

3.5 TERRESTRIAL VEGETATION

Vegetative cover is an important component in the classification of ecoregions that reflects differences in ecosystem quality and integrity (EPA 2006). Ecoregions are described through analysis of patterns and composition of geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The Mainline and Cushing Extension would cross seven Level III Ecoregions of the United States—Lake Agassiz Plain, Northern Glaciated Plains, Western Corn Belt Plains, Central Great Plains, Central Irregular Plains, Interior River Valleys and Hills, and Flint Hills (Figure 3.5-1, Table 3.5-1).

3.5.1 General Vegetation Resources

Vegetation types crossed by the Keystone Project were delineated based on review of aerial photographs, general observations made during reconnaissance, and information collected during wetland delineation and grassland assessment surveys. Plant communities and their occurrence by state within the eight general vegetation types or general land use categories are described in Table 3.5.1-1.

Grassland/rangeland, upland forest, palustrine emergent wetland, palustrine shrub/scrub wetlands, palustrine forested wetland, streams, and open water areas support naturally occurring terrestrial and aquatic vegetation. Residential, commercial, industrial, and special designation areas (e.g., schools, parks, and recreational facilities) primarily include artificially created landscapes with minimal naturally occurring vegetation. Cropland and pivot-irrigated cropland areas primarily include introduced crop species, which provide forage and grain for livestock and human consumption. Right-of-way areas consist of previously disturbed areas associated with pipelines and other utilities that have been restored primarily with native herbaceous species and may include some introduced species.

**TABLE 3.5-1
EPA Level III Ecoregions Crossed by the Keystone Project**

Ecoregion	Location of Occurrence in Keystone Project Area	Description
Lake Agassiz Plain	North Dakota	Glacial Lake Agassiz was the last in a series of proglacial lakes to fill the Red River Valley in the 3 million years since the beginning of the Pleistocene. Thick beds of lake sediments on top of glacial till create the extremely flat floor of the Lake Agassiz Plain. The historic tall-grass prairie has been replaced by intensive row crop agriculture. The preferred crops in the northern half of the region are potatoes, beans, sugar beets and wheat; soybeans, sugar beets, and corn predominate in the south.
Northern Glaciated Plains	North Dakota and South Dakota	The Northern Glaciated Plains Ecoregion is characterized by a flat to gently rolling landscape composed of glacial till. The sub-humid conditions foster a transitional grassland containing tall-grass and short-grass prairie. High concentrations of temporary and seasonal wetlands create favorable conditions for waterfowl nesting and migration. Although the till soils are very fertile, agricultural success is subject to annual climatic fluctuations.

**TABLE 3.5-1
(Continued)**

Ecoregion	Location of Occurrence in Keystone Project Area	Description
Western Corn Belt Plains	Nebraska, Kansas, and Missouri	Once covered with tall-grass prairie, over 75 percent of the Western Corn Belt Plains now is used for cropland agriculture, and much of the remainder is in forage for livestock. A combination of nearly -level to gently -rolling glaciated till plains and hilly loess plains; an average annual precipitation of 63 to 89 centimeters that occurs mainly in the growing season, and fertile, warm, moist soils make this one of the most productive areas of corn and soybeans in the world. Major environmental concerns in the region include surface water and groundwater contamination from fertilizer and pesticide applications, as well as impacts from concentrated livestock production.
Central Great Plains	Nebraska and Kansas	The Central Great Plains are slightly lower, receive more precipitation, and are somewhat more irregular than the Western High Plains to the west. Once a grassland, with scattered low trees and shrubs in the south, much of this ecological region is now cropland. The eastern boundary of the region marks the eastern limits of the major winter wheat-growing area of the United States.
Central Irregular Plains	Missouri	The Central Irregular Plains have a mix of land use and are topographically more irregular than the Western Corn Belt Plains to the north, where most of the land is in crops. The region is less irregular and less forest covered than the ecoregions to the south and east. The potential natural vegetation of this ecological region is a grassland/forest mosaic, with wider forested strips along the streams compared to the Northern Glaciated Plains to the north. The mix of land use activities in the Central Irregular Plains also includes mining operations of high-sulfur bituminous coal. The disturbance of these coal strata in southern Iowa and northern Missouri has degraded water quality and affected aquatic biota.
Interior River Valleys and Hills	Missouri and Illinois	The Interior River Lowland is made up of many wide, flat-bottomed terraced valleys; forested valley slopes; and dissected glacial till plains. In contrast to the generally rolling to slightly irregular plains in adjacent ecological regions to the north, east, and west—where most of the land is cultivated for corn and soybeans, a little less than one-half of this area is in cropland, about 30 percent is in pasture, and the remainder is in forest. Bottomland deciduous forests and swamp forests were common on wet lowland sites, with mixed oak and oak-hickory forests on uplands. Paleozoic sedimentary rock is typical, and coal mining occurs in several areas.
Flint Hills	Kansas and Oklahoma	The Flint Hills is a region of rolling hills, with relatively narrow steep valleys, and is composed of shale and cherty limestone with rocky soils. In contrast to surrounding ecological regions that are mostly in cropland, most of the Flint Hills region is grazed by beef cattle. The Flint Hills mark the western edge of the tall-grass prairie and contain the largest remaining intact tall-grass prairie in the Great Plains.

Sources: Classification of Level III Ecoregions is based on EPA (2006); descriptions of the regions are based on EPA (2002).

TABLE 3.5.1-1 (Continued)											
General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State								
			Mainline Project						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
Herbaceous Rangeland (continued)											
Non-native grassland	Pasturelands planted with non-native cool-season grasses	Fescue (<i>Festuca</i> spp.), smooth brome (<i>Bromus inermis</i>), and other seed pasture grasses				X	X				
Deciduous shrubland	Upland or lowland communities dominated by shrubs	Chokecherry (<i>Prunus virginia</i>), sandbar willow (<i>Salix interior</i>), silver buffaloberry (<i>Shepherdia argentea</i>), western snowberry (<i>Symphoricarpos occidentalis</i>)	X	X							
Conservation reserve program	Mixed native and non-native grasses and forbs; may include shrubs; land is fallow	A variety of native and introduced grass species	X	X	X	X					
Mixed prairie	Prairie grasses of mixed heights	Grama (<i>Bouteloua</i> spp.), little bluestem (<i>Schizachyrium scoparium</i>)	X	X	X	X					
Upland Forest											
Deciduous woodland	Woodlands dominated by a wide variety of mixed native and non-native deciduous species	Green ash (<i>Fraxinus pennsylvanica</i>), quaking aspen (<i>Populus tremuloides</i>), bur oak (<i>Quercus macrocarpa</i>), American elm (<i>Ulmus americana</i>)	X		X		X				
Maple-basswood forest	Community dominated by sugar maple and basswood; found in valley slopes and bottoms	Sugar maple (<i>Acer saccharum</i>), red oak (<i>Quercus rubra</i>), american basswood (<i>Tilia americana</i>)				X					
Oak-hickory forest	Upland community dominated by multiple oak and hickory species	Bitternut hichory (<i>Carya cordiformis</i>), shagbark hickory (<i>C. ovata</i>), white oak (<i>Quercus alba</i>), black oak (<i>Q. velutina</i>)				X	X	X		X	
Green ash woodland	Community dominated by green ash; occurs in floodplains and mesic slopes	Boxelder (<i>Acer negundo</i>), green ash (<i>Fraxinus pennsylvanica</i>), American elm (<i>Ulmus americana</i>)	X								

TABLE 3.5.1-1 (Continued)											
General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State								
			Mainline Project						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
Upland Forest (continued)											
Aspen woodland	Woodlands dominated by aspen species	Green ash (<i>Fraxinus pennsylvanica</i>), quaking aspen (<i>Populus tremuloides</i>), bur oak (<i>Quercus macrocarpa</i>)	X								
Bur oak woodland	Woodlands dominated by bur oak, generally in ravines and well-drained uplands	Green ash (<i>Fraxinus pennsylvanica</i>), quaking aspen (<i>Populus tremuloides</i>), bur oak (<i>Quercus macrocarpa</i>)	X								
Evergreen forest	Forest with greater than 60% evergreen trees	Shortleaf pine (<i>Pinus echinata</i>)					X				
Mixed oak ravine	Oak forest with multiple species on moderate to steep slopes of ravines and river valleys	Big bluestem (<i>Andropogon gerardii</i>), bur oak (<i>Quercus macrocarpa</i>), chinquapin oak (<i>Q. muhlenbergii</i>)			X	X	X		X	X	
Deciduous	Native deciduous forest communities	Bur oak (<i>Quercus macrocarpa</i>), post oak (<i>Q. stellata</i>)					X				
Riverine/Open Water											
Open water	Open water, sometimes associated with wetland habitat	None			X				X		
Riverine wetlands	Wetlands contained within a channel		X						X		
Palustrine Forested Wetlands											
Floodplain woodland	Wooded communities in floodplains	Green ash (<i>Fraxinus pennsylvanica</i>), eastern cottonwood (<i>Populus deltoides</i>), bur oak (<i>Quercus macrocarpa</i>), American elm (<i>Ulmus americana</i>)	X								
Riparian or floodplain woodland	Temporarily flooded woodlands				X				X		

**TABLE 3.5.1-1
(Continued)**

General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State										
			Mainline Project						Cushing Extension				
			ND	SD	NE	KS	MO	IL	NE	KS	OK		
Palustrine Forested Wetlands (continued)													
Mixed oak floodplain forest	Oak-dominated forests with temporary flooding in floodplains	Bitternut hichory (<i>Carya cordiformis</i>), Indian woodoats (<i>Chasmanthium latifolium</i>), bur oak (<i>Quercus macrocarpa</i>), shumard oak (<i>Q. shumardii</i>)				X							
Ash-elm-hackberry floodplain forest	Forest in floodplains and upland ravine bottoms; dominated by ash, elm, and hackberry	Common hackberry (<i>Celtis occidentalis</i>), green ash (<i>Fraxinus pennsylvanica</i>), elm (<i>Ulmus</i> spp.)				X							
Woody-dominated wetland	Semi-permanently or permanently flooded forest community	Maple (<i>Acer</i> spp.), hickory (<i>Carya</i> spp.), oak (<i>Quercus</i> spp.)					X	X					
Cottonwood floodplain woodland	Floodplain forest dominated by cottonwood species	Green ash (<i>Fraxinus pennsylvanicus</i>), eastern cottonwood (<i>Populus deltoides</i>), willow (<i>Salix</i> spp.)				X							
Palustrine Emergent/Scrub-Shrub Wetlands													
Palustrine emergent wetlands	Temporary, seasonal, or semi-permanent wetlands dominated by persistent emergent vegetation	Common spikerush (<i>Eleocharis palustris</i>), rush (<i>Juncus</i> spp.), rice cutgrass (<i>Leersia oryzoides</i>), bulrush (<i>Schoenoplectus</i> spp.), burreed (<i>Sparganium</i> spp.), cattail (<i>Typha</i> spp.)	X	X	X	X	X	X	X	X	X	X	X
Riparian shrubland	Temporarily flooded shrub community	Sedge (<i>Arex</i> spp.), willow (<i>Salix</i> spp.), bulrush (<i>Schoenoplectus</i> spp.), western snowberry (<i>Symphoricarpos occidentalis</i>)	X	X	X								
Aquatic bed wetland	Intermittently, temporarily, or permanently flooded wetlands	Inland saltgrass (<i>Distichlis spicata</i>), western wheatgrass (<i>Pascopyrum smithii</i>), smartweed and knotweed (<i>Polygonum</i> spp.), pondweed (<i>Potamogeton</i> spp.)				X							

TABLE 3.5.1-1 (Continued)											
General and Subclass Designation	General Description	Common Species	Occurrence along Right-of-Way by State								
			Mainline Project						Cushing Extension		
			ND	SD	NE	KS	MO	IL	NE	KS	OK
Palustrine Emergent/Scrub-Shrub Wetlands (continued)											
Cattail or freshwater marsh	Shallow to deep emergent marshes	Rush (<i>Juncus</i> spp.), bulrush (<i>Schoenoplectus</i> spp.), burreed (<i>Sparganium</i> spp.), cattail (<i>Typha</i> spp.)	X	X	X	X					
Herbaceous-dominated wetland	Semi-permanently or permanently flooded wetland	Rush (<i>Juncus</i> spp.), bulrush (<i>Schoenoplectus</i> spp.), cattail (<i>Typha</i> spp.), sedge (<i>Carex</i> spp.)					X				
Right-of-Way											
None	Pipeline and other utilities	Mixture of grasses and forbs				X	X				

Source: ENSR 2006a.

3.5.2 Vegetation Communities of Conservation Concern

Native grasslands or prairies are considered the most threatened vegetation communities in the United States. In the past, grasslands such as the tall-grass prairies, mixed-grass prairies, and short-grass prairies dominated central North America. Prairies have been lost to agriculture, urbanization, and mineral exploration and have been altered by invasions of non-native plants after fire suppression, establishment of woodlots and shelterbelts, water developments, and tree-lined river and stream corridors. Tall-grass prairie is the wettest of the grasslands composed of sod-forming bunch grasses. Mixed-grass prairies are intergrades between tall-grass and short-grass prairies and are characterized by the warm-season grasses of the short-grass prairie and the cool and warm-season grasses of the tall-grass prairie. Short-grass prairies are dominated by blue grama and buffalo grass—two warm-season grasses that flourish under intensive grazing. The status of native grasslands in states where the pipeline ROW would pass is listed in Table 3.5.2-1. The 49 plant species of conservation concern that have been identified along the pipeline ROW are listed in Table 3.5.2-2; many of these species occupy prairie and wetland habitats.

Type	State	Past Area (hectares)	Current Area (hectares)	Current Area (acres)	Decline (%)
Tall grass	North Dakota	130,000	120	297	99.9
	South Dakota	2,600,000	20,000	49,421	99.2
	Nebraska	6,100,000	123,000	303,940	98.0
	Kansas	6,900,000	1,200,000	2,965,265	82.6
	Missouri	6,000,000	32,000	79,074	99.5
	Illinois	8,500,000	2,930	2,298	99.9
	Oklahoma	5,200,000	NA	NA	NA
Mixed grass	North Dakota	14,200,000	4,500,000	11,119,742	68.3
	South Dakota	1,600,000	480,000	1,186,106	70.0
	Nebraska	7,700,000	1,900,00	4,695,002	75.3
	Oklahoma	2,500,000	NA	NA	NA
Short grass	South Dakota	179,000	116,350	287,507	35.0
	Oklahoma	1,300,000	NA	NA	NA

NA = Not available.

Source: Samson et al. 2007.

TABLE 3.5.2-2 Plants of Conservation Concern along the Keystone Project Route									
Species	Status ^a	State Conservation Status ^b							Habitat
		ND	SD	NE	KS	MO	IL	OK	
Indian ricegrass (<i>Achnatherum hymenoides</i>)	KS-SC	SNR	SNR	SNR	S2	SNR		S1	Sandy, stony, gravelly, shallow soils in upland and semi-desert climatic zones. Adapted to soils high in lime, moderately salt and alkali tolerant. Flowering: May–August.
Woolly milkweed (<i>Asclepias lanuginosa</i>)	SD-SC	S1	S4	S3	S1		S1		Dry woods, prairies, hillside prairies, rocky soils. Flowering: June–July.
Subarctic ladyfern (<i>Athyrium filix-femina</i>)	ND-SC	S3	SNR	SH	SNR	SNR	SNR	SNR	Swamp margins, wooded banks, and alluvial woods. Aquatic or wetland species.
Texas bergia (<i>Bergia texana</i>)	MO-SC		SNR	S1	S2	S2	SNR	SNR	Muddy or sandy shores and flats, rare. Flowering: June–October.
Broad-glumed (earlyleaf) brome (<i>Bromus latiglumis</i>)	MO-SC	SNR	SNR	SNR	S1	S3	S3		Wooded slopes and bluffs, alluvial banks of streams, usually in limestone areas. Flowering: July–August.
Nottoway (Valley) brome grass (<i>Bromus nottowanus</i>)	MO-SC				S1	S3	S1	SNR	Rich, loamy soils in bottomland forests along rivers and streams, mesic woods not far (<50 meters) from a river or stream.
Bellow's-beak sedge (<i>Carex albicans</i> var. <i>australis</i>)	MO-SC				S1	S1	SNR	SNR	Acid, dry soils of sandstone and granite, calcareous regions, wooded slopes, sandstone ridges, woodland clearings in partial shade of deciduous forests. Fruiting: April–June.
Buxbaum's sedge (<i>Carex buxbaumii</i>)	ND-SC	S1		S2	S1	S2	SNR	SNR	Bogs, wet meadows, springs, and fens. Flowering: Late May–June.
Crested sedge (<i>Carex cristatella</i>)	KS-SC	SNR	SNR	SNR	S2	SNR	S3		Openings in wet meadows, moist woodlands, swamps, soggy thickets, wet prairies, sedge meadows, sloughs, low-lying areas along rivers, power line clearances in woodlands, and ditches. Occurs in both degraded and higher quality habitats. Flowering: late spring–early summer.
Ravenfoot sedge (<i>Carex crus-corvi</i>)	KS-SC			S1	S2	SNR	S3	SNR	Wet meadows, wet prairies, swamps, floodplain woods, and roadside ditches. Flowering: May–July.
Bristly-stalk sedge (<i>Carex leptalea</i>)	ND-SC	S2	S2			SNR	S2	S1	Bogs and wet woodlands. Flowering: June–July.

TABLE 3.5.2-2 (Continued)									
Species	Status ^a	State Conservation Status ^b							Habitat
		ND	SD	NE	KS	MO	IL	OK	
Blue cohosh (<i>Caulophyllum thalictroides</i>)	ND-SC	S1	S3	S1	S1	SNR	SNR	SNR	Rich valley woodlands, ravines, north-facing wooded slopes, and moist base of bluffs. Flowering: April–May.
Sand (lanceleaf) coreopsis (<i>Coreopsis lanceolata</i>)	KS-SC				S2	SNR	SNR	SNR	Dunes, dry woods, and meadows; in full sun to partial sun; and very dry to somewhat moist sites. Occurs in open sandy banks, roadsides, grasslands, banks, and bluffs in oak-pine woodland and in other sandy areas. Flowering: April–June.
American yellow lady's-slipper (<i>Cypripedium parviflorum</i>)	ND-SC	SNR	S3	SNR	SNR	SNR	SNR	SNR	Soft soils in moist tall-grass prairie, especially near trees or shrubs along lakeshores. Flowering: 25 May–20 June.
Showy lady's-slipper (<i>Cypripedium reginae</i>)	ND-SC	S2				S2	S1		Calcareous wetlands, wet woodlands. Flowering: 20 June–5 July.
Spinulose shieldfern (woodfern) (<i>Dryopteris carthusiana</i>)	ND-SC	S3	SNR	S2		S2	S3		Wet alluvial woods or swamps.
Crested shieldfern (woodfern) (<i>Dryopteris cristata</i>)	ND-SC	S3		S1		S1	S2		Wet alluvial woods or swamps.
Walter's barnyard grass (<i>Echinochloa walteri</i>)	MO-SC					S1	S3	SNR	Low ground, rarely standing water, basic to alkaline marshes.
Small spikerush (<i>Eleocharis parvula</i>)	ND-SC	S1	SNR		S2	SNR	EX	SNR	Wet saline or alkaline flats and shores. Flowering: July–early September.
Green keeled cottongrass (<i>Eriophorum viridi-carinatum</i>)	ND-SC	S1					SX		Cold, calcareous sphagnum bogs, and swamps, permafrost tussocks and calcicoles.
Spotted Joe-pyeweed (<i>Eupatorium maculatum</i> var. <i>bruneri</i>)	KS-SC	SNR	SNR	SNR	S1	SNR			Moist black soil prairies, sand prairies, sedge meadows, marshes, fens, and swampy thickets with small trees or shrubs. Flowering: July–September.
Fringed gentian (<i>Gentianopsis crinita</i>)	ND-SC	S1	SNR					SNR	Low, moist native grassland. Flowering: September–October.
Plains frostweed (<i>Helianthemum bicknellii</i>)	ND-SC	S1	SNR	S1	SNR	SNR	SNR		Prairies, rocky open areas, dry sandy soil. Also woodlands and glades. Flowering: early June–late July.

TABLE 3.5.2-2 (Continued)									
Species	Status ^a	State Conservation Status ^b							Habitat
		ND	SD	NE	KS	MO	IL	OK	
Greater Canadian St. John's wort (<i>Hypericum majus</i>)	KS-SC	SNR	SNR	SNR	S2	SH	SNR	S1	Along ponds, lakesides, or other low, wet places; facultative wetland species. Flowering: July–September.
Narrowleaf morning-glory (<i>Ipomoea shumardiana</i>)	KS-SC				S1			SNR	Prairie species, eastern Kansas through central Oklahoma to north Texas. Flowering: June–August.
Butternut (<i>Juglans cinerea</i>)	MO-SC	SNR			SNR	S2	S2		Mixed hardwood forests, often on stream benches and terraces, on slopes, in the talus of rock ledges, on other sites with good drainage. Flowering: April–May.
Star duckweed (<i>Lemna trisulca</i>)	MO-SC	SNR	SNR	SNR	S1	S2	S3		Cool, freshwater creeks and in shallow lakes, ponds, and marshes. Flowering: (rare) late spring to summer.
Loesel's twayblade (<i>Liparis loeselii</i>)	ND-SC	S2	S1	S1	SX	S2	S1		Bogs, wet ditches, old sand pits, and moist meadows. Often in acidic soils, also in strongly basic soils; requires lack of competing vegetation. Flowering: 10 July–20 July.
Fourflower (prairie) loosestrife (<i>Lysimachia quadriflora</i>)	SD-SC	SNR	S1	SNR		SNR	SNR	S1	Wet meadows and around pond margins, usually where sandy, often on calcareous soils. Flowering: July–August.
Hispid (yellow) falsemallow (<i>Malvastrum hispidum</i>)	MO-SC				SNR	S3	S1	SNR	Rocky prairies; limestone, sandstone, or cherty limestone glades; bluffs; open alluvial valleys; along gravel bars. Flowering: July–September.
Tender creeping-cucumber (<i>Melothria pendula</i>)	KS-SC				S2	SNR	S1	SNR	Rich or rocky low woods, at base of limestone bluffs, and in alluvial woods—often along streams. Flowering: July–September.
Naked bishop's-cap (<i>Mitella nuda</i>)	ND-SC	S3							Moist forests, thickets, bogs, and swamps; often growing among mosses.
Southern adder's tongue (<i>Ophioglossum vulgatum</i>)	MO-SC				SX	S3	SNR	SNR	Shaded secondary woods, wooded slopes, forested bottomlands, and floodplain woods. Leaves: spring to early summer. Spores: April–June.

TABLE 3.5.2-2 (Continued)										
Species	Status ^a	State Conservation Status ^b							Habitat	
		ND	SD	NE	KS	MO	IL	OK		
Lanceolateleaf rock moss (<i>Orthotrichum speciosum</i> var. <i>elegans</i>)	MO-SC					S1				Epiphytic moss generally on tree trunks and branches.
Pendant-pod point-vetch (<i>Oxytropis deflexa</i>)	ND-SC	S1								Drier prairies and plains, open wooded areas. Flowering: June–July.
Oklahoma phlox (<i>Phlox oklahomensis</i>)	KS-SC			SNR	S2				S1	Tall–grass and mixed–grass prairies, thrives in low to moderately grazed areas; gently rolling uplands and steeper slopes of canyons; most abundant on north-facing slopes and well–drained grassland soils, weathered from calcareous shales. Flowering: March–May.
Heartleaf plantain (<i>Plantago cordata</i>)	MO-SC					S3	S1			Semi–aquatic, areas of dolomitic limestone; often in rock crevices or gravel bars in shallow, clear streams running through heavily wooded areas; requires a specific stream habitat, with regular and predictable erosion and deposition. Flowering: April–June.
Greek valerian (Jacob's ladder) (<i>Polemonium reptans</i>)	KS-SC		SNR	S1	S2	SNR	SNR	SNR		Rich low woods, thickets at the base of bluffs, and moist ground near streams. Flowering: April–June.
Prickly gooseberry (<i>Ribes cynosbati</i>)	ND-SC	S3	SNR			SNR	SNR	S1		Thin rocky woodlands, wooded slopes, woodland borders, and limestone bluffs; some disturbance beneficial, if it reduces overhead tree canopy.
Prairie willow (<i>Salix humilis</i>)	SD-SC	SNR	S1	SNR	SNR	SNR	S3	SNR		Moist to slightly dry black soil prairies, sand prairies, sandy savannas, barrens, and gravelly seeps; lowland or upland areas, depending on variety or local ecotype.
Rocky Mountain bulrush (<i>Schoenoplectus saximontanus</i>)	MO-SC		SNR	S1	S1	S1			SNR	Damp sandy soils near freshwater ponds, ditches, or watercourses. Fruiting: summer to fall.
Lesser (oval) ladies'-tresses (<i>Spiranthes ovalis</i> var. <i>erostellata</i>)	MO-SC				S1	S3	SNR	SNR		Moist, rich woodlands; thickets; old fields; second–growth woodlands; and wooded hillsides. Flowering: September–October.

TABLE 3.5.2-2 (Continued)									
Species	Status ^a	State Conservation Status ^b							Habitat
		ND	SD	NE	KS	MO	IL	OK	
Goat's-rue (<i>Tephrosia virginiana</i>)	NE-SC			S1	SNR	SNR	SNR	SNR	Sandy soils in open woods, glades, and prairies, and along roadsides. Often indicates shallow soils. Flowering: May–July.
Nodding pogonia (<i>Triphora trianthophora</i>)	KS-SC			S1	S1	SNR	S3	S2	Moist lowland woods, ravines, stream valleys, and bottoms in the lower half of Missouri. Flowering: August–September.
Rock elm (<i>Ulmus thomasii</i>)	MO-SC	SNR	SNR	S3	S1	S2	S1		Mesic hardwood forests; moist, well-drained uplands; rocky ridges; floodplains; stream banks; and on limestone outcrops.
Flatleaf bladderwort (<i>Utricularia intermedia</i>)	ND-SC	S2					S1		Aquatic species in bogs, ponds, swamps, slow-moving streams, and wet sedge or rush meadows. Flowering: July–August.
Lesser bladderwort (<i>Utricularia minor</i>)	ND-SC	S2	SNR	S1			S1		Open bogs, sedge meadows, and marshlands; prefers calcium-rich shallow water.
Bird's-foot violet (<i>Viola pedata</i>)	NE-SC			S1	SNR	SNR	SNR	SNR	Rocky or dry open woodlands, on slopes, ridges, prairies, glades, and roadsides; almost always in acid soils. Flowering: April–June, September–December.

EX = Exotic species.

SX = Presumed extirpated.

SH = Possibly extirpated.

S1 = Critically imperiled.

S2 = Imperiled.

S3 = Vulnerable.

S4 = Apparently secure.

S5 = Secure.

SNR = Species not ranked.

^a State listing as species of conservation concern (SC) according to ENSR 2006a.

^b State conservation status (Natureserve 2006).

Native forests, especially forested floodplains, are also of conservation concern. Forest communities are generally rare within the native prairie grasslands but provide refuge habitats for many wildlife species. Native wooded communities were once an integral component of the landscape throughout the Great Plains. Many of these communities have been lost due to land conversion to agricultural uses, levee construction, and urban development. The current distribution of forested lands, grasslands and prairies, and croplands and pasture in the states crossed by the Keystone Project are illustrated in Figure 3.5.2-1.

3.5.3 Conservation Reserve Program

The Mainline Project and Cushing Extension would potentially cross one easement enrolled in the Conservation Reserve Program (CRP). The CRP is described in Section 3.9.3.2.

3.5.4 Noxious Weeds

Noxious weeds and other invasive plants are non-native, undesirable native, or introduced species that are able to exclude and out-compete desirable native species, thereby decreasing overall species diversity. The term “noxious weed” is legally defined under both federal and state laws. Under the Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974 [7 USC SS 2801–2814]), a noxious weed is defined as “any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment.” The Federal Plant Protection Act contains a list of 137 federally restricted and regulated federal noxious weeds, as per CFR Title 7, Chapter III, Part 360, including 19 aquatic and wetland weeds, 62 parasitic weeds, and 56 terrestrial weeds. Each state is federally mandated to uphold the rules and regulations set forth by the Federal Plant Protection Act and to manage its lands accordingly. Five federally listed noxious weeds have been reported to occur in states that would be crossed by the construction ROWs (NRCS 2007); one aquatic species (ducklettuce) occurs in Missouri; parasitic species of dodder, including the native bigfruit dodder, occur in North Dakota, South Dakota, Nebraska, and Kansas; the introduced upland species professor-weed occurs in Nebraska, and giant hogweed and serrated tussock occur in Illinois (Table 3.5.4-1).

In addition to federal noxious weed lists, each state that would be crossed by the proposed Mainline Project and Cushing Extension pipelines maintains a list of regulated and prohibited noxious and invasive weed species. County weed control boards or districts are present in most counties that would be crossed by the pipeline route. These county weed control boards monitor local weed infestations and provide guidance on weed control. An additional 68 state-listed noxious, invasive, and regulated weed species occur across the construction ROWs—including nine aquatic and wetland species and 59 upland species (Table 3.5.4-1).

Many of these noxious weeds are widespread across the Keystone Project area but are listed as noxious in only one or a few of the states. Noxious weeds listed as occurring by all states that would be crossed by the construction ROWs include Canada thistle and nodding plumeless (musk) thistle (Table 3.5.4-1). Species listed as noxious by four of the seven affected states include leafy spurge, purple loosestrife, field bindweed, and Johnsongrass (Table 3.5.4-1). The differences in listing terminologies and status for weed species across states may lead to difficulties in obtaining seed sources consistently identified as “weed free” across the Keystone Project area.

TABLE 3.5.4-1 Noxious and Invasive Weeds along the Keystone Project Route								
Species ^a	Status / Habitat	Occurrence and State Designations						
		ND	SD	NE	KS	MO	IL	OK
Hardheads (Russian knapweed) (<i>Acroptilon repens</i>)	Introduced species / Upland	√ NW	√ CP	√	√ NW	√	√	√
Creasted wheatgrass (<i>Agropyron cristatum</i>)	Introduced species / Upland	√ INV	√	√	√		√	√
Garlic mustard (<i>Alliaria petiolata</i>)	Introduced species / Upland	√ INV		√	√	√	√	√
Annual ragweed (<i>Ambrosia artemisiifolia</i>)	Native species / Upland	√	√	√	√	√	√ NW	√
Wollyleaf burr ragweed (<i>Ambrosia grayi</i>)	Native species / Upland			√	√ NW			√
Great ragweed (<i>Ambrosia trifida</i>)	Native species / Upland	√	√	√	√	√	√ NW	√
Corn chamomile (<i>Anthemis arvensis</i>)	Introduced species / Upland	√ INV		√		√	√	
Lesser burdock (<i>Arctium minus</i>)	Introduced species / Upland	√	√ LW	√	√	√	√	√
Absinthium (<i>Artemisia absinthium</i>)	Introduced species / Upland	√ NW	√ LW	√	√	√	√	
Smooth brome (<i>Bromus inermis</i>)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Japanese brome (<i>Bromus japonicus</i>)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Cheatgrass downy brome (<i>Bromus tectorum</i>)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Marijuana (<i>Cannabis sativa</i>)	Introduced species / Upland	√	√	√	√	√ NW	√ NW	√
Siberian peashrub (<i>Caragana arborescens</i>)	Introduced species / Upland	√ INV	√	√			√	
Whitetop (<i>Cardaria draba</i>)	Introduced species / Upland	√ INV	√ NW	√	√ NW	√	√	√

TABLE 3.5.4-1 (Continued)								
Species ^a	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Spiny plumeless thistle (<i>Carduus acanthoides</i>)	Introduced species / Upland	√ INV	√ LW	√ NW	√		√	√
Nodding plumeless (musk) thistle (<i>Carduus nutans</i>)	Introduced species / Upland	√ NW	√ CP	√ NW	√ NW	√ NW	√ NW	√ NW
Meadow knapweed (<i>Centaurea debeauxii</i>)	Introduced species / Upland	INV						
Diffuse (white) knapweed (<i>Centaurea diffusa</i>)	Introduced species / Upland	NW	CP	√ NW		√	√	
Bighead knapweed (<i>Centaurea macrocephala</i>)	Introduced species / Upland	INV						
Spotted knapweed (<i>Centaurea stoebe [maculosa]</i>)	Introduced species / Upland	√ NW	√ CP	√ NW	√	√	√	
Yellow star-thistle (<i>Centaurea solstitialis</i>)	Introduced species / Upland	√ NW	√ CP	√	√	√	√	√
Rush skeletonweed (<i>Chondrilla juncea</i>)	Introduced species / Upland		CP					
Chickory (<i>Cichorium intybus</i>)	Introduced species / Upland	√	√ CP	√	√	√	√	√
Canada thistle (<i>Cirsium arvense</i>)	Introduced species / Upland and wetland	√ NW	√ NW	√ NW	√ NW	√ NW	√ NW	√ NW
Bull thistle (<i>Cirsium vulgare</i>)	Introduced species / Upland	√ INV	√ NW	√	√ LW	√	√	√
Poison hemlock (<i>Conium maculatum</i>)	Introduced species / Upland	√	√ NW	√	√	√	√	√
Field bindweed (<i>Convolvulus arvensis</i>)	Introduced species / Upland	√ NW	√ CP	√	√ NW	√ NW	√	√
Common crupina (<i>Crupina vulgaris</i>)	Introduced species / Upland		CP					
Dodder (<i>Cuscuta</i> spp. – not inclusive)	Native and introduced species / Upland	√	√ CP	√	√	√	√	√

TABLE 3.5.4-1
(Continued)

Species ^a	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Bigfruit dodder (<i>Suscuta megalocarpa</i>)	Native species / Upland	√	√	√	√			
Gypsyflower (<i>Cynoglossum officinale</i>)	Introduced species / Upland and woodland	√ INV	√ LW	√	√	√	√	
Fuller's teasel (<i>Dipsacus fullonum</i>)	Introduced species / Upland		√	√	√	√ NW	√	√
Cutleaf teasel (<i>Dipsacus laciniatus</i>)	Introduced species / Upland			√	√	√ NW	√	
Brazilian waterweed (<i>Egeria densa</i>)	Introduced species / Aquatic	INV		√	√	√	√	√
Russian olive (<i>Elaeagnus angustifolia</i>)	Introduced species / Upland, wetland, and woodland	√ INV	√	√	√	√	√	√
Quackgrass (<i>Elymus repens</i>)	Introduced species / Upland	√ INV	√	√	√ NW	√	√	√
Leafy spurge (<i>Euphorbia esula</i>)	Introduced species / Upland	√ NW	√ NW	√ NW	√ NW	√	√	
Professor-weed (Goatsrue) (<i>Galega officinalis</i>)	Introduced species / Upland			√				
Giant hogweed (<i>Heracleum mantegazzianum</i>)	Introduced species / Upland						√	
Orange hawkweed (<i>Hieracium aurantiacum</i>)	Introduced species / Upland	INV					√	
Meadow hawkweed (<i>Hieracium pratense</i>)	Introduced species / Upland	INV					√	
Indian rushpea (<i>Hoffmannseggia densiflora</i>)	Native species / Upland				√ NW			√
Black henbane (<i>Hyoscyamus niger</i>)	Introduced species / Upland	√ INV	√	√			√	
Common St. Johnswort (<i>Hypericum perforatum</i>)	Introduced species / Upland	√	√ CP	√	√	√	√	√

TABLE 3.5.4-1 (Continued)								
Species ^a	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Broadleafed pepperweed (<i>Lepidium latifolium</i>)	Introduced species / Upland		CP	√	√	√	√	
Sericea (Chinese) lespedeza (<i>Lespedeza cuneata</i>)	Introduced species / Wetland			√	√ NW	√	√	√
Dalmatian toadflax (<i>Linaria dalmatica</i>)	Introduced species / Upland	√ NW	√ CP	√	√		√	√
Butter-and-eggs (<i>Linaria vulgaris</i>)	Introduced species / Upland	√ INV	√ CP	√	√	√	√	√
Purple loosestrife (<i>Lythrum salicaria</i>)	Introduced species / Wetland	√ NW	√ NW	√ NW	√	√ NW	√	√
Black medick (<i>Medicago lupulina</i>)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Yellow sweetclover (<i>Melilotus officinalis</i>)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Twoleaf watermilfoil (<i>Myriophyllum heterophyllum</i>)	Native species / Aquatic	√ INV	√		√	√	√	√
Eurasian (Spike) watermilfoil (<i>Myriophyllum spicatum</i>)	Introduced species / Aquatic	√ INV	√ CP	√		√	√	√
Serrated tussock (<i>Nassella trichotoma</i>)	Introduced species / Upland						√	
Scotch cottonthistle (<i>Onopordum acanthium</i>)	Introduced species / Upland	INV	LW	√	√	√ NW		√ NW
Ducklettuce (<i>Ottelia alismoides</i>)	Introduced species / Aquatic					√		
Reed canarygrass (<i>Phalaris arundinacea</i>)	Native species / Wetland	√ INV	√	√	√	√	√	√
Kentucky bluegrass (<i>Poa pratensis</i>)	Native and introduced species / Upland	√ INV	√	√	√	√	√	√
Japanese knotweed (<i>Polygonum cuspidatum</i>)	Introduced species / Upland	INV	√	√	√	√	√	√

TABLE 3.5.4-1
(Continued)

Species ^a	Habitat	Occurrence and Status by State						
		ND	SD	NE	KS	MO	IL	OK
Giant knotweed (<i>Polygonum sachalinense</i>)	Introduced species / Upland	INV	LW				√	
Curly pondweed (<i>Potamogeton crispus</i>)	Introduced species / Aquatic	√ INV	√	√	√	√	√	√
Kudzu (<i>Pueraria lobata</i>)	Introduced species / Upland			√	√ NW	√ NW	√ NW	√
Common buckthorn (<i>Rhamnus cathartica</i>)	Introduced species / Upland and woodland	√ INV	√	√	√	√	√	
Multiflora rose (<i>Rosa multiflora</i>)	Introduced species / Upland		CP	√	√ NW	√ NW	√	√
Field sowthistle (<i>Sonchus arvensis</i>)	Introduced species / Upland and wetland	√ INV	√ NW	√	√	√	√ NW	
Columbus grass (<i>Sorghum almum</i>)	Introduced species / Upland						√ NW	
Johnsongrass (<i>Sorghum halepense</i>)	Introduced species / Upland	√	√ CP	√	√ NW	√ NW	√ NW	√
Tamarisk (Salt cedar) (<i>Tamarix aphylla</i> , <i>T. chinensis</i> , <i>T. gallica</i> , <i>T. parviflora</i> , <i>T. ramosissima</i>)	Introduced species / Upland, wetland, and woodland	√ NW	√ NW	√	√	√	√	√
Common tansy (<i>Tanacetum vulgare</i>)	Introduced species / Upland	√	√ LW	√	√	√	√	√
Puncturevine (<i>Tribulus terrestris</i>)	Introduced species / Upland	√ INV	√ LW	√	√	√	√	√
Narrowleaf cattail (<i>Typha angustifolia</i>)	Introduced species / Wetland	√ INV	√	√	√	√	√	√
Hybrid cattail (<i>Typha x. glauca</i>)	Native species / Wetland	INV	√			√	√	
Siberian elm (<i>Ulmus pumila</i>)	Introduced species / Upland	√ INV	√	√	√	√	√	√
Common mullein (<i>Verbascum thapsus</i>)	Introduced species / Upland	√	√ LW	√	√	√	√	√

**TABLE 3.5.4-1
(Continued)**

- √ = Occurs within state (Natureserve 2006).
- CP = Classified as a state regulated plant.
- INV = Classified as a state invasive species.
- LW = Classified as a local noxious weed.
- NW = Classified as a state noxious weed.

^a Species in bold are federal noxious weeds. Source: NRCS 2007.

Source: Adapted from ENSR 2006a.

Noxious weeds are addressed by Executive Order 13112, which directs federal agencies to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health impacts that invasive species can cause. The executive order further specifies that federal agencies shall not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless it has been determined that the benefits of such actions outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize the risk of harm will be taken in conjunction with the actions.

3.5.5 Potential Impacts and Mitigation

Total miles crossed and acres of terrestrial vegetation affected during construction and operation of the Mainline Project and Cushing Extension are presented in Tables 3.5.5-1, 3.5.5-2, and 3.5.5-3. Individual grasslands that would be crossed by the pipeline ROWs are presented in Table 3.5.5-4.

Potential construction- and operations-related effects include:

- Temporary and permanent modification of vegetation community composition and structure from clearing and operational maintenance;
- Increased risk of soil erosion due to lack of vegetative cover;
- Expansion of invasive and noxious weed populations along the pipeline ROW as a result of construction and operational vegetation maintenance;
- Loss of sensitive plant species and habitats as a result of construction clearing and grading;
- Soil and sod disturbance (mixing of topsoil with subsoil with altered biological activities and chemical conditions that could affect reestablishment and natural recruitment of native vegetation after restoration);
- Compaction and rutting of soils from movement of heavy machinery and transport of pipe sections, altering natural hydrologic patterns, inhibiting seed germination, or increasing siltation; and
- Alteration in vegetation productivity and phenology due to increased soil temperatures associated with heat input from the pipeline.

3.5.5.1 General Vegetation Resources

The primary impacts on vegetation from construction and operation of the Mainline Project and Cushing Extension pipelines would be cutting, clearing, or removing the existing vegetation within the construction work area and potential invasion by noxious weeds. The degree of impact would depend on the type and amount of vegetation affected, the rate at which vegetation would regenerate after construction, and the frequency of vegetation maintenance conducted on the ROW during pipeline operation.

Impacts on pastureland generally would be shorter term, with vegetation typically becoming reestablished within 2 years. Impacts on these communities during operation of the pipeline would be minimal because these areas would be allowed to recover following construction and typically would not require maintenance mowing. Impacts on annually tilled croplands also generally would be short term and limited to the current growing season, provided that topsoil segregation was maintained and soils were not compacted during construction.

**TABLE 3.5.5-1
Estimated Impacts on Vegetation Communities
for the Keystone Mainline Project**

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres)^a	Community Area Affected by Operations (acres)^a
North Dakota			
Cropland	171.8	2,649	1,033
Grassland/rangeland	26.5	450	175
Upland forest	3.0	48	19
Riverine/open water	0.7	12	5
Forested wetlands	0.3	4	2
Emergent/shrub-scrub wetlands	13.7	187	73
Right-of-way	1.6		
Developed land	0.2	90	35
<i>North Dakota subtotal</i>	<i>217.8</i>	<i>3,440</i>	<i>1,342</i>
South Dakota			
Cropland	163.6	2,504	1,001
Grassland/rangeland	46.3	679	271
Upland forest	0	2	1
Riverine/open water	0.4	6	2
Forested wetlands	0.0	0	0
Emergent/shrub-scrub wetlands	7.0	98	39
Right-of-way	1.9		
Developed land	0.5	88	35
<i>South Dakota subtotal</i>	<i>219.9</i>	<i>3,377</i>	<i>1,349</i>
Nebraska			
Cropland	180.3	2,751	1,091
Grassland/rangeland	26.6	447	177
Upland forest	2.4	44	18
Riverine/open water	1.3	18	7
Forested wetlands	0.2	3	1
Emergent/shrub-scrub wetlands	1.6	22	9
Right-of-way	2.0		
Developed land	0.2	50	20
<i>Nebraska subtotal</i>	<i>214.6</i>	<i>3,335</i>	<i>1,323</i>
Kansas			
Cropland	71.7	1,348	438
Grassland/rangeland	16.9	349	113
Upland forest	7.4	115	37
Riverine/open water	1.1	16	5
Forested wetlands	0.3	8	3
Emergent/shrub-scrub wetlands	0.4	10	3
Right-of-way	0.8		
Developed land	0.1	25	8
<i>Kansas subtotal</i>	<i>98.7</i>	<i>1,871</i>	<i>608</i>

TABLE 3.5.5-1 (Continued)			
Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres)^a	Community Area Affected by Operations (acres)^a
Missouri			
Cropland	151.1	2,754	994
Grassland/rangeland	69.7	1,014	366
Upland forest	37.5	600	217
Riverine/open water	3.3	49	18
Forested wetlands	2.6	40	14
Emergent/shrub-scrub wetlands	2.4	36	13
Right-of-way	5.5		
Developed land	1.9	182	66
<i>Missouri subtotal</i>	<i>274.0</i>	<i>4,675</i>	<i>1,687</i>
Illinois			
Cropland	43.6	581	229
Grassland/rangeland	1.9	112	44
Upland forest	4.7	58	23
Riverine/open water	1.1	14	5
Forested wetlands	0.7	15	6
Emergent/shrub-scrub wetlands	2.7	58	23
Right-of-way	1.7		
Developed land	0.5	71	28
<i>Illinois subtotal</i>	<i>56.9</i>	<i>909</i>	<i>358</i>
Mainline Project			
Cropland	782.1	12,587	4,785
Grassland/rangeland	187.9	3,051	1,147
Upland forest	55.2	867	314
Riverine/open water	7.9	115	43
Forested wetlands	4.1	70	26
Emergent/shrub-scrub wetlands	27.8	411	160
Right-of-way	13.5		
Developed land	3.4	506	192
Mainline Project total	1,081.9	17,607	6,667

^a Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project. Acreage impacts for right-of-way areas are listed under the appropriate vegetation community. Data for operational impacts by vegetation communities were calculated based on the distribution of impacts for construction area by vegetation community and the total acres reported affected by operations.

Sources: TransCanada 2007a, c, d (Tables 2.1-2; 3.6-2; and 4.2-3).

**TABLE 3.5.5-2
Estimated Impacts on Vegetation Communities
for the Keystone Cushing Extension**

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres)^a	Community Area Affected by Operations (acres)^a
Nebraska			
Cropland	0.9	12	5
Grassland/rangeland	1.3	24	10
Upland forest	0.3	0	0
Riverine/open water	0.0	1	0
Forested wetlands	0.0	0	0
Emergent/shrub-scrub wetlands	0.0	0	0
Right-of-way	0.0		
Developed land	0.0	<1	0
<i>Nebraska subtotal</i>	<i>2.5</i>	<i>37</i>	<i>15</i>
Kansas			
Cropland	133.3	2,097	819
Grassland/rangeland	62.7	934	365
Upland forest	7.9	124	48
Riverine/open water	1.1	33	13
Forested wetlands	0.8	10	4
Emergent/shrub-scrub wetlands	1.1	14	5
Right-of-way	3.3		
Developed land	0.2	54	21
<i>Kansas subtotal</i>	<i>210.4</i>	<i>3,266</i>	<i>1,275</i>
Oklahoma			
Cropland	33.2	578	213
Grassland/rangeland	43.8	681	251
Upland forest	2.6	39	14
Riverine/open water	0.8	12	4
Forested wetlands	0.0	0	0
Emergent/shrub-scrub wetlands	0.8	10	4
Right-of-way	0.8		
Developed land	1.1	43	16
<i>Oklahoma subtotal</i>	<i>83.1</i>	<i>1,363</i>	<i>502</i>
Cushing Extension			
Cropland	167.4	2,687	1,042
Grassland/rangeland	107.8	1,639	628
Upland forest	10.8	163	63
Riverine/open water	1.9	46	18
Forested wetlands	0.8	10	4
Emergent/shrub-scrub wetlands	1.9	24	9
Right-of-way	4.1		
Developed land	1.3	97	37
Cushing Extension total	296.0	4,666	1,801

^a Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project. Acreage impacts for right-of-way areas are listed under the appropriate vegetation community. Data for operational impacts by vegetation communities were calculated based on the distribution of impacts for construction area by vegetation community and the total acres reported affected by operations.

Sources: TransCanada 2007a, c, d (Tables 2.1-2; 3.6-2; and 4.2-3)

**TABLE 3.5.5-3
Estimated Impacts on Vegetation Communities
for the Keystone Project**

Vegetation Community Classification	Length of Community Crossed (miles)	Community Area Affected during Construction (acres)^a	Community Area Affected by Operations (acres)^a
Mainline Project			
Cropland	782.1	12,587	4,785
Grassland/rangeland	187.9	3,051	1,147
Upland forest	55.2	867	314
Riverine/open water	7.9	115	43
Forested wetlands	4.1	70	26
Emergent/shrub-scrub wetlands	27.8	411	160
Right-of-way	13.5		
Developed land	3.4	506	192
<i>Mainline Project subtotal</i>	<i>1,081.8</i>	<i>17,607</i>	<i>6,667</i>
Cushing Extension			
Cropland	167.4	2,687	1,042
Grassland/rangeland	107.8	1,639	628
Upland forest	10.8	163	63
Riverine/open water	1.9	46	18
Forested wetlands	0.8	10	4
Emergent/shrub-scrub wetlands	1.9	24	9
Right-of-way	4.1		
Developed land	1.3	97	37
<i>Cushing Extension subtotal</i>	<i>296.0</i>	<i>4,666</i>	<i>1,801</i>
Keystone Project			
Cropland	949.5	15,274	5,827
Grassland/rangeland	295.7	4,690	1,775
Upland forest	66.1	1,030	377
Riverine/open water	9.8	161	61
Forested wetlands	4.9	80	30
Emergent/shrub-scrub wetlands	29.7	435	169
Right-of-way	17.6		
Developed land	4.7	603	229
Keystone Project total	1,377.8	22,273	8,468

^a Acres disturbed on a temporary basis (permanent right-of-way width plus temporary workspace) during construction, and acres disturbed (maintained) on a permanent basis during operation of the proposed Keystone Project. Acreage impacts for right-of-way areas are listed under the appropriate vegetation community. Data for operational impacts by vegetation communities were calculated based on the distribution of impacts for construction area by vegetation community and the total acres reported affected by operations.

Sources: TransCanada 2007a, c; d (Tables 2.1-2; 3.6-2; and 4.2-3).

**TABLE 3.5.5-4
Estimated Impacts on Grasslands Occurring
along the Keystone Project Route**

State and County	Type	Quality	Number Crossed	Milepost ^a
MAINLINE PROJECT				
North Dakota				
Cavalier	Tall grass prairie	Low	2	4–5
Pembina	Tall grass prairie	Low	3	6–8
Walsh	Tall grass prairie	Low	2	32–42
Nelson	Tall grass prairie	Medium	1	58–59
Barnes	Tall grass prairie	High to low	4	124–163
Ransom	Tall grass prairie	Medium to low	2	168–169
Sargent	Tall grass prairie	Medium	1	207–208
South Dakota				
Day	Tall grass prairie	High to low	3	258–267
Clark	Tall grass prairie	Medium	2	278–280
McCook	Tall grass prairie	Medium	1	385–386
Hutchinson	Tall grass prairie	High	1	392–393
Yankton	Tall grass prairie	High	2	422–424
Nebraska				
Cedar	Mixed grass prairie	High to low	4	440–457
Stanton	Mixed grass prairie	High to low	4	504–517
Colfax	Mixed grass prairie	Medium	1	542–543
Saline	Mixed grass prairie	Low	3	594–606
Jefferson	Mixed grass prairie	High to medium	5	624–644
Kansas				
Nemaha	Mixed grass prairie	Unknown	2	690–693
Brown	Mixed grass prairie	Unknown	2	711–712
Doniphan	Mixed grass prairie	Unknown	2	737–739
Missouri				
Clinton	Mixed grass prairie	Unknown	4	768–788
Chariton	Mixed grass prairie	Unknown	3	847–863
Randolph	Mixed grass prairie	Unknown	22	878–891
Audrain	Mixed grass prairie	Unknown	14	901–917
Illinois				
None				
Mainline Project subtotal			90	

TABLE 3.5.5-4 (Continued)				
State and County	Type	Quality	Number Crossed	Milepost ^a
CUSHING EXTENSION				
Nebraska				
Jefferson	Grassland	Unknown	7	0–2.5
Kansas				
Washington	Grassland	Unknown	22	3–31
Clay	Grassland	Unknown	26	33–59
Dickinson	Grassland	Unknown	49	63–98
Marion	Grassland	Unknown	50	100–132
Butler	Grassland	Unknown	59	136–177
Cowley	Grassland	Unknown	23	181–209
Oklahoma				
Kay	Grassland	Unknown	49	212–242
Noble	Grassland	Unknown	51	244–268
Payne	Grassland	Unknown	76	269–295
<i>Cushing Extension subtotal</i>			412	
Keystone Project total			502	

^a Approximate.

Sources: ENSR 2006a, b; ENSR 2007; TransCanada 2007d (Table 3.6-3).

Clearing trees within upland forest communities, including riparian forest, would result in long-term impacts on these vegetation communities, given the length of time needed for the community to mature to pre-construction conditions. Permanent impacts would occur within the 30-foot-wide permanent easement, where trees would be removed and prevented from reestablishing through the periodic mowing and brush clearing required for pipeline operation and inspections.

Impacts on shrubland also would be long term because of the time required to reestablish the woody vegetation characteristic of this community type. Permanent impacts on shrubland would result from vegetation clearing over a 10-foot-wide corridor centered over the pipeline and vegetation clearing at 3-year intervals within the 30-foot-wide permanent ROW in non-riparian areas. These clearing activities would prevent larger woody species from reverting to preconstruction form and size.

Operation of the Keystone project would cause slight increases in soil temperatures at the soil surface (from 1 to 2 °F) primarily during winter, and at depths of 6 inches (from 1 to 5 °F), with most notable increases during spring (March). While many species would not produce root systems that would penetrate much below 6 inches, the root systems of some species—notably native prairie grasses, trees and shrubs—often penetrate well below 6 inches. Soil temperatures closer to the pipeline burial depth of 6 feet may be as much as 30 °F warmer than the ambient surrounding soil temperatures. In general, increased soil temperatures during early spring would cause early germination and emergence in annual crops such as corn and soybeans and in tall-grass prairie species (TransCanada 2007c). Increased soil temperatures also may stimulate root growth in oak species (TransCanada 2007c).

To reduce impacts on vegetation within the construction and permanent ROWs and to improve the probability of successful revegetation of disturbed areas, Keystone would implement the following measures in its CMR Plan (Appendix B):

- Provide temporary and permanent erosion control measures.
- Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas.
- Restore pre-construction contours and natural drainage patterns.
- Fertilize and add soil pH modifiers in accordance with written recommendations from the local soil conservation authority.
- Monitor the ROW for the first year following construction and again during the second growing season; consider revegetation successful if density and cover are similar to adjacent undisturbed lands.
- Complete additional revegetation efforts until revegetation is deemed successful.
- Construction traffic shall be restricted to the construction ROW, existing roads, and approved private roads.
- Construction ROW boundaries, including pre-approved temporary workspaces, shall be clearly staked to prevent disturbance to unauthorized areas.
- If crops are present, they shall be mowed or disced to ground level unless an agreement is made for the landowner to remove for personal use.
- Burning is prohibited on cultivated land.
- The construction ROW at timber shelterbelts in agricultural areas shall be reduced to the minimum necessary to construct the pipeline.
- In agricultural lands, topsoil will be stripped from the area to a maximum of 12 inches.
- In non-cultivated agricultural lands, the actual depth of topsoil (up to 12 inches) shall be stripped from the areas to be excavated unless otherwise agreed to with the landowner.
- When grading is required, the topsoil shall be removed from the entire area to be graded and shall be stored.
- Stripped topsoil is to be stockpiled, and mixing of topsoil and subsoil is to be minimized.
- Topsoil will not be used to fill low areas.
- To prevent wind erosion, topsoil piles shall be tackified, as necessary, using either water or a suitable tackifier.
- The surface drainage network shall be maintained to prevent any accumulation of water.
- Topsoil shall not be used to construct ramps at road or water body crossings.
- Compaction shall be alleviated on all agricultural land crossed by construction equipment. Cropland that has been compacted will be ripped a minimum of three passes at least 18 inches deep, and all pasture and woodland shall be ripped or chiseled a minimum of three passes at least 12 inches deep.
- Areas stripped for topsoil salvage shall be ripped at 18 inches or less a minimum of three passes, graded, and smoothed prior to topsoil replacement.

- Topsoil shall be replaced to pre-existing depths once ripping and discing of subsoil is complete.
- Plowing under of organic matter, including wood chips, manure, or planting a new crop such as alfalfa, to decrease soil bulk density and improve soil structure or any other measures in consultation with the NRCS shall be considered if mechanical relief of compaction is deemed unsatisfactory.
- 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).
- The final seed mix shall be based on input from the local NRCS and availability of seed at the time of reclamation. The landowner may request specific seeding requirements during easement negotiations.
- Certificates of seed analysis shall be required for all seed mixes, to limit the introduction of noxious weeds.
- Seeds not used within 12 months of seed testing shall be approved by Keystone prior to use.
- Remove and dispose of excess mulch prior to seedbed preparation.
- Evenly re-apply and anchor temporary mulch following seeding.
- Seed at a rate appropriate for the region and stability of the reclaimed surface based on Pure Live Seed.
- Weather conditions, construction ROW constraints, site access, and soil type shall influence the seeding method used. Drill seed unless too steep, temporary cover crop seed shall be broadcast.
- Delay seeding until soil is in an appropriate condition for drill seeding.
- Use Truax or an equivalent-type drill seeder equipped with a cultipacker that is 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 and with an adjustable metering mechanism to accurately deliver the specified seeding rate and depth.
- Calibrate drill seeders so that the specified seeding rate is planted; row spacing shall not exceed 8 inches.
- Seep depths shall be consistent with local or regional agricultural practices.
- Broadcast or hydro-seeding shall be used in lieu of drilling. For these uses, double the recommended seeding rates and use a harrow, cultipacker, or other equipment immediately following broadcasting to incorporate the seed to the specified depth and to firm the seedbed.
- Hand rake all areas that are too steep or otherwise cannot be safely harrowed or cultipacked.
- Use hydro-seeding on a limited basis, where the slope is too steep or soil conditions do not warrant conventional seeding methods.

3.5.5.2 Vegetation Communities of Conservation Concern

Construction effects on previously untilled native prairies may be irreversible, as destruction of the prairie sod during trenching may require more than 100 years for recovery. Short-grass prairie and mixed-grass prairie areas may take 5 or more years to become reestablished due to poor soil conditions and low moisture levels. Invasion of non-native plants also may prevent recovery of prairie grasslands, especially as these are related to altered land management that would require suppression of wildfires that maintain

prairie sod. An estimated minimum of 29 miles of native prairie and/or grasslands would be affected during construction of the Keystone Project (Table 3.5.5-4). These impacts would contribute to the decline in native grasslands described in Table 3.5.2-1 and represent an additional loss to current grassland areas across the Keystone Project area.

To minimize impacts to native prairie communities, Keystone would implement the following measures in its CMR Plan (Appendix B):

- Siting extra workspaces outside of native prairie habitats,
- Minimizing the width of the construction area within native prairie areas, and
- Continuing consultation with federal and state management agencies on avoidance of native prairie impacts.
- Contracting a qualified biologist to conduct a survey of sensitive species associated with native tall-grass prairie.
- Monitoring restoration in native prairies to ensure that native species become established and to ensure no net loss of native prairie habitats

If sensitive species are identified in the construction ROW, Keystone would work with the relevant regulatory authorities to determine whether any additional protection measures would be required. Once construction is complete, disturbance in native prairie would be reclaimed to native prairie species, using native seed mixes specified by applicable state and federal agencies such that no net loss of native prairie habitat would occur. To minimize impacts on native prairie, no permanent developments (such as access roads or pump stations) would be constructed in native prairie tracts, if possible.

The following measures would further minimize or mitigate impacts on native prairie communities:

- Encouraging private landowners to replant native prairie communities disturbed during construction with native prairie species.
- Mitigating any remaining unavoidable impacts to native prairie communities at a minimum replacement/restoration of 1 acre of native prairie for each acre of native prairie impact; mitigation compensation should occur offsite and onsite, which may involve a restoration or preservation program (Larry Svoboda, EPA, May 3, 2007).

Native forests, especially forested floodplains, are also of conservation concern. Native wooded communities were once an integral component of the landscape throughout the Great Plains. Many of these communities have been lost due to land conversion to agricultural uses, levee construction, and urban development. An estimated 867 acres of upland forests and 70 acres of forested wetlands would be cut down during construction of the Mainline Project. An estimated 163 acres of upland forests and 10 acres of forested wetlands would be cut down during construction of the Cushing Extension. An estimated 314 acres of upland forests and 26 acres of forested wetland would not be allowed to reestablish within the permanently maintained 30-foot Mainline Project ROW. An estimated 63 acres of upland forest and 4 acres of forested wetlands would not be allowed to reestablish within the permanently maintained 30-foot Cushing Extension ROW. While these areas represent a small proportion of the total area affected by construction of the Keystone Project, these forested communities are already reduced in most areas.

Keystone would implement the following measures in its CMR Plan (Appendix B) for forested uplands and wetlands:

- Prior to the start of clearing, clearly stake ROW boundaries, including pre-approved temporary workspaces, to prevent disturbance to unauthorized areas.
- Consult with the landowner to determine whether any trees are of commercial or other value to the landowner. Salvage timber as requested by the landowner.
- Grub tree stumps only 5 feet on either side of the trench line and only where necessary for grading a level surface for pipeline construction equipment to operate safely.
- Follow the landowner's desires in the easement agreement regarding the disposal of trees, brush, and stumps of no value to the landowner by burning, burial, or complete removal from any affected property.
- Use cut-off-type saw equipment for timber salvage operations. Undertake felling in a manner that minimizes butt shatter, breakage, and off-ROW disturbance. Use skidders or alternate equipment to transport salvaged logs to stacking sites.
- Fell trees in such a way that they fall toward the centre line of the ROW, to avoid breaking trees and branches off the ROW. Salvage leaners or felled trees that inadvertently fall into adjacent undisturbed vegetation.
- Recover and dispose of trees and slash falling outside the ROW.
- Limb and top salvaged logs before removal from the construction ROW. Orient log decks (if required) to best facilitate loading by picker trucks and locate them adjacent to the working side of the ROW where possible.
- The Contractor would not be allowed to dispose of woody debris in wooded areas along the pipeline ROW.
- Prune branches hanging over the ROW 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 should be preserved.
- All tree wastes, stumps, tree crown, brushes, branches, and other forest debris will be either burned, chipped (using a mobile chipper), buried (with landowner approval), or removed from the ROW. 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 will not prevent revegetation of grass.
- Stump removal and brush clearing would be performed with bulldozers equipped with brush rakes to preserve organic matter.
- Establish decking sites, approximately 2,000 feet apart in timbered areas, on sites located on approved temporary workspaces in existing cleared areas, and size them appropriately to accommodate the loading equipment.
- The Contractor would remove decked timber from the construction ROW and transport it to a designated all-weather access point or mill if the landowner does not want the timber.

The following measures would further minimize or mitigate impacts on native forest communities:

- Siting extra workspaces outside of forested areas (John Cochnar, USFWS, May 27, 2007).
- Minimizing the width of the construction area (John Cochnar, USFWS, May 27, 2007).
- Mitigating unavoidable impacts to native wooded communities at a minimum replacement of 2 acres of native forest for each acre of native forest impact; higher ratios may be applicable if mitigation ratios already have been determined for specific habitat at the state level by federal and/or state resource agencies (John Cochnar, USFWS, May 27, 2007).
- Evaluating terrestrial vegetation impacts and habitat fragmentation impacts to the Mississippi/Missouri Confluence COA in St. Charles and Lincoln Counties in Missouri and to the COE lands in the Carlyle Lake WMA in Fayette County, Illinois to determine compensatory mitigation for impacts to these habitats (St. Louis District COE, May 2007).
- Continuing consultation with federal and state management agencies on avoidance of forested community impacts.

3.5.5.3 Conservation Reserve Program

Temporary and permanent impacts on CRP land generally would be the same as those described above for vegetation. Keystone has committed to avoiding two of the three NRCS Wetlands Reserve Program (WRP) lands potentially crossed by the pipeline ROW. The NRCS has agreed that Keystone may cross the third WRP tract, subject to an appropriate restoration agreement.

3.5.5.4 Noxious Weeds

After disturbances to the soil, vegetation communities can be susceptible to infestations of invasive or noxious weed species. Vegetation removal and soil disturbance during construction could create optimal conditions for the establishment of undesirable species. Construction equipment traveling from weed-infested areas into weed-free areas could disperse invasive or noxious weed seeds and propagates, resulting in the establishment of noxious weeds in previously weed-free areas.

A number of federal and state agencies submitted comments requesting that disturbed areas be revegetated with native plant species that currently are found in the Keystone Project area. Keystone has agreed to recommend to private landowners that revegetation occur using native plant species. The ultimate decision on the revegetation approach would be made by each individual landowner. Keystone proposes to control the introduction and spread of noxious weeds by implementing the construction and restoration procedures detailed in its CMR Plan (Appendix B). The plan includes coordination with appropriate local, state, and federal agencies to:

- Obtain written recommendations from local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specification; and
- Develop specific procedures in coordination with the appropriate agency to prevent the introduction or spread of noxious weeds resulting from construction and restoration activities, including:
 - Ensuring that all soil imported for agricultural or residential use has been certified as weed-free,

- Ensuring that only weed-free straw or hay for sediment control devices or mulch application,
- Cleaning all equipment and vehicles prior to beginning of construction, and
- Monitoring restoration for 3 years following construction in wetlands and during the first and second growing seasons in uplands as required by federal and state regulators.

Weed control addressed in Section 2.13 of Keystone’s CMR Plan (Appendix B) includes the following measures:

- Thoroughly clean all construction equipment, including timber mats, prior to moving the equipment to the job site, using high-pressure washing equipment.
- Mark all areas of the ROW that contain infestations of noxious, invasive species or soil-borne pests. Clean the tracks, tires, and blades of equipment by hand or compressed air to remove excess soil prior to movement of equipment out of weed- or soil-borne pest-infested areas.
- Use mulch and straw or hay bales that are free of noxious weeds for temporary erosion and sediment control.
- Implement best management practices for vegetation control, including use of agricultural herbicides in consultation with county or state regulatory agencies based on the weed species requiring control.
- Apply 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.
- Where required, apply herbicides by state-licensed or -certified personnel, within 1 week or as deemed necessary for optimum mortality success prior to disturbing the area by clearing, grading, trenching, or other soil-disturbing work.
- Prohibit application of herbicides in or within 100 feet of a wetland or water body.
- Provide weed control on the construction ROW with Keystone surface jurisdiction (i.e., valve sites, metering station, and pump stations).
- Reimburse landowners adjacent to aboveground facilities when landowners must control weeds determined to have spread from land with Keystone aboveground facilities.

As a result of this environmental analysis and based on comments received from regulatory agencies, Keystone has agreed to the following additional mitigation measures:

- Develop a project-wide general Noxious Weed Control Plan (NWCP) that would address pre-construction noxious weed surveys, control methods, herbicide application, equipment washing, and post-construction monitoring.
- Ensure that the NWCP provides for cleaning or washing of equipment used to clear and grade the ROW at an appropriate location to avoid transfer of noxious weeds across the Kansas/Oklahoma state line.

3.5.5.5 Connected Actions

Power Lines and Substations. The primary impacts on vegetation from construction or modification of Western’s transmission lines to provide electric power to pump stations would be cutting, clearing, or removing the existing vegetation within the construction work area and potential invasion by

noxious weeds. In general, transmission line construction impacts to vegetation would be minor, as most transmission lines would run alongside existing roadways. Trees generally would be removed from the transmission line ROW, and the ROW would be maintained free of woody vegetation. Total miles of terrestrial vegetation affected during construction and operation of Western's 193 miles of new transmission lines for the Mainline Project and the Cushing extension is presented in Table 3.5.5-5.

TABLE 3.5.5-5								
Estimated Impacts on Vegetation Communities Crossed by Proposed Electric Transmission Lines for the Keystone Project								
	Community Length Crossed by Right-of-Way (miles)							
	North Dakota	South Dakota	Nebraska	Kansas	Oklahoma	Missouri	Illinois	Totals
Mainline Project								
Cropland and pasture	18.1	50.4	30.0	15.8		1.7		116.0
Cropland/grassland mosaic	31.7	13.9	0.3			5.0	0.0	50.9
Cropland/woodland mosaic	10.0					0.7	0.9	11.6
Grassland			0.6				0.1	0.7
Savanna						0.3		0.3
<i>Mainline Project subtotal</i>	<i>59.8</i>	<i>64.3</i>	<i>30.9</i>	<i>15.8</i>		<i>7.6</i>	<i>1.1</i>	<i>179.5</i>
Cushing Extension								
Cropland and pasture				2.6	0.3			2.8
Cropland/grassland mosaic								0.0
Cropland/woodland mosaic								0.0
Grassland				4.5				4.5
Savanna				4.5				4.5
<i>Cushing Extension subtotal</i>				<i>11.5</i>	<i>0.3</i>			<i>11.8</i>
Keystone Project								
Cropland and pasture	18.1	50.4	30.0	18.4	0.3	1.7		118.9
Cropland/grassland mosaic	31.7	13.9	0.3			5.0	0.0	50.9
Cropland/woodland mosaic	10.0					0.7	0.9	11.6
Grassland			0.6	4.5			0.1	5.2
Savanna				4.5		0.3		4.8
Keystone Project total	59.8	64.3	30.9	27.3	0.3	7.6	1.1	191.3

Note: Length of vegetation community impacts was calculated from land cover mapping (USGS 1998) and proposed transmission line routes provided by Keystone. Total inexact due to rounding.

Sources: USGS1998; TransCanada 2007d, transmission line route sheets.

Measures listed below would be implemented by servicing electric cooperatives or their contractors in the modification or construction of transmission lines:

- ROW would be located to avoid sensitive vegetation conditions including wetlands where practical, or, if they are linear to cross them at the least sensitive feasible point.
- Clearing for the access roads would be limited to only those trees necessary to permit the passage of equipment.
- Water bars or small terraces would be constructed across all ROW and access roads on hillsides to prevent water erosion and to facilitate natural revegetation.
- Western or its contractor would exercise care to preserve the natural landscape and would conduct construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, approved construction roads, or excavation operations, all trees, native shrubbery, and vegetation would be preserved and would be protected from damage by construction operations and equipment.
- Construction staging areas would be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. On abandonment, all storage and construction buildings, including concrete footings and slabs, and all construction materials and debris would be removed from the site. The area would be regraded as required so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that would facilitate natural revegetation, provide for proper drainage, and prevent erosion.
- Topsoil would be removed, stockpiled, and respread at all heavily disturbed areas not needed for maintenance access.
- All construction equipment and vehicles would be pressure-washed (especially the undercarriage) to remove foreign soil and debris that may introduce weeds into the project area.
- On completion of the work, all work areas except access roads needed for maintenance would be scarified or left in a condition which would facilitate natural revegetation, provide for proper drainage, and prevent erosion. All destruction, scarring, damage, or defacing of the landscape resulting from Western or its contractor's operations would be repaired.
- If revegetation is required, regionally native plants would be used.

Wood River Refinery Expansion. No impacts related to terrestrial vegetation are associated with the Wood River Refinery Expansion other than those evaluated as part of that project.

3.5.6 References

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