation	5/22/1961	190	85
830.8	104461	592.4	Agvest LLC	Irrigation	5/1/1997	210	65
831.4	222059	1,943.2	Galen Kuska	Irrigation	5/10/2013	240	75

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831.8	82123	1,838.2	Loukota Family Farms LLC	Irrigation	12/1/1990	136	20
832.0	19317	842.6	Alan E & Glenn F Kovanda	Irrigation	12/30/1954	100	12
832.2	72588	703.6	Alan E & Glenn F Kovanda	Irrigation	6/24/1980	143	13
832.2	83466	1,404.1	Alan E & Glenn F Kovanda	Irrigation	4/13/1992	150	19
832.9	197028	468.7	Western Gold Cattle Company	Livestock	1/21/2009	188	70
832.9	197027	476.2	Western Gold Cattle Company	Livestock	1/20/2009	186	74
832.9	219983	694.0	Virginia & Kathy & Eric Vavra & Krupicka & Krupicka	Irrigation	11/26/2012	180	75
833.4	220321	500.1	Jeff Krupicka	Irrigation	12/3/2012	129	68
833.6	215526	156.1	Delmar J Kuska	Irrigation	3/13/2012	160	80
833.6	74110	1,036.1	Harvey N Milton	Irrigation	4/8/1981	168	76
838.5	128865	600.8	Roland D Crays	Domestic	11/1/2000	105	23
839.7	93213	1,108.1	Jerry Young	Domestic	11/8/1994	165	36
841.7	164535	2,386.4	Larry E & Regina M Schafer	Domestic	11/21/2003	145	30
841.9	172076	903.9	Roger Rada	Domestic	4/7/2005	134	35
846.4	209097	1,724.5	Roesler Farm Inc	Irrigation	2/7/2011	155	112
846.6	167335	747.3	Kevin & Arnold Homolka	Irrigation	5/3/2005	150	103
846.7	54496	1,346.8	Orville Nolte	Irrigation	8/30/1975	169	124
847.1	20339	1,417.1	Herbert Nielsen	Irrigation	3/13/1957	167	110
847.6	31722	255.6	Otto Uher	Irrigation	5/25/1965	180	120
848.1	63475	386.6	Uher Farms Inc	Irrigation	4/14/1977	143	70
848.4	14893	1,236.5	August F Drus	Irrigation	4/18/1957	134	46
848.6	179070	655.2	Donald & Cheryl Uher	Domestic	7/20/2006	156	85
848.9	157312	494.2	Hummel Farms Inc	Irrigation	3/26/2004	140	52
849.1	31647	396.6	Hummel Farms Inc	Irrigation	5/25/1965	122	41
849.3	30081	513.9	Hummel Farms Inc	Irrigation	1/2/1965	134	45
849.4	182633	747.0	Hummel Farms Inc	Irrigation	2/7/2007	160	68
849.7	31648	1,111.1	Hummel Farms Inc	Irrigation	9/22/1972	143	60
850.2	154556	493.2	Phyllis Ziemann Life Estate	Irrigation	12/17/2003	238	132
850.7	208982	1,194.8	Brent Ziemann	Irrigation	3/31/2011	197	90
851.5	55768	389.5	Daniel Drees	Irrigation	12/20/1975	221	110
851.5	202526	397.5	Daniel Drees	Irrigation	4/1/2010	230	111
851.7	130223	975.1	Robert D Spilker	Irrigation	4/18/2001	235	116
851.8	129655	567.4	Robert D Spilker	Domestic	8/7/2000	190	118
852.0	218057	1,081.1	Immanuel Lutheran Church	Domestic	5/21/2012	200	112
852.2	161504	272.8	Howard Zabel	Irrigation	11/2/2004	235	117
852.4	31570	453.8	Andy Fairley	Irrigation	6/1/1965	200	120
853.1	152036	527.4	Schmidt Ag Inc	Irrigation	10/8/2003	220	101
853.9	170627	1,209.3	Andy Fairley	Irrigation	10/7/2005	220	88

Table GW-2
Water Well Summary
Nebraska Preferred Route
Keystone XL Pipeline Project

Nearest Milepost	State/USGS ID	Lateral Distance from PL CL (ft)	Owner	Purpose	Date Completed	Total Depth (ft-bgs)	Static Water Level (ft-bgs)
854.3	55201	583.9	Victor Blobaum	Irrigation	11/5/1975	221	116
854.8	27339	1,302.6	Orlynn F Heidemann	Irrigation	7/9/1960	200	116
855.0	30118	1,180.9	Martin W Jordening	Irrigation	1/20/1965	200	100
855.5	175316	371.1	Myron Schwisow	Irrigation	3/23/2006	248	119
855.9	194508	880.5	Myron Schwisow	Irrigation	11/10/2008	250	116
856.2	172813	678.3	Douglas Sellenrick	Irrigation	12/12/2005	257	114
856.4	55202	1,214.6	Werner C Blobaum	Irrigation	8/3/1975	221	110
856.5	78151	1,323.3	Werner C Blobaum	Irrigation	4/18/1985	208	102
856.9	55203	288.2	Judith Lynch Trustee	Irrigation	7/12/1975	218	114
857.5	31897	308.1	Alfred Frey	Irrigation	1/29/1966	240	102
858.0	73420	1,031.5	Ralph J Knobel	Irrigation	2/1/1981	250	118
858.1	36154	423.0	Wilbert Frey	Irrigation	4/9/1968	230	93
858.4	47927	396.4	Barber Farms Inc	Irrigation	2/7/1974	247	79
858.9	229343	1,487.6	Mark A Grummert	Domestic	5/24/2012	197	86
859.1	32921	454.6	Bonnie Zulauf	Irrigation	9/30/1966	188	80
859.1	183177	1,077.9	Robert D Spilker	Irrigation	3/13/2007	220	62
859.6	21920	405.0	Emil Weise	Irrigation	4/17/1957	154	58
860.0	106572	1,373.5	Bruce Wiese	Irrigation	5/4/1997	120	50
860.1	41916	296.2	Bruce Wiese	Irrigation	5/15/1971	140	61
860.4	221161	850.2	Robert Weise	Irrigation	3/14/2013	350	105
860.5	135705	2,122.6	Robert Weise	Irrigation	11/12/2001	350	108
861.0	213229	1,881.7	Randy Weise	Irrigation	11/1/2011	330	90
862.0	213230	867.5	Douglas Sellenrick	Irrigation	10/31/2011	316	94
862.6	213491	187.6	James A Katz	Irrigation	11/3/2011	326	111
863.7	183882	1,496.0	Stan/Jason Meyer & Rippe	Irrigation	3/22/2007	310	126
864.2	34815	955.1	John Freese	Irrigation	7/23/1967	168	136
864.3	213449	1,227.9	Mary L Heidemann	Irrigation	11/7/2011	333	140
864.6	45378	1,384.7	Weise Farm Corporation	Irrigation	5/12/1972	143	101
864.8	209729	556.5	James A Katz	Irrigation	3/14/2011	155	120
864.9	178470	1,162.1	Les Thompson	Domestic	7/31/2006	153	123
865.3	52629	842.9	Geraldine L Katz	Irrigation	6/1/1975	163	128
865.9	130219	206.0	Wegele Family Trust	Irrigation	3/7/2001	202	102
866.4	189085	984.5	Wegele Family Trust	Irrigation	12/4/2007	204	124
866.6	106294	905.4	Clayton Peters Dr	Irrigation	5/8/1997	240	120
867.2	55702	377.0	General Agricultural Services LLC	Irrigation	11/30/1975	164	106
867.8	208566	547.5	Brian T & Katherine A Genrich Trust	Irrigation	1/26/2011	180	97
868.1	225752	856.6	Brian T & Katherine A Genrich Trust	Domestic	5/31/2013	172	96
868.3	80857	911.5	Loal A Genrich	Irrigation	3/1/1990	172	95

Table GW-2
Water Well Summary
Nebraska Preferred Route
Keystone XL Pipeline Project

Nearest Milepost	State/USGS ID	Lateral Distance from PL CL (ft)	Owner	Purpose	Date Completed	Total Depth (ft-bgs)	Static Water Level (ft-bgs)
868.5	215698	1,039.2	Esther I Heckman Rev Trust	Irrigation	4/30/2012	167	90
868.6	213134	499.3	Amaryllis Gerber	Irrigation	10/6/2011	241	99
869.8	165913	579.8	Jason Nimmich	Domestic	2/3/2005	85	31
872.5	59869	1,466.2	Verne A Prestzer	Irrigation	8/25/1976	195	115
872.9	215148	1,108.7	Alan Svajgr	Irrigation	4/19/2012	225	135
872.9	37722	1,318.1	Edward Svajgr	Irrigation	7/12/1968	220	145
873.0	215149	413.2	Alan Svajgr	Irrigation	4/19/2012	195	129
873.2	176426	834.6	Martha Sasse	Irrigation	11/10/2006	192	120
873.5	191288	409.6	Larry L Sasse	Irrigation	4/2/2008	195	132
873.5	172943	586.4	Larry L Sasse	Irrigation	12/15/2005	222	141
873.9	161895	1,389.5	Glennda Marsh Letts	Irrigation	9/20/2004	207	145

Source: Banks Information Solutions, Austin, TX March 2014)

Notes:
PL CL - Pipeline Centerline
bgs - Below Ground Surface

Depths to Water

10	Magenta - 1 to 10 ft Bgs
25	Orange - >10 to 25 ft Bgs
50	Yellow - >25 to 50 ft Bgs
100	Yellow-Green - >50 to 100 ft Bgs
101	Green - >100 ft Bgs

Table GW-1
Depth To Groundwater
Nebraska Preferred Route
Keystone XL Pipeline Project

From Milepost	To Milepost	Min DTW (ft bgs)	Avg DTW (ft bgs)	Assigned DTW (ft bgs)	Report Figure
601	613	-	-	-	
613	614	25	25	25	
614	618	-	-	***25***	
618	619	26	26	26	
619	620	20	20	20	
620	621	14	16	15	
621	622	10	14	10	
622	623	43	47	43	
623	625	-	-	***20***	
625	626	5	5	5	
626	630	-	-	***5***	
630	631	9	9	9	
631	632	8	8	8	
632	633	-	-	***15***	
633	634	21	29	24	
634	635	-	-	***23***	
635	636	23	23	23	
636	637	20	21	20	
637	638	-	-	***25***	
638	639	30	34	30	GW-01
639	640	4	4	4	
640	642	-	-	***15***	
642	643	32	32	32	
643	644	15	25	18	
644	645	27	32	28	
645	646	36	37	36	
646	647	26	34	27	
647	648	38	39	38	
648	649	55	55	55	
649	650	20	20	20	
650	651	-	-	***35***	
651	652	45	69	50	
652	654	-	-	***60***	
654	655	84	89	85	
655	656	75	82	77	
656	657	51	62	54	
657	658	58	99	66	
658	659	43	43	43	
659	660	33	40	33	
660	661	38	43	38	
661	662	18	29	20	
662	664	-	-	***30***	
664	665	41	41	41	
665	666	23	32	25	
666	667	18	27	20	
667	668	21	28	22	
668	669	22	25	22	GW-02
669	670	34	35	34	
670	671	18	25	20	
671	672	30	33	30	
672	673	34	36	34	
673	674	42	48	43	
674	675	60	60	60	
675	676	60	65	60	

Table GW-1
Depth To Groundwater
Nebraska Preferred Route
Keystone XL Pipeline Project

From Milepost	To Milepost	Min DTW (ft bgs)	Avg DTW (ft bgs)	Assigned DTW (ft bgs)	Report Figure
676	677	54	63	54	
677	678	26	41	28	
678	679	19	45	19	
679	680	20	20	20	
680	681	55	61	55	
681	682	39	51	39	
682	683	22	51	33	
683	684	30	30	30	
684	685	47	63	50	
685	686	-	-	***75***	
686	687	106	109	106	
687	688	76	86	77	
688	689	39	72	53	
689	690	72	77	72	
690	691	54	69	54	
691	692	50	53	50	
692	693	64	71	64	
693	694	70	89	74	
694	695	88	98	88	
695	696	79	101	79	
696	697	75	97	81	
697	698	87	111	87	
698	699	35	61	45	
699	700	49	57	49	
700	701	15	19	15	
701	702	37	41	37	
702	703	66	93	66	GW-02
703	704	58	81	64	
704	705	78	80	78	
705	706	55	72	55	
706	707	143	156	144	
707	708	112	112	112	
708	709	56	97	70	
709	710	180	180	180	
710	711	83	113	83	
711	712	38	72	38	
712	713	21	38	24	
713	714	4	12	4	
714	715	14	20	14	
715	716	35	53	35	
716	717	40	68	40	
717	718	92	92	92	
718	719	26	59	26	
719	720	42	61	49	
720	721	124	134	124	
721	722	92	105	92	
722	723	134	146	137	
723	724	155	175	155	
724	725	174	174	174	
725	726	83	103	83	
726	727	80	88	80	
727	728	191	206	191	
728	729	188	188	188	
729	730	-	-	***100***	

Table GW-1
Depth To Groundwater
Nebraska Preferred Route
Keystone XL Pipeline Project

From Milepost	To Milepost	Min DTW (ft bgs)	Avg DTW (ft bgs)	Assigned DTW (ft bgs)	Report Figure
730	731	59	59	59	GW-03
731	732	14	61	14	
732	733	129	129	129	
733	734	85	90	85	
734	735	190	190	190	
735	736	-	-	***150***	
736	737	128	128	128	
737	738	98	120	107	
738	739	105	117	105	
739	740	61	80	62	
740	741	76	76	76	
741	742	72	118	80	
742	743	111	155	129	
743	744	30	64	35	
744	745	5	7	5	
745	746	10	20	10	
746	747	25	33	25	
747	748	30	41	30	
748	749	40	40	40	
749	750	35	63	45	
750	751	50	86	50	
751	752	51	57	51	
752	753	175	179	175	
753	754	115	148	115	
754	755	120	150	120	
755	756	179	179	179	
756	757	-	-	***150***	
757	758	146	156	146	
758	759	121	121	121	
759	760	42	55	42	
760	761	32	75	32	
761	762	11	33	14	
762	763	-	-	***10***	
763	764	1	14	9	
764	765	8	9	8	
765	766	8	8	8	
766	767	3	7	4	
767	768	4	9	7	
768	769	7	12	8	
769	770	16	22	19	
770	771	5	17	9	
771	772	4	7	5	
772	773	6	9	8	
773	774	5	9	5	
774	775	4	7	5	
775	776	-	-	***10***	
776	777	16	17	16	
777	778	11	26	16	
778	779	22	66	22	
779	780	70	114	85	

Table GW-1
Depth To Groundwater
Nebraska Preferred Route
Keystone XL Pipeline Project

From Milepost	To Milepost	Min DTW (ft bgs)	Avg DTW (ft bgs)	Assigned DTW (ft bgs)	Report Figure
780	781	99	119	99	
781	782	110	114	111	
782	783	85	108	85	
783	784	70	84	74	
784	785	83	87	83	
785	786	78	79	78	
786	787	76	78	76	
787	788	81	81	81	
788	789	76	79	76	
789	790	43	61	50	
790	791	72	76	73	
791	792	83	88	83	
792	793	80	80	80	
793	794	80	85	82	
794	795	86	91	86	
795	796	83	91	85	
796	797	67	76	70	
797	798	62	63	62	
798	799	23	24	23	
799	800	40	57	40	
800	801	68	78	73	
801	802	53	67	59	
802	803	57	67	58	
803	804	35	44	35	
804	805	25	51	32	GW-04
805	806	76	81	77	
806	807	69	79	71	
807	808	76	93	80	
808	809	75	83	78	
809	810	72	82	75	
810	811	55	83	70	
811	812	40	67	40	
812	813	63	63	63	
813	814	24	25	24	
814	815	25	37	25	
815	816	66	85	71	
816	817	102	109	102	
817	818	105	105	105	
818	819	85	93	85	
819	820	84	93	84	
820	821	90	107	90	
821	822	92	101	94	
822	823	96	106	96	
823	824	66	109	83	
824	825	90	116	95	
825	826	78	93	82	
826	827	99	103	100	
827	828	85	110	85	
828	829	110	110	110	
829	830	84	98	84	

Table GW-1
Depth To Groundwater
Nebraska Preferred Route
Keystone XL Pipeline Project

From Milepost	To Milepost	Min DTW (ft bgs)	Avg DTW (ft bgs)	Assigned DTW (ft bgs)	Report Figure
830	831	65	72	65	GW-04
831	832	20	48	20	
832	833	12	44	15	
833	834	68	75	70	
834	838	-	-	***50***	
838	839	23	23	23	
839	840	36	36	36	
840	841	-	-	***30***	GW-05
841	842	30	33	30	
842	846	-	-	***50***	
846	847	103	113	104	
847	848	110	115	110	
848	849	46	63	48	
849	850	41	54	43	
850	851	90	111	90	
851	852	110	114	110	
852	853	112	116	113	
853	854	88	95	88	
854	855	116	116	116	
855	856	100	112	103	
856	857	102	110	105	
857	858	102	102	102	
858	859	79	94	79	
859	860	58	67	58	
860	861	50	81	55	
861	862	90	90	90	
862	863	94	103	94	
863	864	126	126	126	
864	865	101	124	110	
865	866	102	115	102	
866	867	120	122	120	
867	868	97	102	97	
868	869	90	95	92	
869	870	31	31	31	
870	872	-	-	***50***	
872	873	115	132	119	
873	874	120	133	125	
874	876	-	-	-	

Source: Banks Information Solutions, Austin, TX (March, 2014)

Notes:
DTW - Depth to Water
bgs - Below Ground Surface
"-" - No Data
25 - Inferred DTW

Depths to Water

10	Magenta - 1 to 10 ft Bgs
25	Orange - >10 to 25 ft Bgs
50	Yellow - >25 to 50 ft Bgs
100	Yellow-Green - >50 to 100 ft Bgs
101	Green - >100 ft Bgs

APPENDIX H – Socioeconomic Report

The Socioeconomic Impact of the Keystone XL Pipeline on the State of Nebraska and Its Counties

Produced for:

TransCanada
450 - 1 Street SW
Calgary, Alberta, Canada
T2P 5H1

February 13, 2017

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Table of Contents

The Socioeconomic Impact of the Keystone XL Pipeline on the State of Nebraska and its Counties

Preface

The Socioeconomic Impact of the Keystone XL Pipeline on the State of Nebraska and its Counties

In the Fall of 2012, Goss & Associates completed an economic impact assessment of the Keystone XL pipeline on the State of Nebraska for the Consumer Energy Alliance (CEA). Due to the passage of time, TransCanada in 2017 requested that Goss & Associates update the 2012 study using more recent data. Specifically, the goal of this 2017 study is to update the socioeconomic impact of the Keystone XL pipeline on the Nebraska economy by using the most recent data and a timeline that is more in-line with the current construction and operations calendar.

Updated results differ from those in the 2012 analysis. The principal factors accounting for differentials in impacts between the two studies are:

1. The present study assumes that one-third of Nebraska workers will live in construction camps. The 2012 study assumed that all workers lived in public accommodations.
2. As the result of a significant decline in interest rates, the present study uses a lower discount rate than the 2012 study. Lowering the discount rate raises the estimated impacts.
3. Many variables changed between 2012 and 2017. For example, inflation rates, state and local tax rates, as well as multipliers have changed over the five-year period.
4. The time period for construction and operations changed.

Using input-output multipliers, the study provides sales, earnings and job impacts in addition to estimating the impact of the development on yearly state and local tax collections. This study, while funded by TransCanada, was developed independently of this organization. Any conclusions, findings, errors or mis-statements contained in this study are solely the responsibility of Goss & Associates, Economic Solutions.

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Glossary

The Socioeconomic Impact of the Keystone XL Pipeline on the State of Nebraska and its Counties

Definition of Terms	
Term	**Definition**
Current dollars	Dollars not adjusted for inflation or discounted to 2015 dollars
Discounted	Unless stated otherwise, all financial data in this report are stated in dollars discounted to 2015 dollars
Direct effects	The set of expenditures applied to the predictive model for impact analysis.
IMPLAN	Using classic input-output analysis in combination with regional specific Social Accounting Matrices and Multiplier Models, IMPLAN provides an accurate and adaptable model for its users. The IMPLAN database contains county, state, zip code, and federal economic statistics which are specialized by region and can be used to measure the effect on a regional or local economy of a given change or event in the economy's activity. See Appendix C.
Input-output analysis	A type of applied economic analysis that tracks the interdependence among various producing and consuming sectors of an economy. More particularly, it measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands (U.S. Bureau of Economic Analysis).
Jobs supported	A job in IMPLAN = the annual average of monthly jobs in that industry. Thus, 1 job lasting 12 months = 2 jobs lasting 6 months, or = 3 jobs lasting 4 months each. A job can be either full-time or part-time.
Labor income	Wages & salaries plus self-employment income.
Overall or sales impacts	Amount of additional sales, including insurance premiums, retail sales, wholesale expenditures, construction sales, etc. It is analogous to gross domestic product (GDP), but will include some double counting and will thus exceed GDP.
Payroll	All forms of compensation, such as salaries, wages, commissions, dismissal pay, bonuses, vacation allowances, sick-leave pay, and employee contributions to qualified pension plans paid during the year to all employees.
Private workers	All those working excluding government workers, state, local and federal.
Productivity	Growth in Gross Domestic Product (GDP) per worker.
Self-employment income	Income of proprietors of non-incorporated companies including attorneys, accountants and consultants.
Wages and salaries	The total payroll cost of the employee paid by the employer and for earnings for self-employed. Total payroll cost includes wages and salary, all benefits (e.g., health, retirement, etc) and employer-paid payroll taxes (e.g. employer side of social security, unemployment taxes, etc).

Executive Summary

The Socioeconomic Impact of the Keystone XL Pipeline on the State of Nebraska and Its Counties

Applying direct Nebraska spending by TransCanada between 2018 and 2034 to the Implan Multiplier System discussed in the Appendices of this study, Goss & Associates obtained impacts for Nebraska, the 12-county region, and each of the 12 Nebraska counties over which the pipeline crosses.[2]

Unless otherwise noted, all estimates are discounted to 2015 dollars. Estimates are provided for the construction phase 2018 - 20 and the operation period 2020 - 2034. In order to produce more conservative estimates, it is assumed that only 7.3 percent of TransCanada construction workers and their contractors are Nebraska residents.[3] Furthermore, the cost and installation of replacement materials over the operations period are not considered and it is assumed that all pipe, pump stations and terminals are produced outside of Nebraska. Additionally, estimates contained in this study do not include TransCanada pre-construction spending. Thus, estimates contained in this study are conservative, or below the impacts actually generated.

Table EX.1: Summary of the impacts of Keystone XL on Nebraska, 2018-2034

	Construction	Operations	2018-34
Sales/output	$890,995,940	$1,236,688,436	$2,127,684,376
Jobs (average per year)	3,397.2	371.7	727.6
Labor income	$326,558,356	$415,471,634	$742,029,990
State & local taxes	$43,538,660	$221,240,614	$264,779,274

Source: IMPLAN Multiplier System

Additionally, estimates contained in this study do not include TransCanada pre-construction spending. Thus, estimates contained in this study are conservative, or below the impacts actually generated.

[2] Estimated direct TransCanada spending is listed in Tables D.1 – D.5 of Appendix D of this study.

[3] Goss and Associates.

Executive Summary

Construction Period, 2018 - 2020[4]

- Between 2018 and 2020, the Keystone XL pipeline construction will have a significant positive impact on the Nebraska counties which it crosses. In 2015 dollars the impact will be:[5]
  - State of Nebraska (see Table 3.1):
    - Total impact (output/sales): $891.0 million.
    - Labor income (wages & salaries plus self-employment income): $326.6 million.
    - Average jobs supported per year: 3,397.2.
  - 12-county region that the pipeline crosses (see Table 3.4a):
    - Total impact (output/sales): $42.6 million.
    - Labor income (wages & salaries plus self-employment income): $15.6 million.
    - Average jobs supported per year: 162.4.
  - Nebraska counties outside the region for the construction period:
    - Total impact (output/sales): $848.4 million.
    - Labor income (wages & salaries plus self-employment income): $311.0 million.
    - Average jobs supported per year: 3,234.8.

Operation Period 2020 - 2034[6]

- During the first 15 years of operation, 2020 to 2034, the Keystone XL pipeline will have a significant positive impact on the state, the region, and Nebraska counties which it crosses:
  - State of Nebraska (see Table 3.1):
    - Total impact (output/sales): $1.2 billion.
    - Labor income (wages & salaries plus self-employment income): $415.5 million.
    - Average jobs supported per year: 371.7.
  - 12-county region that the pipeline crosses (see Table 3.4b):
    - Total impact (output/sales): $59.1 million.
    - Labor income (wages & salaries plus self-employment income): $19.9 million.
    - Average jobs supported per year: 17.8.
  - Nebraska counties outside the region of operations for the operations period:
    - Total impact (output/sales): $1.2 billion.
    - Labor income (wages & salaries plus self-employment income): $395.6 million.
    - Average jobs supported per year: 353.9.

[4]It is assumed that construction begins July 1, 2018 and ends June 30, 2020.

[5]Throughout this study, unless indicated otherwise, all financial values are expressed in dollars discounted to present value (2015).

[6]It is assumed that operations begin July 1, 2020. The 15-year period is used since that is the depreciable life of pipelines and equipment.

Executive Summary

State and Local Tax Impacts 2018 - 2034[7]

- Between 2018 and 2034 construction and operations of the Keystone XL pipeline will contribute the following to state and local Nebraska taxes:
  - State tax collections, all in 2015 dollars (see Table 3.6b):
    - Sales taxes: $16.8 million (discounted).[8]
    - Use taxes: $16.5 million (discounted).
    - Individual income taxes: $14.6 million (discounted).
    - Corporate income taxes: $2.7 million (discounted).
    - Other taxes & fees: $10.8 million (discounted).
    - Total state taxes & fees: $61.4 million (discounted).
  - Local tax collections, all in 2015 dollars (see Table 3.6a)
    - Property taxes: $203.2 million (discounted).[9]
    - Other taxes & fees: $0.2 million (discounted).
    - Total local taxes & fees: $203.4 million (discounted).

Impacts do not include TransCanada upfront payments

[7]Impacts do not include TransCanada upfront payments and activity.

[8]Sales taxes include local option sales taxes outside the 12-county area.

[9]Indirect property taxes are excluded.

Executive Summary - Summary of Impacts

Figure EX.1: Property tax collections, 2018 - 2034 (discounted to 2017 dollars)

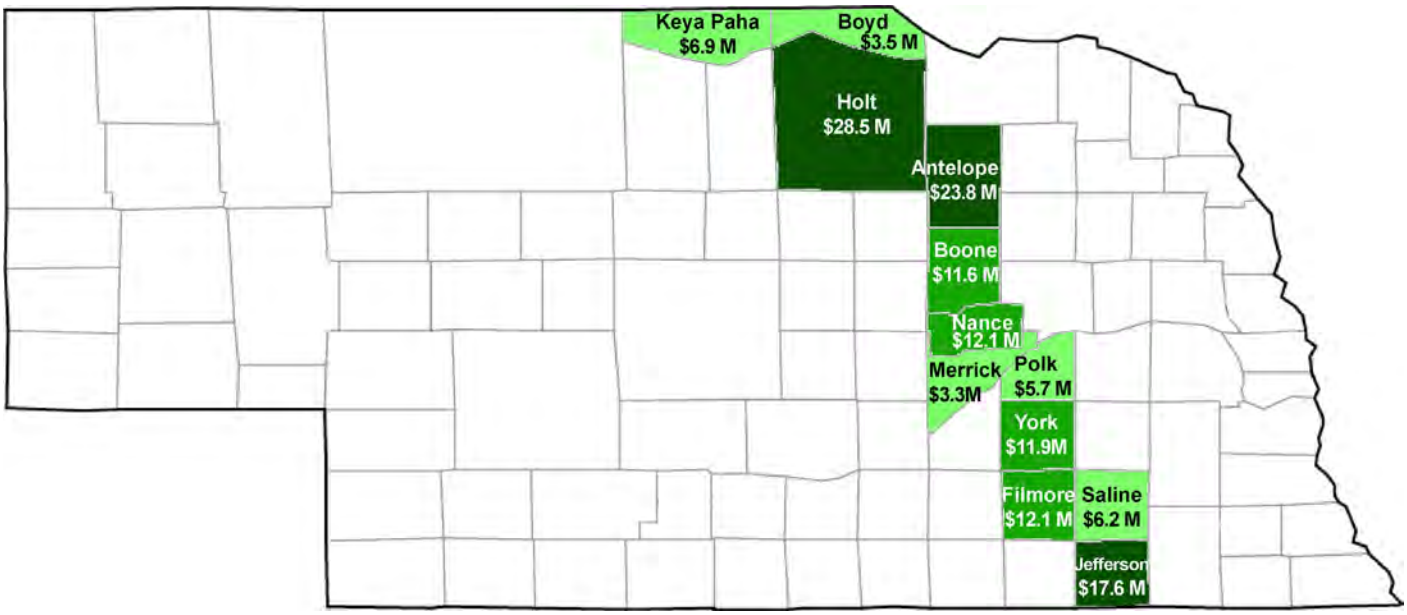
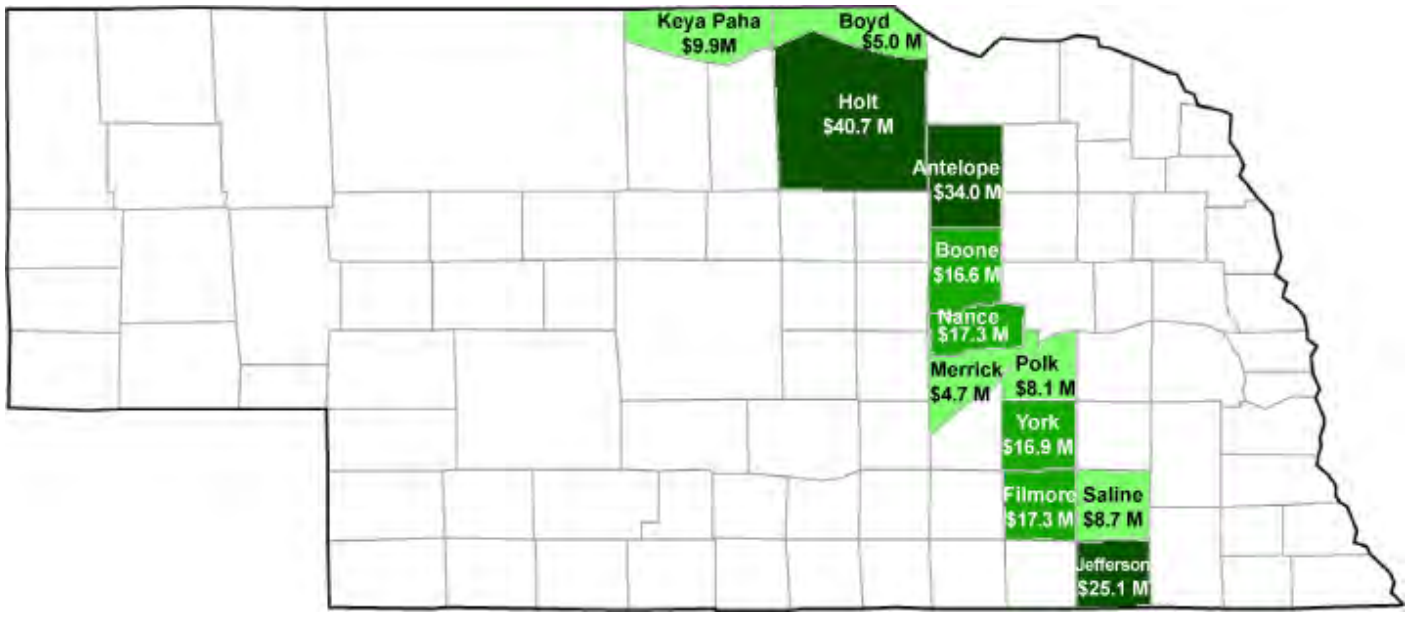


Figure EX.2: Property tax collections, 2018 - 2034 (2015 dollars)



Executive Summary - Summary of Impacts

Other Estimated Impacts of the Keystone XL Pipeline

- Keystone XL pipeline construction spending creates or supports additional spending as follows:
  - Yearly, each $1.0 million of Keystone XL pipeline *construction spendin*g creates $286,522 of spillover impacts for a total Nebraska impact of $1.29 million.[10]
  - Yearly, each $1 million of yearly Keystone XL pipeline *operations spending* creates $0.15 million of spillover impacts for a total Nebraska impact of $1.15 million.
  - Yearly, each $1 million of Keystone XL pipeline operations spending creates $0.39 million in wages, salaries and self-employment income for Nebraska.
- Keystone XL pipeline construction and operations will stimulate economic activity among Nebraska subcontractors and other Nebraska firms linked to energy and construction:
  - In terms of jobs, construction of the Keystone XL pipeline in 2018 and 2019 will support:[11]
    - A yearly average of 387.1 jobs in Nebraska firms supporting oil and gas operations.
    - A yearly average of 320.6 jobs in Nebraska business support services firms.
    - A yearly average of 282.3 jobs in Nebraska construction firms.

  - In terms of overall economic activity, or sales, construction of the Keystone XL pipeline in 2018 and 2019 will support:
    - Approximately $174.5 million for Nebraska firms supporting oil and gas operations.
    - More than $90.3 million for Nebraska construction firms.
    - More than $64.2 million for Nebraska architectural and engineering services firms.

[10] This number could potentially grow in years ahead as TransCanada purchases a portion of its replacement pipeline, pump stations and terminals in Nebraska. In this study, it is assumed that 50 percent of these products are purchased outside the U.S. and 50 percent purchased inside the U.S., but outside of Nebraska.

[11] Data for 2019 is for the period July 1, 2019 to June 30, 2020.

Chapter 1: Overview- The Keystone XL Pipeline in Nebraska

Introduction

TransCanada's Keystone XL project is a proposed extension of the existing Keystone Pipeline System that will consist of an 1,205-mile crude oil pipeline and related facilities that would be used largely to connect Canada's crude oil from a supply hub in Hardisty, Alberta to Steele City, Nebraska for eventual transport to refineries on the Gulf of Mexico in Texas.[12] The Northern pipeline could transport up to 830,000 barrels per day and is estimated to cost approximately $8.02 billion.

After its application was rejected by the United States State Department in January 2012,[13] and due to concerns regarding the route across the Sand Hills region of Nebraska, TransCanada provided a new application with a different route that avoids the areas of concern and is awaiting approval. If permitted, Keystone XL could begin construction in 2018.[14]

Keystone XL has generated much debate surrounding issues of pipeline safety, effect on gasoline prices, energy independence (from unstable regions of the world), environment and ecology, and economic impacts. The economic impact is the focus of this study with the goal being to gauge the impact that the construction and operations of Keystone XL would have on the state and local economies of Nebraska.

A significant effect of the Keystone XL project would be the generation of economic activity. That activity would consist of:

- Sales or output total - Amount of additional sales, including insurance premiums, retail sales, wholesale expenditures, construction sales, etc. It is analogous to gross domestic product (GDP), but will include some double counting and will thus exceed GDP; both direct and multiplier effects.
- Wages and salaries - the income of Nebraska's workers – including those self-employed; both direct and multiplier effects.
- Jobs – construction and spin-off jobs from the pipeline's construction, operation, and maintenance; both direct and multiplier effects
- Tax revenues – to the state and to the local economies; both direct and multiplier effects.

While each of these impacts will be examined in detail in the chapters that follow, the tax implications of the current Keystone pipeline (not Keystone XL) have been visible in Nebraska's news. Nebraska's valuation of the Keystone pipeline (not Keystone XL) has more than tripled to $466.0 million from $145.3 million in 2011. Keystone construction was completed in 2014.

Applying an average personal property tax rate of $1.8 per $100 of assessed value yields estimated property taxes of $8.4 million for 2016 assuming no local property tax lids.

While the impact to rural schools and counties could be limited due to spending lids placed on local governments and state aid to schools laws, the additional revenue will benefit individual taxpayers, particularly farmers, by shifting the general property tax load away from them and to TransCanada.

[12] http://www.transcanada.com/keystone.html.
[13] http://www.state.gov/r/pa/prs/ps/2012/01/181473.htm
[14] For this study, it is assumed that construction of the Keystone XL pipeline will be completed by the end of June 30, 2020 with operations beginning July 1, 2020.

Based on the 2011 valuation for the previously-constructed Keystone Pipeline, TransCanada paid $2.2 million in Nebraska property taxes in 2012 and the company estimates they paid approximately $8.5 million in 2013. All of the valuation attributable to the pipeline is categorized as personal property, and by state law such personal property is depreciated over 15 years at which time it is fully depreciated.[15] The amount of tax revenue that will be generated by the Keystone XL project is uncertain, but it is safe to assume it will produce more in tax benefits than the first pipeline, because it will be larger (a 36-inch pipe versus a 30-inch pipe). Additionally, the length across Nebraska per current estimates is 275.17 miles (versus original estimate of 215 miles).[16]

Keystone XL Pipeline by Nebraska County

Figure 1.1 shows the revised path by county that the pipeline will take across Nebraska. The new route will span 275.17 miles.

Figure 1.1: Nebraska path of Keystone pipeline by county, 2017

Table 1.1 lists the Nebraska counties which the pipeline will cross from the northern entry county of Keya Paha to the southern exit county of Jefferson. As listed, Holt County will receive the largest total capital investment. In terms of pipeline services costs, Holt County also is highest among the Nebraska counties. Additionally, Holt County will host the Nebraska construction camp.

However, the impacts will not be limited to these counties since Keystone XL pipeline workers and TransCanada will spend a significant portion of overall expenditures in other Nebraska counties. Furthermore, many Keystone XL vendors will reside outside the construction counties, but in Nebraska. Currently, it is expected that 50 percent of pipeline will be produced in Canada and 50 percent in Arkansas. It will be assumed by this study that none of the pipeline, pump stations or terminals will be produced in Nebraska during the period 2018-2034.

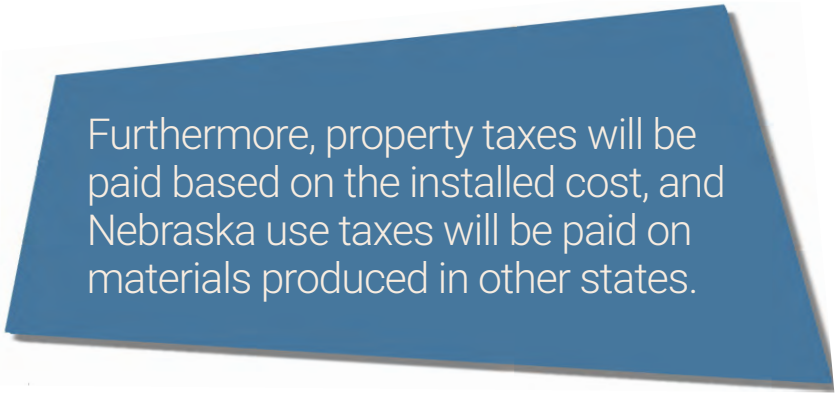
[15] http://www.omaha.com/article/20120814/NEWS/120819881/1707

[16] TransCanada

Table 1.1: Pipeline material costs and labor costs by Nebraska county (pipeline, pump station, sales tax)		
	Material costs	Labor Costs
Keya Paha (northernmost county)	$14,759,232	$37,694,803
Boyd	$7,544,245	$19,267,860
Holt	$64,996,376	$150,326,846
Antelope	$55,050,141	$124,924,347
Boone	$24,830,808	$63,417,419
Nance	$29,936,107	$60,783,575
Merrick	$7,008,041	$17,898,406
Polk	$12,126,979	$30,972,076
York	$25,299,739	$64,615,060
Fillmore	$29,904,271	$60,702,267
Saline	$13,031,012	$33,280,960
Jefferson (southernmost county)	$41,760,613	$90,983,141
Total for Nebraska	$326,247,564	$754,866,760
Source: TransCanada		

Summary

The estimation methodology assumes that impacts by county from spending listed in Table 1.1 will be reduced by the employment of workers from outside Nebraska along with pipeline and associated materials manufactured outside the state. The impacts presented in subsequent chapters are nevertheless quite significant. Furthermore, property taxes will be paid based on the installed cost, and Nebraska use taxes will be paid on materials produced in other states.



Chapter 2: Direct Spending (Round One)

Construction

As a starting point, Goss & Associates estimates the direct spending related to the Keystone XL pipeline construction and operations. The U.S. State Department estimates that roughly 10 percent of the jobs generated due to construction of the Keystone XL pipeline are hired locally.[17] In the analysis that follows, it is assumed that $196.7 million of the $2.7 billion in total labor costs for the northern portion of Keystone XL during the construction phase will be paid to Nebraska workers.

Table D.3 lists the expected wages and salaries directly spent by TransCanada in the three states: Montana, Nebraska and South Dakota. Column 1 shows total Keystone XL labor costs for the two-year construction period. Column 2 lists the share of the workers that are expected to be Nebraska residents. Column 3 in Table D.3 lists the total wages and salaries of $196.7 million that are expected to be paid to workers that are Nebraska residents.

Of course, a large share of the direct jobs created by the pipeline will be filled by non-Nebraskans. A Cornell study that examined the expected Keystone XL construction activity concluded that it is likely that only 11.0 percent of Keystone XL pipeline workers would be residents of Nebraska. This study will use an even more conservative 10.0 percent value.

A Cornell study that examined the expected Keystone XL construction activity concluded that it is likely that only 11.0 percent of Keystone XL pipeline workers would be residents of Nebraska. This study will use an even more conservative 10.0 percent

That is, this study will assume that 10.0 percent of pipeline workers in Nebraska will be Nebraska residents. However, it is also likely that a share of Keystone XL pipeline workers in Montana and South Dakota will also be Nebraska residents.

This study assumes that Nebraska workers will represent the same share of the direct workers in Montana and South Dakota that they represent in area construction trades.[18] In 2010, Nebraska workers represented 6.1 percent of the construction and extraction occupations in the total area.

To summarize, it is assumed that of the Keystone XL pipeline workers in the northern portion of the pipeline: 10.0 percent of Nebraska workers will be Nebraska residents, 6.1 percent of Montana workers will be Nebraska residents, and 6.1 percent of South Dakota workers will be Nebraska residents. This means that it is assumed that 7.3 percent of all workers in the northern portion of the Keystone XL pipeline construction will be Nebraska workers with an estimated payroll of $196.7 million for the two-year period (Column 3 of Table D.3).

This means that it is assumed that 7.3 percent of all workers in the northern portion of the Keystone XL pipeline construction will be Nebraska workers with an estimated payroll of $196.7 million for the two-year period.

[17] US State Department's Final Environmental Impact Statement (FEIS), Socioeconomics, Section. 3.10-57. http://www.keystonepipeline-xl.state.gov/clientsite/keystonexl.nsf?Open.

[18] This study assumes that workers will come from the following states: Colorado, Iowa, Kansas, Missouri, Montana, North Dakota, Oklahoma, Minnesota, and South Dakota.

Chapter 2: Direct Spending (Round One)

As listed, in Table 2.1 TransCanada is expected to spend approximately $71.6 million for land rights in Nebraska. This value includes the direct purchase of land, easements and the value of crop losses due to the construction phase of the Keystone XL pipeline. Pipeline services costs include spending for regulatory requirements, including permitting, environmental and safety requirements, community relations, engineering, surveying, construction management, inspections, power infrastructure, commissioning, and pre-operations.[19]

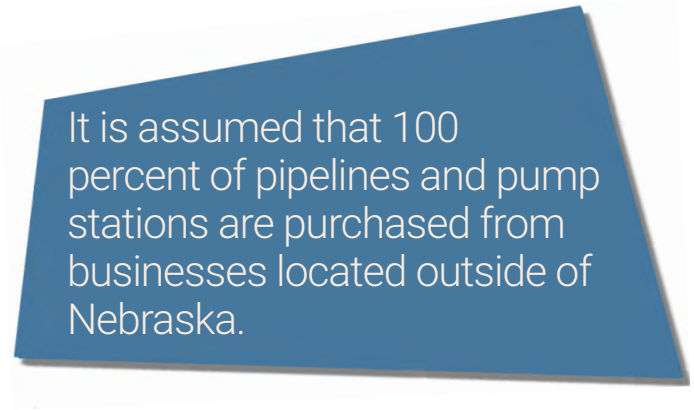


Table 2.1: Total project (direct) spending in Nebraska

	Total NE
Services spending (details Table D.1, Appendix D)	$422,845,840
Land purchases, easements and crop damage (details Table D.2)	$73,044,094
Labor spending (details Table D.3)	$196,671,507
Other costs (details Table D.4)	$30,014,443
Total	$722,575,884

Source: TransCanada

It is assumed that 100 percent of pipelines and pump stations are purchased from businesses located outside of Nebraska. A total of $722.6 million in spending related to the construction of Nebraska's pipeline is expected to be made to Nebraska individuals and businesses.

A total of $722.6 million in direct project spending is expected within the borders of Nebraska in 2018 and 2019.[20] Details of this spending is provided in Tables D.1 through D.4 in Appendix D.

[19]Percent spent in Nebraska: regulatory, including permitting (50%), environmental (2.5%), safety (2.5%), community relations ($5 million), power infrastructure (100%), commissioning (10%), and pre-operations (10%).

[20]2019 construction runs from July 1, 2019 to June 30, 2020.

Operations Phase

Materials and personnel. As displayed in Table 2.2, during the Keystone XL pipeline operations phase from 2020 to 2034, TransCanada is estimated to spend $1,078,126,791 on salaries, benefits, maintenance, freight, vehicles, office expenses and other costs. This expected spending is based on TransCanada spending for 2014 on the Keystone pipeline in Nebraska. In 2014, TransCanada spent $28,092,487 on the 217.4 miles of Keystone Nebraska pipeline. This represents 2020 spending of $160,077 per mile. Using this spending per mile of pipeline, and including property tax, Nebraska spending for Keystone XL pipeline would be $47,545,050 (1/2 year) for 2020.[21]

Table 2.2: Total Nebraska direct spending for operations July 2020-July 2035 (2015 dollars)

Year	Direct Spending (not discounted)
2020	$47,545,050
2021	$69,468,395
2022	$69,425,637
2023	$69,443,145
2024	$69,523,108
2025	$69,667,794
2026	$69,879,557
2027	$70,160,833
2028	$70,514,148
2029	$70,942,119
2030	$71,447,459
2031	$72,032,979
2032	$72,701,593
2033	$73,456,319
2034	$74,300,286
2035	$37,618,369
Total	$1,078,126,791

Source: Goss & Associates

[21] In 2020, this represents $160,077 per Nebraska Keystone XL mile plus property tax payments. For each year in Table 2.2, spending is for the period July 1 to June 30 of the next year.

Chapter 3: Estimated Socioeconomic Impacts

Introduction

The expenditures of Keystone XL, its workers, contractors and vendors provide a source of jobs and income for residents of the state and counties through which it crosses. This spending for locally-supplied goods and services produces a first round of impacts.

This initial spending leads to further spending, with a resultant impact that is a multiple of "first round" spending. Thus, the impact of Keystone XL continues after the initial money is spent for goods and services. It supports many enterprises and individuals indirectly linked to the pipeline, such as residential housing, retail, restaurant, and hotel sectors.

Based on 2018 to 2034 spending listed in Tables 2.1 and 2.2, the task is to estimate the economic impact of these outlays of Keystone XL. Using input-output multipliers, the study provides sales, earnings and job impacts in addition to estimating the impact of the initial spending on state and local tax collections.

Input-output multipliers show how spending initiated in one industry or several industries is filtered throughout the local and state economies. For each dollar generated by Keystone XL, there are direct effects for the initial spending plus the spillover impacts into the rest of the Nebraska economy.

Input-output multiplier models are the most frequently-used type of analysis tool for economic impact assessment. Input-output analysis assumes that each sector purchases products and services from other sectors and then sells its output to other sectors and/or final consumers. The multiplier system that will be used is IMPLAN.[22] This is a widely-used and accepted methodology and is described in more detail in the accompanying appendices.

This initial spending leads to further spending, with a resultant impact that is a multiple of "first round" spending.

[22]The IMPLAN Software. IMPLAN (Impact Analyses and Planning) is a computer software package that consists of procedures for estimating local input-output models. The U.S. Forest Service, in cooperation with the Federal Emergency Management Agency and the U.S. Bureau of Land Management originally developed IMPLAN to assist in land and resource management planning. Since 1993, the Minnesota IMPLAN Group Inc. in Stillwater, Minnesota with exclusive rights has continued development and maintenance of the IMPLAN system. This group licenses and distributes the software to users. IMPLAN is one of the most widely used and accepted software packages for impact assessment. Goss & Associates is a licensed user of IMPLAN.

In tailoring the IMPLAN model for Keystone XL spending, Goss & Associates used conservative assumptions. Impacts were calculated for five categories that reflect the contribution of Keystone XL to the state and local economy:

1. Output-contribution to overall economic activity.
2. Value added or gross domestic product.
3. Employment-contribution to the job base.
4. Labor income- the sum of wages, salaries and self-employment income.
5. Taxes-contribution to state and local tax collections.

Impacts are estimated for the State of Nebraska, the counties through which the pipeline passes and individual industries. The results presented in this study are generated for the period 2018 - 2034. All estimates listed in this chapter are in 2015 dollars. Appendix A lists discount rates and factors used throughout this study.

Total Impact on Nebraska Economic Activity

The first step in measuring impacts was to input Keystone XL direct spending from Table 2.1 into the IMPLAN Multiplier System. Table 3.1 summarizes total impacts between 2018 and 2034. As listed, the initial spending from 2018-19[23] will generate almost $891.0 million in output, or sales, and $326.6 million in labor income. Almost $2.1 billion in output, or sales, and $0.7 billion in labor income will be generated from 2018-34, and an average of 727.6 jobs per year will be supported for the period.[24]

Table 3.1: Impact of Keystone XL on Nebraska Economy, 2018- 2034 (discounted to 2015 dollars)

	Construction 2018-19	Operations 2020-34	2018-34
Output	$890,995,940	$1,236,688,436	$2,127,684,376
Jobs (average) per year	3,397.2	371.7	727.6
Labor income	$326,558,356	$415,471,634	$742,029,990

Source: IMPLAN Multiplier System

[23]Impacts for 2019 are for the period July 1, 2019 to June 30, 2020.

[24]For 2021, TransCanada spending for electric power is estimated to be $35.2 million, for property taxes is estimated to be $21.8 million (direct and indirect and induced) and for pipeline support is $5.8 million.

Chapter 3: Estimated Socioeconomic Impacts

In sales or output, the impact of Keystone XL on the economy was $2,127,684,374 with the breakdown by year contained in Table 3.2.

Table 3.2: Impact of Keystone XL on state of Nebraska output, 2018 - 2035 (discounted to 2015 dollars)

Year	Total	Labor income	Jobs (average per year)
2018	$494,516,390	$177,587,209	3,784.1
2019	$396,479,550	$148,971,147	3,010.2
2020	$70,521,484	$22,012,944	347.2
2021	$95,592,734	$31,104,696	448.6
2022	$92,969,203	$30,415,167	433.4
2023	$90,483,962	$29,766,068	419.0
2024	$88,133,671	$29,156,461	405.2
2025	$85,893,578	$28,578,946	392.1
2026	$83,825,045	$28,052,102	379.8
2027	$81,860,499	$27,555,605	368.1
2028	$80,018,468	$27,095,110	357.0
2029	$78,296,072	$26,669,810	346.6
2030	$76,690,512	$26,278,923	336.8
2031	$73,861,298	$25,460,548	321.7
2032	$71,216,031	$24,694,730	307.6
2033	$68,744,730	$23,978,620	294.5
2034	$66,437,895	$23,309,503	282.3
2035	$32,143,252	$11,342,401	135.4
Total	$2,127,684,374	$742,029,990	727.6

Source: IMPLAN Multiplier System

Impacts for 12-County Region

The number of jobs created in conjunction with Keystone XL development for each year from 2018 to 2034, an average of 34.8, direct, indirect, and induced impacts per year is presented in Table 3.3.

Table 3.3: Impact of Keystone XL on 12-county region, 2018-34 (discounted to 2015 dollars)

	Construction 2018-19	Operations 2020-34	Total 2018-34
Output	$42,595,476	$59,121,855	$101,717,331
Jobs (average per year)	162.4	17.8	34.8
Labor income	$15,611,641	$19,862,282	$35,473,923

Source: Goss & Associates estimates from IMPLAN

Table 3.4a lists total impacts of Keystone XL as well as wages & salaries and average jobs supported for the 12 Nebraska counties for the construction period and Table 3.4b lists impacts for the operations period 2020-34.

Table 3.4a: Impacts of Keystone XL on 12-county region for construction period (discounted to 2015 dollars)

County	Total output	Labor income	Average jobs
Antelope	$3,528,003	$1,293,046	13.5
Boone	$2,963,201	$1,086,041	11.3
Boyd	$1,154,223	$423,034	4.4
Fillmore	$3,140,737	$1,151,110	12.0
Holt	$5,468,594	$2,004,291	20.9
Jefferson	$3,945,095	$1,445,914	15.0
Keya Paha	$465,382	$170,567	1.8
Merrick	$3,884,023	$1,423,531	14.8
Nance	$1,911,712	$700,660	7.3
Polk	$2,669,674	$978,460	10.2
Saline	$6,553,696	$2,401,991	25.0
York	$6,911,136	$2,532,996	26.4
Total	$42,595,476	$15,611,641	162.4

Source: Goss & Associates from IMPLAN

Table 3.4b: Impacts of Keystone XL on 12-county region for operation period (discounted to 2015 dollars)			
County	Total output	Labor income	Average jobs
Antelope	$4,896,813	$1,645,109	1.5
Boone	$4,112,876	$1,381,741	1.2
Boyd	$1,602,044	$538,215	0.5
Fillmore	$4,359,294	$1,464,526	1.3
Holt	$7,590,323	$2,550,007	2.3
Jefferson	$5,475,730	$1,839,599	1.6
Keya Paha	$645,943	$217,008	0.2
Merrick	$5,390,963	$1,811,121	1.6
Nance	$2,653,426	$891,432	0.8
Polk	$3,705,466	$1,244,870	1.1
Saline	$9,096,428	$3,055,990	2.7
York	$9,592,549	$3,222,665	2.9
Total	$59,121,855	$19,862,282	17.8
Source: Goss & Associates from IMPLAN			

Impacts by Nebraska Industry

Table 3.5 lists the top ten impact industries for the state for the construction period July 1, 2018 to June 30, 2020. As presented, firms in support activities for oil and gas operations experience the largest impact for the two-year construction period at approximately $174.5 million.

Table 3.5: Top ten impact industries for Nebraska, construction period discounted to 2015 dollars, 2018-20

Industry	Average jobs	Labor income	Total impact (output)
Support activities for oil and gas operations	387.1	$57,143,199	$174,519,685
Construction of other new residential structures	282.3	$23,905,637	$90,342,180
Architectural, engineering, and related services	240.1	$36,282,018	$64,202,856
Electric power generation, transmission, and distribution	20.9	$11,500,981	$46,776,399
Business support services	320.6	$20,874,085	$37,515,937
Environmental and other technical consulting services	124.5	$13,869,258	$22,883,346
Monetary authorities and depository credit intermediation activities	32.8	$3,077,057	$22,117,113
Insurance agencies, brokerages, and related activities	103.1	$12,449,031	$21,789,422
Commercial and industrial machinery and equipment repair and maintenance	145.1	$13,430,911	$19,661,500
Securities, commodity contracts, investments, and related activities	117.3	$5,371,009	$19,545,238
All other industries	1,623.6	$128,655,170	$371,642,264
Total all industries	3,397.2	$326,558,356	$890,995,940

Source: Goss & Associates estimates from IMPLAN

Impact on State and Local Tax Collections

Not only do Keystone XL vendors pay taxes on profits, their employees, residents and vendors, as well as businesses tied to these groups, pay state and local taxes. Table 3.6a and 3.6b provide details on state and local tax collections, Table 3.7 lists the impacts on property taxes in both current dollars, and Table 3.8 lists the impacts on property taxes in both current and discounted dollars.

Property taxes. TransCanada will be required to pay personal property taxes on the pipeline for the first 15 years of operations. It is assumed that taxes are paid on the installed costs with the pipeline fully depreciated after 15 years of operations. These estimates assume that there are no major capital improvements to the pipelines that increase the value of the pipeline and property taxes.

Nebraska adjusted basis for property taxes is the company's federal basis. Generally it is the cost of the item, including sales tax, freight, installation, testing charges, and other fees or taxes associated with the acquisition of the property. The state will assess the pipeline when it is operational. In this study, it is assumed that the pipeline will be operational on July 1, 2020. If the pipeline owns any property in the state which has been placed into service for federal tax purposes prior to being operational, that property is subject to local assessment. If it becomes operational in the middle of the year, then it is locally assessed for that year and transfers to state assessment the following year. The actual rate that it will be taxed is the actual local consolidated rate.[25]

Table 3.6a: Local tax collections, 2018-34 (discounted to 2015 dollars)

County	Property taxes	Other taxes & fees	Total local taxes & fees
Antelope	$23,768,699	$14,746	$23,783,445
Boone	$11,583,809	$12,385	$11,596,194
Boyd	$3,519,462	$4,824	$3,524,286
Fillmore	$12,037,911	$13,127	$12,051,038
Holt	$28,408,713	$22,857	$28,431,570
Jefferson	$17,569,007	$16,489	$17,585,496
Keya Paha	$6,885,323	$1,945	$6,887,268
Merrick	$3,269,318	$16,234	$3,285,552
Nance	$12,052,763	$7,990	$12,060,753
Polk	$5,657,351	$11,158	$5,668,509
Saline	$6,079,091	$27,392	$6,106,483
York	$11,802,570	$28,886	$11,831,456
Total - 12-county area	$142,634,017	$178,034	$142,812,051
Nebraska outside 12-county area	$60,606,608	n.a.	$60,606,608
Total local taxes	$203,240,625	$178,034	$203,418,659

Source: Goss & Associates; IMPLAN Multipliers

[25]"As a rough estimate, since pipelines are in the rural areas more than cities, the average levy is more like $1.8 per $100 of assessed value. The overall average state levy is closer to 1.95." (Nebraska Department of Revenue official). TransCanada will also pay property taxes on any significant replacements or upgrades. The impacts of these replacements/upgrades are not included here.

Table 3.6b: State tax collections, 2018-34	
State summary	Discounted to 2015 dollars
Sales taxes	$16,770,952
Use taxes on pipeline and pump stations	$16,452,088
Individual income taxes	$14,619,088
Corporate income taxes	$2,738,968
Other taxes & fees	$10,779,519
Total state taxes & fees	$61,360,615
Source: Goss & Associates; IMPLAN Multipliers	

Table 3.7: Local tax collections in 12-county area, 2018-34 (current dollars--not discounted)			
County	Property taxes (includes direct and indirect)	Other taxes & fees	Total local taxes
Antelope	$34,022,520	$18,863	$34,041,383
Boone	$16,581,066	$15,843	$16,596,909
Boyd	$5,037,759	$6,171	$5,043,930
Fillmore	$17,231,068	$16,793	$17,247,861
Holt	$40,664,237	$29,239	$40,693,476
Jefferson	$25,148,280	$21,093	$25,169,373
Keya Paha	$9,855,652	$2,488	$9,858,140
Merrick	$4,679,703	$20,767	$4,700,470
Nance	$17,252,327	$10,221	$17,262,548
Polk	$8,097,934	$14,274	$8,112,208
Saline	$8,701,613	$35,041	$8,736,654
York	$16,894,201	$36,952	$16,931,153
Total	$204,166,359	$227,747	$204,394,106
Source: Goss & Associates; IMPLAN Multipliers			

Table 3.8: Property taxes by county in 12-county area, total 2018-34		
County	Total current dollars	Total discounted to 2015 dollars
Antelope	$34,022,520	$23,768,699
Boone	$16,581,066	$11,583,809
Boyd	$5,037,759	$3,519,462
Fillmore	$17,231,068	$12,037,911
Holt	$40,664,237	$28,408,713
Jefferson	$25,148,280	$17,569,007
Keya Paha	$9,855,652	$6,885,323
Merrick	$4,679,703	$3,269,318
Nance	$17,252,327	$12,052,763
Polk	$8,097,934	$5,657,351
Saline	$8,701,613	$6,079,091
York	$16,894,201	$11,802,570
Total Property taxes	$204,166,359	$142,634,016
Source: Goss & Associates		

Summary

This study has detailed the impacts of construction and operation of the Keystone XL pipeline in Nebraska. The impacts presented are conservative in the sense that it is assumed that 1) only 10.0 percent of the workers installing and constructing the Nebraska pipeline are Nebraska residents; 2) all estimates are discounted to present value; 3) none of the pipe, pumps or terminals are produced in Nebraska; 4) additionally, the economic impacts of significant pipeline or pump station replacements over the period 2020-34 are not included.

As a result of these conservative assumptions, the economic impacts in this study are lower than the impacts that will ultimately be experienced.

Appendices

Appendix A: Discount Factors

Table A.1 lists discount factors for the period 2020 – 2034. Goss & Associates uses the average yield for 10-year U.S. Treasury bonds over the past fifteen years from 2000 to 2015. The average yield was 3.88 percent over the period.

Table A.1: Discount factor by year, 2020-34

Period	Year	Discount factor
1	2020	1.21
2	2021	1.26
3	2022	1.31
4	2023	1.36
5	2024	1.41
6	2025	1.46
7	2026	1.52
8	2027	1.58
9	2028	1.64
10	2029	1.70
11	2030	1.77
12	2031	1.84
13	2032	1.91
14	2033	1.98
15	2034	2.06

Source: Based on the average yield on 10-year U.S. Treasury bonds over the past 15 years

Appendix B: Measuring the Socioeconomic Impact of the XL Pipeline

According to the previous estimates, the development of the Keystone XL pipeline will be an important stimulus of economic growth for the state of Nebraska and the counties through which it crosses. Furthermore, Keystone XL vendors contribute to the economy through their own employment and payroll, and through purchases from their own vendors. Payments to these vendors are an important source of growth for the state economy. Thus, the Keystone XL pipeline produces benefits for the Nebraska taxpayer, both directly and indirectly.

> ...direct benefits for the Nebraska taxpayer include the receipt of sales taxes on purchases by Keystone XL workers.

As a result of the widespread distribution of construction and operations of the Keystone XL pipeline, the pipeline will influence the state's economy in many ways. As discussed earlier, the presence of Keystone XL increases the spending by non-Nebraska residents in Nebraska. Furthermore, construction and operations of the pipeline, in the long run, encourages the startup and/or relocation of retail businesses and manufacturing firms to the state. Access to Keystone XL jobs increases employment opportunities and assists the state in retaining and attracting individuals to the state, thereby helping to create "brain gain." [26]

In addition to these growth dynamics, there also is economic activity related to the direct expenditures by Keystone XL vendors, such as payroll, local jobs and income.

> ...the Keystone XL pipeline contributes to Nebraska's economy by encouraging businesses, residents, and visitors to purchase in the state.

Furthermore, Keystone XL indirectly affects the overall level of the state's economic activity. For example, the office supplies industry provides jobs and income for workers in the area as a result of TransCanada spending on computers, pens and paper related to Keystone XL.

Large portions of Keystone XL spending are made in the state economy. That portion spent locally adds to the state's income. Economic impacts that take place outside the state economy, for example spending in Kansas, are called outflows and reduce overall impacts. They are excluded when estimating economic impacts of the local area.

Additionally, Keystone XL increases retail sales in the state as employees and visitors who reside outside Nebraska spend a portion of their wages in the state. In other words, Keystone XL contributes to the region's export of retail goods. These sales have a positive impact on the state by adding jobs and income in retail and related industries. Figure B.1 demonstrates the four components of the total economic impact: 1) the Direct Economic Impact, 2) the Indirect Economic Impact, 3) the Induced Economic Impact, and 4) Outflows. Each is defined on the following page.

[26] In 1995, the Federal Reserve Bank of Kansas City estimated that the state of Nebraska loses over $246 million per year as a result of the net out-migration of college educated workers (termed "brain drain").

Appendix B: Measuring the Socioeconomic Impact of the XL Pipeline

Goss & Associates

Direct Economic Impacts

Keystone XL spending flowing into the area has direct economic effects on the local economy via expenditures for goods and services and for employee salaries. The most obvious direct expenditures are payment of wages to Nebraska workers employed by Keystone XL. In addition, expenditures non-Nebraska Keystone XL workers employed in the state generate direct impacts on the state affecting primarily retail trade and accommodation Industries. Direct economic impacts are color coded green in Figure B.1.

Indirect Economic Impacts

Keystone XL also produces indirect economic effects on the area economy. For example, Keystone XL contractors will purchase supplies from area wholesalers. Furthermore, Keystone XL encourages the startup and expansion of other businesses. Keystone XL generates indirect effects by increasing: (a) the number of firms drawn to the state, (b) the volume of deposits in the state's financial institutions and, (c) economic development. Examples of indirect economic impacts are color coded blue on Figure B.1.

Induced Economic Impacts

Induced impacts in the region occur as the initial spending feeds back to industries in the region when workers in the state purchase additional output from local firms in a second round of spending. That is, Keystone XL increases overall area income and population, which produces another round of increased spending adding to sales, earnings and jobs. Examples of induced economic impacts are color coded red in Figure B.1.

Outflows

Outflows represent spending linked to the Nebraska portion of the Keystone XL pipeline that go to businesses and or individuals outside the state. For example, engineering spending related to the Nebraska portion of the Keystone XL pipeline construction going to firms located in Tulsa, Oklahoma would reduce overall Nebraska impacts. These impacts are color-coded gray in Figure B.1.

In terms of yearly spillover, or indirect plus induced impacts, data indicate that for Nebraska, each $1,000,000 of Keystone XL construction spending in the state generates another $0.15 million in spending across other industries for a total impact of $1.15 million.[27]

Yearly, each $1 million of Keystone XL pipeline operations spending creates $0.39 million in wages, salaries and self-employment income for Nebraska.

Thus, the spillover effect creates a large, additional economic impact on the economy. For example during the construction phase, the Keystone XL pipeline creates 240.1 jobs, and $36.3 million in labor income for the state's architectural and engineering industry (see Table 3.5).[28]

Table B.1 on the next page provides details on the total, both construction and operations, impacts divided into direct, indirect and induced for the period 2018-34.

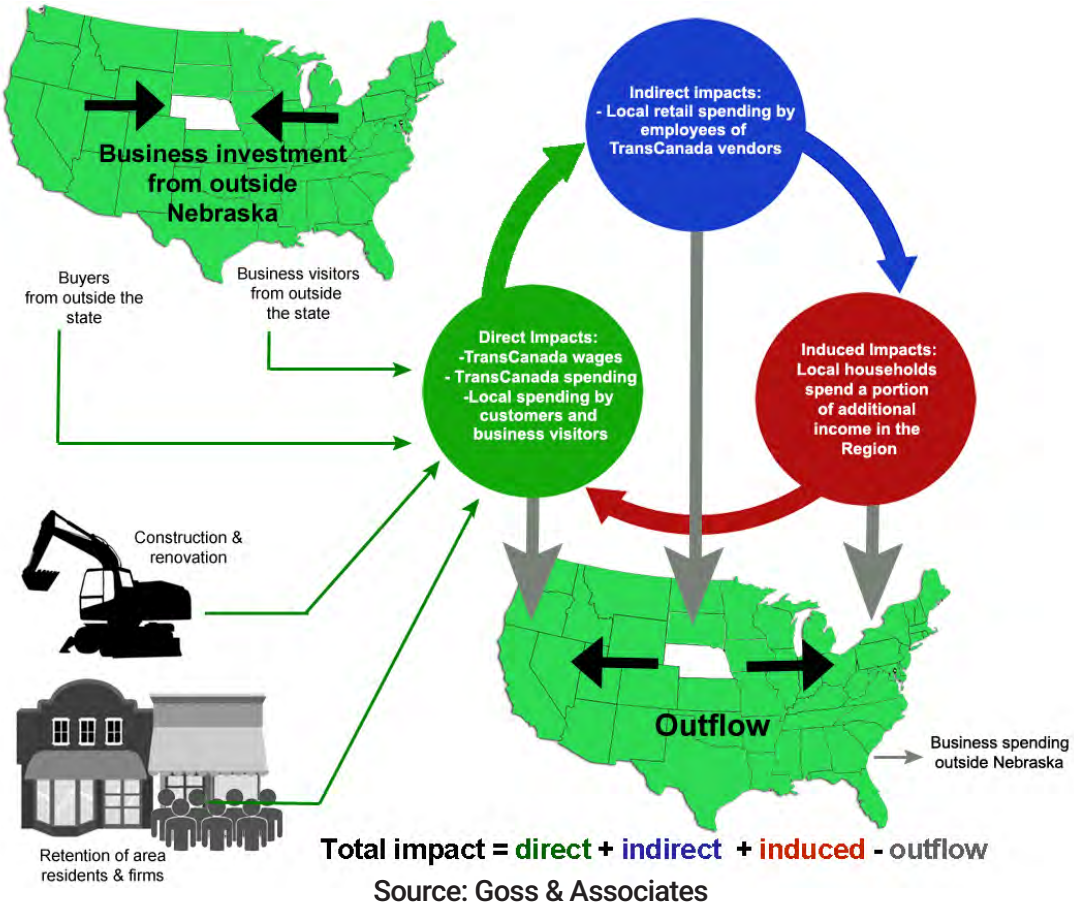
> ...Keystone XL increases overall area income and population, which produces another round of increased spending adding to sales, earnings and jobs.

[27] This number could potentially grow in years ahead as TransCanada purchases a portion of its pipeline, pump stations and terminals in Nebraska. In this study, it is assumed that 50 percent of these products are purchased outside the U.S. and 50 percent purchased inside the U.S. but outside of Nebraska.

[28] Source: IMPLAN Multiplier System, 2004.

Appendix B: Measuring the Socioeconomic Impact of the XL Pipeline

Figure B.1: Direct, indirect and induced impacts of the Keystone XL pipeline on Nebraska and its counties



Source: Goss & Associates

Table B.1: Direct, indirect, induced impacts (2015 dollars)

	Total construction impacts (2018-2020)		
	Output	Labor income	Employment
Direct	$526,543,910	$196,650,370	1,845.6
Indirect	$161,919,557	$60,454,928	644.3
Induced	$202,532,472	$69,453,058	907.4
Total	$890,995,939	$326,558,356	3,397.2
	Total operations impacts (2020-2034)		
	Output	Labor income	Employment
Direct	$823,577,525	$271,582,000	149.1
Indirect	$155,411,605	$55,515,668	68.7
Induced	$257,699,306	$88,373,966	153.9
Total	$1,236,688,436	$415,471,634	371.7

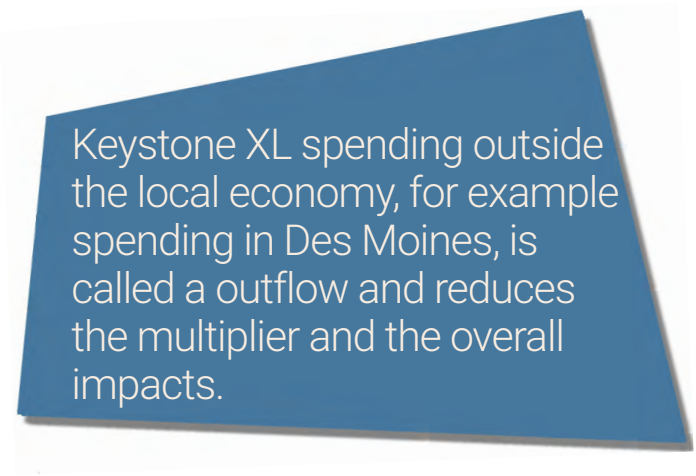
Source: Goss & Associates based on IMPLAN ouput

Appendix B: Measuring the Socioeconomic Impact of the XL Pipeline

Three factors determine the size of the spillover effects in communities and the state:

Location. Distance to suppliers affects the willingness to purchase locally. If local firms are unable to provide many of the supplies at competitive prices and there are alternative suppliers in Des Moines, for example, who are more price-competitive, then TransCanada/Keystone XL will be encouraged to spend outside the community. This results in greater outflows, lower multipliers and smaller impacts.

Population size. A larger population provides more opportunities for companies and workers to purchase locally. Larger population areas are associated with fewer outflows and larger multipliers.



Clustering. A community will gain more if the inputs required by local industries for production match local resources and are purchased locally. Thus, over time, as new firms are created to match the requirements of Keystone XL, outflows will be fewer, resulting in larger multipliers and impacts. This issue is at the heart of economic development, amplifying the impacts of the clustering of Keystone XL related facilities, investment and jobs. As the community gains more and more Keystone XL investment and jobs, educators, training institutions and suppliers become more proficient and focused on meeting the needs of the industry.

Furthermore, suppliers unique to Keystone XL are more likely to locate in close proximity to these organizations with the passage of time. For example, it is assumed that all pipelines and pump stations come from outside of Nebraska. Over time, some of these suppliers may move to or expand in the state of Nebraska. This not only expands income and jobs in the area, it increases the size of multipliers related to Keystone XL related organizations. However, this study assumes that this does not occur during the period 2018 to 2034. Omitting these potential impacts results in a more conservative or lower estimated economic impact.

Economic models can be used in order to estimate the direct, indirect and induced impacts of Keystone XL on Nebraska. These models produce estimates that reflect the characteristics of the industry in question as well as the characteristics of the state economy in terms of location, population size, and clustering. As it will be discussed in Appendix C, an input-output model is the most appropriate methodology for measuring indirect and induced impacts. Further, the IMPLAN model is the most widely-used software package for conducting the input-output analysis. IMPLAN was used to estimate the economic impacts of Keystone XL for this study.

Appendix C: Choosing a Technique to Measure Impacts

The three most common types of impact models are economic base, econometric and input-output (I-O). Many types of public and private-sector decisions require an evaluation of probable regional effects. Since important impacts are often economic, this requirement has created a need for regional economic impact models. Two of the three impact models have inherent disadvantages that markedly reduce their viability for estimating the impact of pipeline construction spending on the economy.

Economic Base Model. The economic base model divides the economy into two sectors - the local/service sector and the export sector. The chief problem with the economic base multiplier is that it is an average for all the economy, making it impossible to distinguish, for example, the impact of retail spending from that of a new manufacturing plant.

Econometric Models. Econometric models have two major weaknesses. The time series data used in constructing econometric models are often unavailable at the state and metropolitan area level, thus precluding county-level analysis. This is especially true for rural counties and for counties with small populations.

Input-Output (I-O) Models. I-O models are the most frequently-used type of analysis tool for economic impact assessment. Input-output is a simple, general equilibrium approach based on an accounting system of injections and outflows. Input-output analysis assumes that each sector purchases supplies from other sectors and then sells its output to other sectors and/or final consumers.

Historically, the high cost to develop I-O models prevented their widespread use in regional impact analysis. However, with the advent of "ready-made" multipliers produced by third parties, such as the U.S. Forest Service, I-O multipliers became a much more viable option for performing impact analysis. These "ready-made" models are made region specific at a fraction of the costs of their predecessors.

All purely non-survey techniques or "ready-made" multipliers take a national I-O table as a first approximation of regional inter-industry relationships. The national table is then made region-specific by removing those input requirements that are not produced in the region. This study will use the most widely recognized "ready-made" multiplier system, IMPLAN Multipliers.

I-O models are the most frequently-used analysis tools for economic impact assessment.

IMPLAN and RIMS (Regional Input-Output Modeling System) are two of the most widely-used multiplier models.

Appendix C: Choosing an Technique to Measure Impacts

IMPLAN Multipliers. The Forest Service of the U.S. Department of Agriculture developed the IMPLAN Multipliers in the 1980s (U.S. ForestrService, 1985). For very populous areas, IMPLAN divides the economy into approximately 500 industrial sectors. Industries that do not exist in the region are automatically eliminated during user construction of the model (e.g. coal mining in Omaha).

IMPLAN uses an industry-based methodology to derive its input-output coefficients and multipliers. Primary sources for data are County Business Patterns data and U.S. Bureau of Economic Analysis data.

Researchers have used IMPLAN to estimate the impact of changes in military spending on the Washington state economy (Hughes, et. al, 1991).[29]

IMPLAN and RIMS (Regional Input-Output Modeling System) are two of the most widely-used multiplier models. IMPLAN has been compared to other multiplier systems and found to produce reliable estimates (Richman and Schwer, 1993).[30] Likewise, Crihfield and Campbell (1991), in estimating the impacts of opening an automobile assembly plant, concluded that IMPLAN's outcomes are, on balance, somewhat more accurate than RIMS. [31]

IMPLAN Multipliers possess the following advantages over other I-O multiplier systems:

1. Price changes are accounted for in the creation of the multipliers.
2. Employment increases or decreases are assumed to produce immediate in or out-migration.

[29]Hughes, D., Holland, D. and P. Wandschneider, "The Impact of Changes in Military Expenditures on the Washington State Economy," The Review of Regional Studies, Vol. 21(3), 1991, pp. 221-234.

[30]Richman, D.S. and R.K. Schwer. "A Systematic Comparison of the REMI and IMPLAN Models: The Case of Southern Nevada." Review of Regional Studies, Vol. 23(2), 1993, pp. 143-161.

[31]Crihfield, J. B. and H. S. Campbell, Jr. 1991. "Evaluating alternative regional planning models," Growth and Change 22(2):1-16.

Appendix D: Details on Direct Spending

Tables D.1 through D.5 detail direct TransCanada spending for construction and operation of the Nebraska portion of the Keystone XL pipeline between 2018 and 2034.

Table D.1: Estimated Keystone XL services spending in Nebraska, 2018-20 (2015dollars)			
IMPLAN Industry #	Industry	July 1, 2018 - June 30, 2019	July 1, 2019 - June 30, 2020
417	Commissioning	$9,266,116	$9,266,116
38	Construction camp	$51,759,635	$51,759,635
369	Construction management	$59,659,408	$59,659,408
369	Engineering	$30,559,480	$30,559,480
386	Inspections	$19,582,505	$19,582,505
375	Community, safety and environment	$9,484,416	$9,484,416
375	Misc environmental	$3,117,075	$3,117,075
31	Power infrastructure	$19,692,230	$19,692,230
340	Stockpiling	$5,291,883	$5,291,883
351	Telecom, SCADA, cathodic protection	$3,010,173	$3,010,173
	Total	$211,422,920	$211,422,920
Note: Total Keystone XL services spending to support construction of the Nebraska portion of the pipeline is estimated to be $408 million (source: TransCanada, 2015)			

Appendix D: Details on Direct Spending

Table D.2: Distribution of land purchases, easements and crop destruction, 2018 (current dollars)		
IMPLAN Industry #		Allocation of Land Spending
31	Utilities	$7,561,461
320	Transportation	$12,689,371
324	Food at home	$5,942,221
325	Personal Care Products and Services	$896,869
327	Clothing	$2,356,625
329	Tobacco products	$666,084
330	Reading	$153,856
330	Miscellaneous	$1,373,446
356	Personal insurance and pensions	$7,833,524
361	Shelter	$12,950,175
393	Education	$1,202,704
394	Healthcare	$5,268,632
410	Entertainment	$3,701,926
413	Food away from home	$3,745,081
413	Alcoholic beverages	$576,022
418	Housekeeping	$3,354,812
425	Cash Contributions	$2,771,285
	Total	$73,044,094
Source: Goss & Associates allocation based on U.S. Bureau of Labor Statistics Consumer Expenditure Study		

Table D.3: Direct construction wages & salaries paid, 2018 and 2019 (current or 2017 dollars)			
	Gross TransCanada Wages & Salaries	Percent Nebraska resident workers	Total labor costs for Nebraska workers
Montana	$882,809,847	6.1%	$53,851,401
Nebraska	$826,814,389	10.0%	$82,681,439
South Dakota (excludes taxes)	$985,879,798	6.1%	$60,138,668
Total (Implan industry # 29)	$2,695,504,034	7.3%	$196,671,507
Source: Goss & Associates based on data provided by TransCanada			

Appendix D: Details on Direct Spending

Table D.4: Estimated direct spending from balance of costs, 2018-19 (current dollars)			
	July 1, 2018 to June 30, 2019	July 1, 2019 to June 30, 2020	Total
Property taxes during construction	$6,012,387	$6,012,387	$12,024,775
Insurance	$7,662,621	$7,662,621	$15,325,243
Regulatory & legal	$1,332,213	$1,332,213	$2,664,426
Total	$15,007,222	$15,007,222	$30,014,443
Source: TransCanada			

Table D.5: Pipeline operations spending for first 15 years of operations		
IMPLAN Industry #	Year	Nebraska Yearly Spending
431, 337, 432	2020	$47,545,050
431, 337, 432	2021	$69,468,395
431, 337, 432	2022	$69,425,637
431, 337, 432	2023	$69,443,145
431, 337, 432	2024	$69,523,108
431, 337, 432	2025	$69,667,794
431, 337, 432	2026	$69,879,557
431, 337, 432	2027	$70,160,833
431, 337, 432	2028	$70,514,148
431, 337, 432	2029	$70,942,119
431, 337, 432	2030	$71,447,459
431, 337, 432	2031	$72,032,979
431, 337, 432	2032	$72,701,593
431, 337, 432	2033	$73,456,319
431, 337, 432	2034	$74,300,286
431, 337, 432	2035	$37,618,369
	Total	$1,078,126,791
Source: Goss & Associates based on estimated $129,220 per mile (in 2014) with 275.17 miles in Nebraska with a 3.63% growth rate		

Appendix E: Construction Camp[32]

Non-local construction workers temporarily residing in Nebraska will require short-term accommodations. It is assumed that the Keystone XL workers would not relocate with their families and their stay in any one community would be using temporary housing, such as hotels/motels, RV sites, and campgrounds.

Assumptions:

- Each TransCanada construction camp would be capable of housing up to 900-1,300 workers. Camps would typically include sleeping areas with shared and private baths, craft rooms, recreation facilities, media rooms, kitchen/dining facilities, laundry facilities, a security/infirmary unit, offices, and wastewater treatment facilities. These temporary construction camps would be permitted, constructed, and operated consistent with applicable county, state, and federal regulations, and would likely reduce but not eliminate impacts on nearby towns and public services.
- Construction of the proposed project, including the pipeline and pump stations, would result in hiring approximately 5,000 to 6,000 workers over the three-year construction period. As indicated above, it is expected that roughly 10 percent of the construction work force would be hired from local labor markets, thus 500 to 900 local workers would be hired throughout the entire region of influence, or 50 to 90 local workers per construction spread.
- It is assumed that one-third of workers installing Keystone XL in Nebraska will reside in construction camps.

[32]U.S. Department of State , Keystone XL Pipeline Project, Final Supplemental Environmental Impact Statement (SEIS), http://keystonepipeline-xl.state.gov/finalseis/

Appendix F - Researchers' Biographies

Ernie Goss is the Jack MacAllister Chair in Regional Economics at Creighton University and is the initial director for Creighton's Institute for Economic Inquiry. He is also principal of the Goss Institute in Denver, Colorado. Goss received his Ph.D. in Economics from The University of Tennessee in 1983 and is a former faculty research fellow at NASA's Marshall Space Flight Center. He was a visiting scholar with the Congressional Budget Office for 2003-04, and has testified before the U.S. Congress, the Kansas Legislature, and the Nebraska Legislature. In the fall of 2005, the Nebraska Attorney General appointed Goss to head a task force examining gasoline pricing in the state.

He has published more than 100 research studies focusing primarily on economic forecasting, and on the statistical analysis of business and economic data. His book Changing Attitudes Toward Economic Reform During the Yeltsin Era was published by Praeger Press in 2003, and his book Governing Fortune: Casino Gambling in America was published by the University of Michigan Press in March 2007.

He is editor of Economic Trends, an economics newsletter published monthly with more than 11,000 subscribers, produces a monthly business conditions index for the nine-state Mid-American region and conducts a survey of bank CEOs in ten U.S. states. Survey and index results are cited each month in approximately 100 newspapers and citations have included the New York Times, Wall Street Journal, Investors Business Daily, The Christian Science Monitor, Chicago Sun Times and other national and regional newspapers and magazines. Each month 75-100 radio stations carry his Regional Economic Report.

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Jeffrey Milewski is senior research economist at Goss & Associates. He received his master's degree in political economy from the London School of Economics and Political Science in 2013. He completed his bachelor's degree at Creighton University in 2007, having studied economics and finance. Milewski also has experience working in finance, and as an entrepreneur. Recently, he has co-authored impact studies on a range of topics such as property-casualty insurance, highway expansion, cost/benefit, and national sporting events.

Appendix G - Goss & Associates Research Consultancies, 2014-Current

1. Winter 2017. Contract with Boys Town. A Century of Contributions to the Economy of the Omaha Metropolitan Region and to the Well-Being of its Children and Families (currently being finalized).
2. Winter 2017. Contract with Turner Park, LLC. The Impact of a Walkable, Workable, and Livable Midtown Omaha.
3. Summer 2016. Contract with Equal Justice USA to estimate the economic impact of the death penalty on the state of Nebraska.
4. Fall 2015. Contract with 4 Lanes 4 Nebraska to estimate the impact of the expansion of Highway 81 on Nebraska.
5. Summer 2015. Contract with Consumer Energy Alliance to update previous study examining the impact of the Keystone Pipeline, Washington, DC.
6. Summer 2015. Contract with the Nebraska Bankers Association to examine how credit union tax exemptions and Farm Credit GSE2 status affect the commercial banking industry and competitiveness within the industry, and the effects on consumer choices.
7. Spring 2015. Contract with Ho-Chunk to estimate the benefits of operations of Ho-Chunk on the Winnebago Community, and on the states of Iowa, Nebraska and South Dakota.
8. Spring 2015. Contract with College World Series, Inc. to estimate the economic impact of the College World Series on the city of Omaha and the state of Nebraska, 2014-15
9. Spring 2015. Contract with HDR to estimate the impact of merging UNL's College of Architecture and the Hixson-Lied College of Fine and Performing Arts
10. Spring 2015. Contract with the Platte Institute to estimate the costs and benefits of public power in Nebraska.
11. Spring 2015. Contract with 4 Lanes 4 Nebraska to estimate the impact of the expansion of Highway 275 on Nebraska.
12. Summer 2014. Contract with Consumer Energy Alliance to update previous study examining the impact of the Keystone Pipeline, Washington, DC.
13. Spring 2014. Contract with Fort Dodge Growth Alliance to examine the impact of various economic development options for the eight county economic area, Fort Dodge, Iowa.
14. Spring 2014. Contract with Alegent Health to examine the impact of Alegent's clinical and hospital operations on Iowa and Nebraska (with University of Nebraska-Lincoln).
15. Winter 2014. Contract with 4R Gun Club to determine the economic feasibility of a full-service shooting range in Omaha, Nebraska.
16. Winter 2014. Contract with Creighton University School of Dentistry to determine the economic contribution of an expanded dental school on the State of Nebraska and City of Omaha.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF NEBRASKA

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT,	)))))))	APPLICATION NO. _____ **DIRECT TESTIMONY OF SANDRA BARNETT**

STATE OF TEXAS)
)ss.
COUNTY OF HARRIS)

Q: Please state your name.

A: My name is Sandra Barnett

Q: Ms. Barnett are you employed?

A: Yes, I am an Environmental Specialist TransCanada Corporation.

Q: What are your job duties as an Environmental Specialist?

A: I work on environmental issues for TransCanada Corporation's liquid pipeline facilities, including the Keystone XL Pipeline Project (the "Project").

Q: How long has your work focused on environmental issues with respect to pipeline facilities?

A: I have worked on environmental issues since 1980, and I have 20 years' experience with TransCanada.

Q: What is the purpose of your testimony today?

A: I am offering this testimony in support of the Project's application, which seeks approval for the Preferred Route pursuant to the Major Oil Pipeline Siting Act as reflected in Keystone's application.

Q: Are you familiar with that application?

A: Yes.

Q: How are you familiar with the Project's application?

A: I participated in the preparation of the Project's application, and I am jointly responsible for certain items in the application.

Q: Which items in the application are you individually or jointly responsible for?

A: I am jointly responsible for sections 8.0, 8.1, 8.3, 8.4, 8.5, 8.6, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.10, 9.11, 9.12, 9.13, 9.14, 13, and 18.

Q: Do you have knowledge of the aspects of the Project addressed in those sections?

A: Yes. I have general knowledge of the Project's environmental issues addressed in those sections. In some instances, Mr. Beaver or Dr. Schmidt also have knowledge of the issues and may have more specific knowledge of certain issues.

Q: Specifically, what information does each of those sections address?

A: Sections 8.0, 8.1, 8.3, 8.4, 8.5 and 8.6 contain information relating to the Project's plans and commitment to comply with the Oil Pipeline Reclamation Act. Sections 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.10, 9.11, 9.12, 9.13 and 9.14 generally relate to methods to minimize or mitigate the potential impacts of the Project to land areas and connected resources, other than with respect to oil spills. Section 9.2 addresses the Project's plan and methods to mitigate impacts to natural resources, section 9.3 addresses environmental training and awareness, section 9.4 addresses environmental inspections,

section 9.5 addresses commitment management, section 9.6 addresses the construction mitigation and reclamation plan, section 9.7 addresses construction/reclamation planning, section 9.10 addresses the hydrostatic test plan, section 9.11 addresses a spill prevention control and countermeasure, section 9.12 addresses noxious and invasive weeds, section 9.13 addresses recreation and special interest areas, and section 9.14 addresses a contaminated soils unanticipated discovery plan. Section 13 addresses the Environmental Impact Study, and section 18 addresses minimization or mitigation methods relating to natural resources.

Q: Are the facts stated in the above-referenced sections true and accurate to the best of your knowledge?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Q: Who is responsible for implementing the matters referenced in those sections?

A: I will continue to work with John Beaver and Jon Schmidt to implement those requirements for the Project. We intend to work together to construct and implement this Project in compliance with the statements contained in the application.

Sandra Barnett

Subscribed and sworn to before me this 13th day of February, 2017.

Tammie Michelle Allen
Notary Public

TAMMIE MICHELLE ALLEN
NOTARY PUBLIC-STATE OF TEXAS
COMM. EXP. 01-10-2018
NOTARY ID 10757825

BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT	APPLICATION NO. _____ **DIRECT TESTIMONY OF JOHN BEAVER**

STATE OF MONTANA)
) ss.
COUNTY OF LEWIS & CLARK)

Q: Please state your name.

A: My name is John Beaver.

Q: Mr. Beaver, are you employed?

A: Yes, I am a Project Manager, Ecologist, and Reclamation Specialist with Westech Environmental Services, Inc.

Q: What is your educational background?

A: I graduated from Grinnell College with honors in 1989 with a bachelor's degree in biology, with a concentration in environmental studies. I received a master's degree from Montana State in 1995 in range science.

Q: Since receiving your master's degree in 1995, in what type of work have you been involved?

A: Since 1995, I have been involved in reclamation and mitigation issues relating to environmental concerns for pipeline construction projects.

Q: Are you familiar with the Keystone XL Pipeline Project (the "Project")?

A: Yes.

Q: How are you familiar with the Project?

A: Since 2009 I have served as the Senior Reclamation Specialist and Special-Status Species Biologist for the Project.

Q: What have your duties been in those roles?

A: My duties have involved managing and participating in reclamation planning and noxious weed and special-status species surveys on the Preferred Route within Nebraska. I have also completed pedestrian surveys to identify vegetation communities, revegetation mixtures, soil salvage depths, noxious weed populations, and special-status plant populations in different locations in Nebraska, including the Sandhills.

Q: During the course of your work have you prepared or participated in the preparation of any reclamation or management plans or assessments with respect to the Project?

A: Yes.

Q: What plans or assessments have you prepared or participated in with respect to the Project?

A: I have overseen the design of the reclamation and revegetation plan for the Preferred Route in Nebraska for the Project. This design has included input from numerous meetings with agency personnel and regional experts. I have overseen the formation of the noxious weed management plans for the Project, including a plan for each Nebraska county crossed by the Project's Preferred Route. I have prepared an assessment of impacts to northern long-eared bats and red knots. I have also prepared an assessment/summary of the western prairie fringed orchid. I have prepared mitigation and avoidance strategies for migratory birds. I have also conducted surveys of animals and plants that may be impacted by the Preferred Route.

Q: Are you familiar with TransCanada Keystone Pipeline, LP's application for route approval with respect to the Project?

A: Yes.

Q: How are you familiar with that application?

A: I have reviewed the application, and I am responsible for certain items in the application, either individually or jointly.

Q: Which items in the application are you, either individually or jointly, responsible to address?

A: I am responsible for information contained in sections 8.1, 8.3, 8.4, 8.5, 8.6, 9.6, 9.7, 9.12, 9.13, 16.1, 16.3, 17.1, 17.2, 17.3, and 17.4.

Q: What information does sections 8.1, 8.3, 8.4, 8.5, and 8.6 contain?

A: Those sections relate to the Project's plans and commitment to comply with the Oil Pipeline Reclamation Act.

Q: Are the facts stated in those sections true and accurate to the best of your knowledge?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Q: What information does sections 9.6, 9.7, 9.12 and 9.13 address?

A: Those sections generally relate to the Project's planned methods to minimize or mitigate the potential impacts of the Project to land areas and connected resources, other than with respect to oil spills. Sections 9.6 and 9.7 address the Project's reclamation planning, section 9.12 addresses the Project's Noxious Weed Management Plan, and section 9.13 addresses the Project's plans to address impacts to CRP areas.

Q: Are the facts stated in those sections true and accurate to the best of your knowledge?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Q: What information does sections 16.1 and 16.3 address?

A: Those sections generally relate to the Project's impact on wildlife. Specifically, section 16.1 addresses terrestrial wildlife species and section 16.3 addresses federal and state protected species.

Q: Are the facts stated in those sections true and accurate to the best of your knowledge?

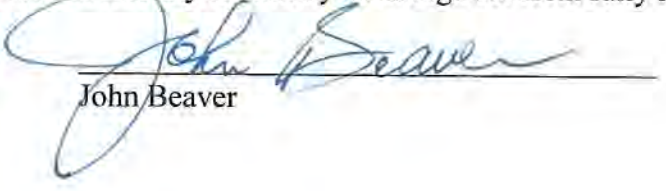
A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Q: The final sections you indicated you are responsible for are sections 17.1, 17.2, 17.3 and 17.4. What do those sections address?

A: Those sections generally relate to the impact of the Project on plants within and surrounding the Preferred Route. Section 17.1 addresses the Project's impact on vegetative types within and surrounding the Preferred Route, section 17.2 addresses the Project's impact on biologically unique landscapes or ecoregions, section 17.3 addresses the Project's impact on sensitive, rare, threatened and endangered plant species, and section 17.4 addresses the Project's impact on the noxious or invasive weeds.

Q: Are the facts stated in those sections true and accurate to the best of your knowledge?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.



John Beaver

Subscribed and sworn to before me this 13 day of February, 2017.

LISA Y ROMERO NOTARIAL SEAL STATE OF MONTANA

LISA Y ROMERO
NOTARY PUBLIC for the
State of Montana
Residing at Helena , Montana
My Commission Expires
January 25,2021

Lisa Y Romero
Notary Public

BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT,	)))))))	APPLICATION NO. _____ **DIRECT TESTIMONY OF PAUL E. FUHRER**

STATE OF NEBRASKA)
)ss.
COUNTY OF DOUGLAS)

Q: Please state your name.

A: My name is Paul E. Fuhrer.

Q: Mr. Fuhrer, are you employed?

A: Yes, I am a Project Manager for TransCanada Corporation.

Q: What is your educational background?

A: I graduated in 1978 with a bachelor's degree in construction management from the University of Nebraska – Lincoln.

Q: During the course of your career have you had any experience with respect to pipeline construction?

A: Yes. I have more than 35 years of experience in engineering, construction and management with an emphasis on pipeline systems, compressors, and pump stations. I was the Project Manager for construction of portions of the first Keystone pipeline, which included pipeline construction in South Dakota, Nebraska and Kansas. I was also Project Manager of the hydrotest and clean-up of portions of that pipeline in North

and South Dakota. I have also served as the Area Manager for the construction of new pump stations in Kansas, Missouri and Oklahoma during 2010 and Oklahoma and Texas in 2012, the Area Manager for centralized pipe fabrication for 30 pump stations from 2012 through 2014, and as the Project Manager for the KXL Facilities from 2014 to the present.

Q: Based on your experiences, are familiar with the condition of land following construction of a pipeline and pump station, particularly in Nebraska?

A: Yes.

Q: Do you have any role with respect to the construction of the Keystone XL pipeline?

A: Yes, I am one of the individuals knowledgeable and responsible for the pipeline and pump station construction process. I am currently involved in planning for the 5 Keystone XL pump stations in Nebraska.

Q: Are you familiar with the Keystone XL Pipeline Project's application for route approval?

A: Yes.

Q: How are you familiar with that application?

A: I have reviewed and am jointly responsible for various sections of the application.

Q: What sections of the application are you responsible to address?

A: I am jointly responsible to address sections 2.1.4 (hydraulics), 5.0 (description of the product or material to be transported), 9.1 (description of the construction process), 9.5 (Commitment Management), 9.9 (Description of the Horizontal Directional Drill Process), 20 (whether any other utility corridor exists that could feasibly and

beneficially be used for the route) and 21 (impact of pipeline development of area around Preferred Route).

Q: Are the facts in those sections are true and accurate to the best of your knowledge?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Paul E. Fuhrer

Subscribed and sworn to before me this 10th day of February, 2017.

Darla L. Steffes
Notary Public

GENERAL NOTARY - State of Nebraska
DARLA L. STEFFES
My Comm. Exp. March 18, 2018

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF NEBRASKA

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT,	)	APPLICATION NO. _____

DIRECT TESTIMONY OF ERNIE GOSS, PH.D.

STATE OF NEBRASKA)
)ss
COUNTY OF DOUGLAS)

Q: Please state your name.

A: My name is Ernie Goss.

Q: Mr. Goss, are you employed?

A: Yes. I am the Jack McAllister Chair in Regional Economics and Professor of Economics at Creighton University. I am the initial director for Creighton's Institute for Economic Inquiry, and I am also a principal of the Goss Institute.

Q: What is your educational background?

A: I obtained a Ph.D. in Economics from the University of Tennessee in 1983.

Q: Since receiving your Ph.D. in Economics, have you published any economic resource studies?

A: Yes. Since that time, I have published in excess of 100 research studies primarily focusing on economic forecasting and the statistical analysis of business and economic data.

Q: Have you prepared any such analysis with respect to the Keystone XL pipeline?

A: Yes. I have prepared a socio-economic analysis of the impacts of the Keystone XL Pipeline on the State of Nebraska and the counties through which the Preferred Route will cross.

Q: Does that analysis include estimates of the taxes which will be paid by TransCanada related to the Keystone XL Pipeline and information regarding employment in Nebraska?

A: Yes.

Q: Is that analysis referenced in TransCanada Keystone Pipeline, L.P.'s application for route approval?

A: Yes, and the full content of my report is reflected in an Appendix to the application.

Q: Who was primarily responsible for the referenced report?

A: I was the principal investigator responsible for the creation of the referenced report.

Q: Have you reviewed the portions of Keystone's application regarding the socio-economic study?

A: Yes.

Q: Is the content of those portions, section 19 and the referenced report, true and accurate to the best of your knowledge?

A: Yes, and I incorporate that section and the report contained therein into my testimony as though set forth fully herein.

Ernie Goss Ph.D.

Subscribed and sworn to before me this 14th day of February, 2017.

Notary Public

GENERAL NOTARY-State of Nebraska
MORGAN WALTER
My Comm. Expires Nov. 7, 2018

BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT,	APPLICATION NO. _____

DIRECT TESTIMONY OF MEERA KOTHARI

STATE OF TEXAS)
)ss.
COUNTY OF HARRIS)

Q: Please state your name.

A: My name is Meera Kothari.

Q: Ms. Kothari, are you employed?

A: Yes. I am currently employed as Manager, US Liquids Projects for TransCanada Corporation.

Q: What are your duties as related to Keystone XL Project?

A: My duties include providing technical guidance and management of the routing of the Keystone XL Pipeline Project ("Project").

Q: What is your educational background?

A: I received my bachelor of science in mechanical and manufacturing engineering from the University of Calgary. I received that degree in 2001.

Q: Do you hold any professional certifications or memberships?

A: Yes, I am a Professional Engineer licensed by the Association of Professional Engineers and Geoscientists of Alberta.

Q: Other than with respect to the Project, have you ever been involved in the development of a pipeline?

A: Yes. I have worked in pipeline engineering since 2001, and during that time, I have worked on developing and implementing integrity management programs and technical support during construction and operations for TransCanada's natural gas pipelines and engineering and project management during design and construction of TransCanada's liquid pipeline projects.

Q: Are you familiar with Keystone's application for route approval pursuant to the Major Oil Pipeline Siting Act, Neb. Rev. Stat. § 57-1401 et seq.?

A: Yes. I reviewed TransCanada Keystone Pipeline, LP's ("Keystone") application, and I assisted with the preparation of that application.

Q: Are you responsible for any information contained within Keystone's application?

A: Yes, either individually or jointly, I am responsible for information and obligations contained within portions of the Project's application.

Q: Which portions of Keystone's application are you, either individually or jointly, responsible to address?

A: My knowledge and responsibilities include sections 2.1.1 - 2.1.3, 3.0 and 20.

Q: What information is reflected in sections 2.1.1 - 2.1.3 of Keystone's application?

A: Those sections discuss the preferred and alternative route development.

Q: Are the facts stated in those sections true and accurate to the best of your knowledge?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Q: What information does section 3.0 of Keystone's application contain?

A: The reasons for the selection of the Preferred Route.

Q: Are the facts stated in that section true and accurate to the best of your knowledge?

A: Yes.

Q: What information does section 20 of Keystone's application contain?

A: Information relating to whether any other utility corridor exists that could feasibly and beneficially be used for the route of the Project.

Q: Are the facts stated in that section true and accurate to the best of your knowledge?

A: Yes.

Meera Kothari

Subscribed and sworn to before me this 13th day of February, 2017.

LEYMA RIVERA
Commission # 128733824
My Commission Expires
September 6, 2019

Notary Public

BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT	APPLICATION NO. _____

DIRECT TESTIMONY OF TONY PALMER

PROVINCE OF ALBERTA)
) ss.
CITY OF CALGARY)

Q: Please state your name.

A: My name is Tony Palmer.

Q: Mr. Palmer, are you employed?

A: Yes, I am currently employed as President, Keystone XL, Energy East, and Prince Rupert Gas Transmission.

Q: How long have you been employed by TransCanada?

A: I have thirty-one years of experience with TransCanada.

Q: Prior to your current roles, what position(s) did you hold?

A: Prior to my current roles, I was Senior Vice-President of Stakeholder Relations. I have also led a number of TransCanada's major business development initiatives.

Q: What are your job duties as President, Keystone XL Pipeline?

A: My current responsibilities include overall responsibility for the development of the Keystone XL Pipeline Project (the "Project"). My responsibilities for the Project include general oversight of development and implementation of the Project. This includes acquiring the necessary property rights and securing all necessary permits to construct

and operate the Project, the Project's engineering, and the Project's procurement, construction, commissioning, start-up and testing.

Q: What is the purpose of your testimony today?

A: TransCanada Keystone Pipeline, LP ("Keystone") has filed an application pursuant to the Major Oil Pipeline Siting Act, Neb. Rev. Stat. 57-1401 et seq. Keystone's application is for route approval of the Project. I am offering this testimony in support of Keystone's request that it receive approval for the Preferred Route as set forth in the application.

Q: Are you familiar with that application?

A: Yes. I have reviewed and assisted with the preparation of the application in this matter.

Q: Other than yourself, are other people involved in the Project?

A: Yes. A Project of this scope involves a number of individuals and requires many people possessing detailed knowledge of various aspects of the Project, including those aspects discussed in Keystone's application.

Q: Before discussing the specifics of Keystone's application, could you give a brief background about Keystone?

A: Keystone is a company organized for the purposes of constructing and owning pipelines which transport crude oil from Canada to the United States, as well as the transportation of domestic crude oil production. It is a Delaware limited partnership owned by TransCanada Keystone Pipeline, LLC and TransCanada Keystone Pipeline CP, LLC which are wholly-owned subsidiaries of TransCanada Corporation.

Q: Which specific sections of Keystone's application are you offering testimony to support?

A: My testimony is specifically directed to matters addressed in sections 1, 1.1, 5.0, 6.0, 7.0,

8.2, 8.7, 9.8 and 12.

Q: Do you have knowledge of the facts stated in those sections?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Q: The first sections of Keystone's application to which you indicated your testimony is directed are sections 1 and 1.1. What information do those sections of Keystone's application contain?

A: Section 1 identifies the name and address of the pipeline carrier applicant, TransCanada Keystone Pipeline, LP. Section 1.1 is provided as background and represents a general summary timeline of major federal and Nebraska regulatory events leading up to this application.

Q: Is the information reflected in sections 1 and 1.1 true and accurate?

A: Yes.

Q: Does Keystone's application also describe the product or material to be transported through the pipeline?

A: Yes. Section 5 and Appendix C describe representative Material Safety Data Sheets.

Q: Is the information reflected in section 5 correct?

A: Yes.

Q: What information is contained in sections 6.0 and 7.0 of the application?

A: Sections 6 and 7 identify the entities that will own and manage the Project.

Q: Is the information reflected in sections 6.0 and 7.0 of the application true and accurate?

A: Yes.

Q: Who will own the Project?

A: TransCanada Keystone Pipeline, LP will own the Project.

Q: Who will manage the Project?

A: TC Oil Pipeline Operations Inc., which is wholly-owned by TransCanada Corporation, will operate and maintain the Project.

Q: Generally, what do sections 8.2, 8.7, 9.8 and 12 address?

A: Sections 8.2, 8.7, 9.8, and 12 relate to legal obligations which apply to the Project.

Q: Has the Project complied with the existing legal obligations that apply to it?

A: The Project has complied with or will comply, when applicable, with the existing legal obligations that apply to the Project.

Q: Specifically, what does section 8.2 address?

A: Section 8.2 deals with reclamation costs.

Q: Is the information contained in section 8.2 true and accurate?

A: Yes. I affirm that Keystone will be responsible for all reclamation costs resulting from construction and operation of the Project, except to the extent that another party is determined to be directly responsible.

Q: What does section 8.7 address?

A: Section 8.7 addresses reclamation and maintenance obligations.

Q: To the best of your knowledge, is the information within section 8.7 true and accurate?

A: Yes.

Q: Will Keystone comply with applicable reclamation and maintenance commitments and regulatory requirements?

A: Yes. With regard to section 8.7, I affirm that Keystone will abide by the applicable

maintenance and reclamation commitments and regulatory requirements, including those prescribed by the Nebraska Oil Pipeline Reclamation Act (Reclamation Act), unless and until the proposed Project is permanently decommissioned and removed.

Q: Does Keystone have a plan to comply with the Reclamation Act?

A: Yes. Keystone has plans to comply with the Reclamation Act.

Q: What are Keystone's plans to comply with the Reclamation Act?

A: Keystone's plans to comply with the Reclamation Act are reflected in the Construction Mitigation and Reclamation Plan attached as an Appendix to Keystone's application, as well as other documents as addressed in the application and accompanying testimony.

Q: The final sections to which your testimony relates are sections 9.8 and 12. What do those sections address?

A: Section 9.8 addresses permit compliance, and section 12 addresses compliance with applicable state statutes, rules, and regulations and local ordinances.

Q: Is the information contained in sections 9.8 and 12 true and correct to the best of your knowledge?

A: Yes.

Q: Has, or will, Keystone comply with applicable state statutes, rules, and regulations and local ordinances?

A: Yes. With regard to sections 9.8 and 12, I affirm that Keystone either has obtained or will obtain the requisite federal, state, and local permits prior to commencing construction, and that Keystone will comply with the terms and conditions stipulated in applicable local, state, and federal permits, and that Keystone will comply with all applicable laws and regulations.

Tony Palmer
President, Keystone XL, Energy East, and
Prince Rupert Gas Transmission

Subscribed and sworn to before me this 9th day of February, 2017.

Notary Public

JOEL FORREST
Barrister & Solicitor

BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT,	APPLICATION NO. _____

DIRECT TESTIMONY OF MICHAEL B. PORTNOY

STATE OF)
) ss.
COUNTY OF)

Q: Please state your name.

A: My name is Michael Portnoy.

Q: Mr. Portnoy, are you employed?

A: Yes, I am President and CEO of PEI which is a full service environmental consulting and engineering firm.

Q: How long have you been involved in the environmental arena?

A: I have over 25 years of experience in environmental sciences in geological disciplines.

Q: What is your educational background?

A: I have a bachelor's degree in geology from Texas Tech which I received in 1983. I received a master's degree in geology and geochemistry from Texas Tech in 1987. I received a master's degree in hydrogeology from Western Michigan University in 1990, and I received a master's of business administration from Texas Tech in 1988.

Q: Do you hold any professional licenses?

A: Yes. I am a professional geologist licensed in Nebraska at License No. 193.

Q: During the course of your career have you ever been involved in any environmental studies?

A: Yes. I have been project manager for numerous studies, including studies which evaluate soil permeability and distance-to-ground water from certain improvements.

Q: Are you familiar with TransCanada Keystone Pipeline, LP's ("Keystone") application for route approval with the Nebraska Public Service Commission?

A: Yes.

Q: How are you familiar with that application?

A: I assisted Keystone with preparing its application for approval of the Preferred Route. My assistance includes section 14, which relates to soil permeability, and section 15, which relates to a distance-to-groundwater survey, of the application.

Q: What was your involvement with respect to those sections?

A: I am the lead hydrologist and project manager for the surveys referenced in sections 14 and 15 of the application relating to the Preferred Route, and I am the individual responsible for evaluating existing applicable published information and using the information to prepare the surveys referenced and attached as an Appendix.

Q: What do the surveys referenced in sections 14 and 15 of Keystone's application show?

A: Those surveys are true and accurate reflections of the soil content and permeability along the Preferred Route and the distance-to-ground water of the Preferred Route, based on the evaluated information.

Q: Does the content of sections 14 and 15, and the appendices referenced therein and attached to Keystone's application, accurately reflect your reports?

A: Yes, the content of sections 14 and 15 and the appendices referenced therein are the reports I was responsible for creating. I incorporate the full content of those sections and the referenced appendices into my testimony as though set forth fully herein

Q: Is the content of those sections and referenced appendices true and correct to the best of your knowledge?

A: Yes, I have reviewed the content of those sections and the appendices referenced therein and I believe that content is true and accurate to the best of my knowledge.

Michael B. Portnoy

Michael B. Portnoy

Subscribed and sworn to before me this 8th day of FEBRUARY, 2017.

Notary Public

BRENDA TUREK
Notary Public, State of Texas
Comm. Expires 03-04-2018
Notary ID 12412507-1

BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF THE APPLICATION OF TRANSCANADA KEYSTONE PIPELINE, LP FOR ROUTE APPROVAL OF THE KEYSTONE XL PIPELINE PROJECT PURSUANT TO THE MAJOR OIL PIPELINE SITING ACT,	))))))	APPLICATION NO. _____ **DIRECT TESTIMONY OF JON A. SCHMIDT PH.D.**

STATE OF FLORIDA)
)ss.
COUNTY OF WALTON)

Q: Please state your name.

A: My name is Jon A. Schmidt Ph.D.

Q: Mr. Schmidt, are you employed?

A: Yes. I am Vice President with exp Energy Services, Inc. ("exp") which is the management contractor for the Keystone XL Pipeline Project ("Project") owned by the applicant TransCanada Keystone Pipeline, LP ("Keystone").

Q: Do you have any responsibilities with respect to the Project?

A: Yes, I am responsible for environmental and regulatory management for the Project.

Q: What is the highest level of education you have obtained?

A: I obtained a doctorate from Florida State University in 1987.

Q: What is the purpose of your testimony today?

A: I am offering this testimony in support of Keystone's application pursuant to the Major Oil Pipeline Siting Act ("MOPSA") for approval of the Project's Preferred Route.

Q: Do you have any prior experience with the preparation of permit applications or regulatory filings?

A: Yes. For the last 30 years, I have worked to prepare permit applications and regulatory filings for pipelines, power lines, LNG facilities, and natural gas storage facilities for various companies throughout the United States. This includes over 10,000 miles of oil and gas pipeline projects in more than 30 states.

Q: Are you familiar with Keystone's application for route approval pursuant to Neb. Rev. Stat. § 57-1401 et seq?

A: Yes.

Q: How are you familiar with that application?

A: I participated in the preparation of the Project's application. With regard to the topics contained in the application, I am individually or jointly responsible for sections 2.1 (Development of the Preferred and Alternative Routes), 3 (reasons for Preferred Route), 13 (the preparation and content of the environmental impact study), 16 (evidence of the Project's impact on wildlife), 17 (the Project's impact on plants, except for noxious weeds), and 18 (mitigation and minimization efforts for reducing impact on natural resources).

Q: Are the facts stated within those sections of the application true and accurate to the best of your knowledge?

A: Yes, and I incorporate those sections into my testimony as though set forth fully herein.

Q: Were you involved with regard to the selection of the Preferred Route?

A: Yes.

Q: What was your involvement?

A: With regard to the selection of the Preferred Route, I was involved with consideration of alternative routes, including those identified in the application during the Nebraska

Department of Environmental Quality's (NDEQ) preparation of its Final Evaluation Report, which was submitted to Governor Heineman. The Preferred Route reflects the NDEQ's positive findings and the Governor's approval with respect to that route. Alternative routes were also considered during preparation of the environmental impact statements during the federal National Environmental Policy Act review, and the DOS' Final Supplemental Environmental Impact Statement (FSEIS) concluded that significant impacts to most resources are not expected along the Preferred Route.

Q: Do the alternative routes confer an environmental advantage over the Preferred Route?

A: Neither the Sandhills Alternative Route nor the Keystone Mainline Alternative Route confers a distinct environmental advantage over the Preferred Route. In fact, the Preferred Route as described in the application disturbs the least amount of land and sensitive areas without crossing the "Sandhills" as defined by the Nebraska Department of Environmental Quality.

Q: How does the Preferred Route impact natural resources, including wildlife and plants, as compared to alternative routes?

A: The Preferred Route reduces impacts to American Burying Beetle habitat and other federally listed threatened and endangered species, habitats that may support state-listed threatened and endangered species, grasslands, and reduces impacts to wellhead protection areas. The Preferred Route also requires one less pump station and associated electrical transmission lines than the Keystone Mainline Alternative Route.

Q: What were the principle reasons Keystone selected the Preferred Route?

A: Minimizing the amount of disruption to land and sensitive environmental resources, avoiding additional infrastructure (i.e., another pump station and associated electrical transmission lines) and avoiding the Sandhills were the principal reasons Keystone selected the Preferred Route.

Q: Have considerations with regard to the impact on natural resources and wildlife and plants within the preferred route been studied by Keystone?

A: Yes. Keystone studied those potential impacts. The considerations were also extensively studied in the NDEQ review and the preparation of the FSEIS by the Department of State and other agencies.

Q: Are impacts on natural resources and wildlife and plants within the Preferred Route discussed in the application?

A: Yes.

Q: Does Keystone have plans to address those impacts?

A: Yes. Keystone's plans to address those impacts are explained in sections 16, 17, 18, and the Construction Mitigation and Reclamation Plan.

Jon A. Schmidt Ph.D.

Subscribed and sworn to before me this 13th day of February, 2017.

DEBBIE A BROOME
MY COMMISSION # FF932452
EXPIRES November 01, 2019
(407) 398-0153 FloridaNotaryService.com

Notary Public

EXPENSE REIMBURSEMENT AGREEMENT

This Expense Reimbursement Agreement (the "Agreement") is made effective as of February 16, 2017 by and between TransCanada Keystone Pipeline, LP ("TransCanada") and the Nebraska Public Service Commission (the "Commission").

RECITALS

A. TransCanada has filed an application to construct a major oil pipeline to be placed in operation in Nebraska (the "Application").

B. Pursuant to the regulations of the Nebraska Public Service Commission, TransCanada's Application is required to be accompanied by a written agreement to reimburse the Commission for certain expenses.

C. The parties to this Agreement are desirous of setting forth the written terms and conditions under which such expenses will be reimbursed.

AGREEMENT

NOW THEREFORE, in order to consummate the intent of the foregoing recitals, each of which are made a contractual part of this Agreement, and in further consideration of the mutual agreement and covenants herein contained, the parties hereby agree as follows:

1. Pursuant to Title 291, Chapter 9, Section 023.02 of the Nebraska Administrative Code, TransCanada's Application must be accompanied by a written agreement to pay the reasonable expenses incurred by the Commission in connection with the Application. The Commission shall assess the reasonable expenses incurred by the Commission in connection with the investigation and hearing and will issue an order assessing such expenses to TransCanada. It will send TransCanada an invoice for these expenses, by United States mail, either at the time the order is issued or from time to time during the application process.

2. The invoice shall provide that TransCanada has 15 days after the mailing to either pay the bill or to file an objection to the assessment pursuant to Neb. Rev. Stat. §57-1406. If an objection is filed, the Commission shall issue a final order either upholding, invalidating, or amending the assessment and TransCanada has ten days from service of the final order to reimburse the Commission as ordered.

3. Any party may appeal the final order of assessment from the Commission pursuant to the Nebraska Administrative Procedures Act.

4. All notices shall be in writing and delivered by U.S. mail addressed as follows:

If to TransCanada:

Immediate Attn: Tony Palmer, President
Keystone XL
TransCanada
Rm 2325, 23rd Floor
450 - 1st Street SW
Calgary, Alberta T2P 5H1

With a copy to:
James G. Powers & Patrick D. Pepper
McGrath North Mullin & Kratz PC LLO
1601 Dodge Street, Suite 3700
Omaha, NE 68102

If to Public Service Commission: _____

_____

5. This Agreement and the rights and duties of the parties hereto shall be governed by and construed, enforced and performed in accordance of the laws of the State of Nebraska.

6. This Agreement constitutes the entire agreement between the parties relating to the subject matter contemplated by this Agreement. No amendment or modification to this Agreement shall be enforced unless reduced to writing and executed by both parties.

TRANSCANADA KEYSTONE PIPELINE, LP

By: _____
Tony Palmer

Its: President

NEBRASKA PUBLIC SERVICE COMMISSION

By: _____

Its: _____