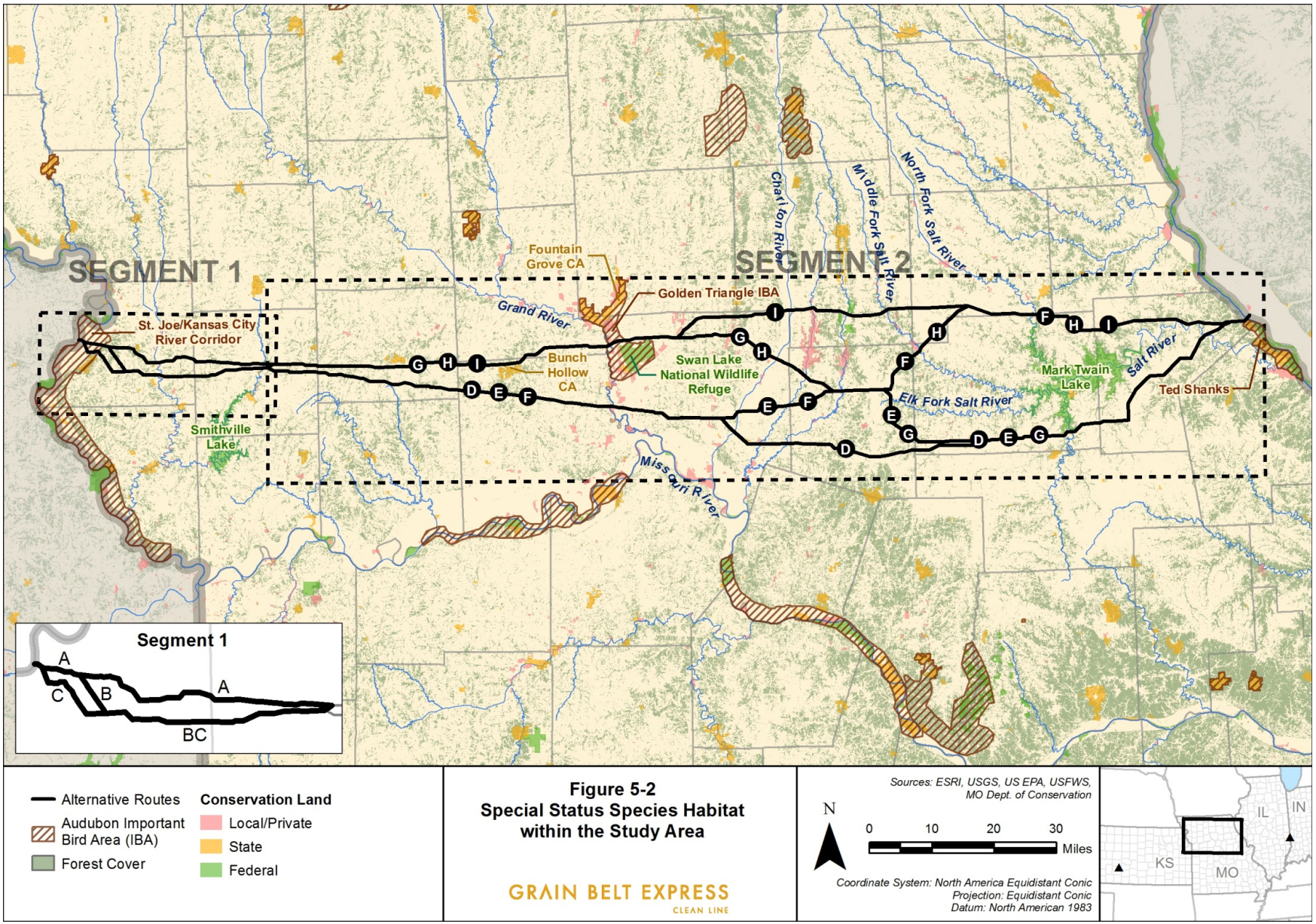

SEGMENT 1
SEGMENT 2
St. Joe/Kansas City River Corridor
Fountain Grove CA
Golden Triangle IBA
Grand River
Bunch Hollow CA
Swan Lake National Wildlife Refuge
Smithville Lake
Missouri River
Chariton River
Middle Fork Salt River
North Fork Salt River
Elk Fork Salt River
Salt River
Mark Twain Lake
Ted Shanks
A
B
C
BC
Segment 1
Alternative Routes
Audubon Important Bird Area (IBA)
Forest Cover
Conservation Land
Local/Private
State
Federal
Figure 5-2
Special Status Species Habitat within the Study Area
GRAIN BELT EXPRESS
CLEAN LINE
Sources: ESRI, USGS, US EPA, USFWS, MO Dept. of Conservation
N
0 10 20 30
Miles
Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983
IL
IN
KS
MO

General Impacts and Mitigation Measures

Vegetation and Habitats

During construction, trees and other tall growing vegetation within the ROW would be removed to maintain appropriate clearances for the conductors. Tall growing vegetation and the associated habitat would be removed from the ROW for the life of the transmission line. Smaller shrub species (less than 10 feet high) or grasses would be encouraged to grow where compatible (i.e., non-farmed areas). In pasture/grassland areas, little vegetation clearing would be required, and permanent impacts would be limited to the foundations of the structures and any areas requiring permanent access roads.

After construction, access roads can be re-vegetated with native grasses or agricultural crops. For areas where a road was cut into the landscape, the road can either be reclaimed back to the original grade or the road bed left in place and re-vegetated for future maintenance needs. Whether or not a road is reclaimed would depend on several factors, including landowner negotiations and the need to access that particular section of the transmission line in the future.

Wildlife

Impacts to wildlife would either be short or long term, depending on the type of impact and nature of the species impacted. Short-term impacts may include temporary displacement from an area due to construction-related noise or temporary modifications in habitat. Long-term impacts occur if the habitat for the species is permanently removed, such as with the conversion of forested habitat to grassland, or less obviously, when the Project introduces a new feature that degrades the overall quality of the habitat for certain species.

Project construction will require forest clearing for ROW construction. In areas where the ROW would be constructed through large relatively undisturbed tracks of forest, the ROW clearing would fragment the forest creating new edge habitat and decrease the interior forest habitat size. Although edge habitat supports a wide diversity and abundance of species, species that require intact interior forest habitats would lose habitat, possibly altering distribution and migration patterns and isolating habitat patches. These effects can be minimized when paralleling an existing ROW because any additional clearing of habitat adjacent to the existing ROW would only result in additional habitat loss but not a new fragmentation impact. Although interior habitat patch size may decrease, it would not decrease to the same extent, and forest fragmentation effects would be considered minimized when compared to clearing through large intact forested areas.

It should be noted, however, that any impacts on habitats should be considered with respect to the current status of suitable habitats and the nature of the current wildlife assemblage. Many of the native grasslands and forest, savanna, and woodland habitats in the Study Area have long been cleared and are tilled yearly for farming. Species that are currently associated with these

converted habitats are typically tolerant of farming operations. Forest-dwelling species located adjacent to agriculture settings are typically either endemic to or tolerant of edge-type habitats. For many of the species now present, additional permanent impacts would be either unlikely or negligible as a result of the construction of the Project, especially when considering the nature of the species present and the ongoing impacts of other area land uses.

Avian collisions with power lines are a recognized concern for transmission line development. Typically, the risk of avian collision is associated with the smaller diameter and less visible shield wire. In areas with high bird use, collision risk can be avoided or minimized by marking the wire to increase visibility. To minimize avian risk, Grain Belt Express will develop an Avian Protection Plan in accordance with the suggested guidance and best practices identified by the Avian Power Line Interaction Committee. The Avian Protection Plan will evaluate potential risks to avian species and develop specific measures to avoid, minimize, and mitigate avian collisions with the transmission line.

Alternative Comparison

The potential for each Alternative Route to impact habitats and wildlife can be generally assessed by comparing each Alternative Route with respect to the amount of natural land cover types crossed such as forested land cover, wetlands, and grassland areas. Additional assessment criteria include the length of each route through grassland/pasture habitats and the length of new transmission line paralleling existing transmission lines and other linear features.

Segment 1

The Alternative Routes are generally similar with respect to total length and acres of wetland, forested land, and pasture/grasslands crossed; however, Alternative Route B crosses the fewest acres of forested area and grassland (see **Table 5-3**). Both Alternative Routes A and B parallel existing linear features with Alternative Route A paralleling the Rockies Express/Keystone Pipeline and Alternative Route B paralleling both the Rockies Express/Keystone pipeline and the Nashua – Lake Road 161 kV transmission line. Given that Alternative Route B has the fewest acres of forested and grassland habitats crossed and is parallel to existing linear infrastructure, Alternative Route B is anticipated to have the least impact to habitat and wildlife.

Table 5-3. Wildlife Habitat within Segment 1			
	Alternative Routes		
	A	**B**	**C**
Total Length (miles)	33.0	33.3	33.9
Habitat Type (within ROW)			
Forested (acres)[1]	162	124	168
Wetlands (acres)	41	36	33
Pasture/grasslands (acres)	187	163	169
Parallel with Existing Linear Features			
Parallel transmission ROW (miles)	0.5	4.4	-
Parallel pipeline ROW (miles)	6.3	0.7	-

[1]Includes forest, woodland, savanna, and forested riparian

Segment 2

Segment 2 is considerably longer than Segment 1 and, therefore, crosses more acres of forest and grassland habitat (**Table 5-4**). Windbreak forest cover and hedgerows are less frequent farther east with much of the forest cover occurring in the drainages and on steeper hillsides that are less suitable for farming. Alternative Route D has the fewest acres of forested habitat and Alternative Route H has the most. The number of acres of grassland habitat crossed is nearly the same across all Alternative Routes; however, Alternative Routes D and F cross slightly fewer acres of grassland. Alternative Route D also crosses the fewest acres of wetlands, while Alternative Routes F and I cross the most. Alternative Routes D, E, and F are located farther from Swan Lake National Wildlife Refuge, approximately 5 miles south. Alternative Routes G, H, and I are within 0.5 mile of the northern boundary of the refuge and cross an Important Bird Area (as designated by the Audubon Society) associated with the refuge.

All of the Alternative Routes parallel existing linear infrastructure for a portion of their length. Alternative Routes D, E, and F parallel more linear infrastructure than Alternative Routes G, H, or I. Given that Alternative Route D has the fewest acres of forested areas, grassland habitat, and wetlands, parallels existing linear infrastructure, and is farthest from Swan Lake National Wildlife Refuge, it is anticipated that Alternative Route D would have the least potential impact to wildlife and habitat.

Table 5-4. Wildlife Habitat within Segment 2						
	Alternative Routes					
	D	**E**	**F**	**G**	**H**	**I**
Total Length (miles)	172.4	176.5	169.4	177.5	170.4	163.2
Habitat Type (within ROW)						
Forested (acres)	759	813	937	932	1,056	1,054
Wetlands (acres)	118	129	132	137	141	143
Pasture/grassland (acres)	1,154	1,194	1,161	1,239	1,206	1,221
Length of Parallel to Existing Linear Features						
Parallel transmission ROW (miles)	10.3	31.0	25.7	39.0	33.6	4.3
Parallel pipeline ROW (miles)	44.6	39.3	39.3	-	-	-

5.1.3 Special Status Species

Grain Belt Express coordinated with USFWS, MDC, and The Nature Conservancy to identify threatened and endangered species or sensitive species that may potentially be affected by the Project. A search of the USFWS and Missouri Natural Heritage Program (MONHP) websites resulted in a list of threatened and endangered and rare wildlife and plant species with known current ranges within the counties where the Alternative Routes occur (USFWS 2013b; MONHP 2013; MDC 2013). **Table 5-5** presents all federally listed and state-listed species that may occur in the counties crossed by the Alternative Routes. Specific information for the location of known occurrences of federally threatened or endangered species is not publically available in Missouri; therefore, potential impacts to sensitive species were analyzed by the potential for suitable habitat to occur along the Alternative Routes.

Federal Species

According to the USFWS' *Missouri County Distribution of Federally-Listed Threatened, Endangered, Proposed, and Candidate Species* list (USFWS 2013b) and the Missouri Species and Communities of Conservation Concern Checklist (MDC 2013), one federally threatened plant species (eastern prairie fringed orchid), ten federally endangered species (gray bat, Indiana bat, interior least tern, Topeka shiner, pallid sturgeon, shovelnose sturgeon, spectaclecase, fat pocketbook, Higgins eye, and sheepnose), and one proposed federally endangered species (northern long-eared bat) have known current ranges within the counties crossed by the Alternative Routes (see **Table 5-5**). Additionally, according to the USFWS's species occurrence database, all counties crossed by the Alternative Routes have potential habitat for Indiana bat

Table 5-5. Federal and State Special Status Species												
Common Name	**Scientific Name**	**Status[1]**	**Habitat Association**	**Known Current Range Within Study Area**								
				Segment 1			**Segment 2**					
				A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Mammals												
Gray bat	*Myotis grisescens*	FE/SE	Caves	-	-	-	X	X	X	X	X	X
Northern long-eared bat	*Myotis septentrionalis*	FPE	Caves, mines, woodland, forest	X	X	X	X	X	X	X	X	X
Indiana bat	*Myotis sodalis*	FE/SE	Caves, mines, stream corridors, riparian, forest	X	X	X	X	X	X	X	X	X
Plains spotted skunk	*Spilogale putorius*	SE	Grassland, forest, brushy areas, cultivated land	X	X	X	X	X	X	X	X	X
Birds												
American bittern	*Botaurus lentiginosus*	SE	Marsh	X	X	X	X	X	X	X	X	X
Northern harrier	*Circus cyaneus*	SE	Marsh, grassland, shrubland	X	X	X	X	X	X	X	X	X
Snowy egret	*Egretta thula*	SE	Marsh, lowland forest	X	X	X	X	X	X	X	X	X
Peregrine falcon	*Falco peregrinus*	SE	River bluffs, tall buildings	X	X	X	X	X	X	X	X	X
King rail	*Rallus elegans*	SE	Marsh, wetlands, river floodplains	-	-	-	-	-	-	-	-	-
Interior least tern	*Sterna antillarum athalassos*	FE/SE	Bare alluvial deposits	X	X	X	X	X	X	X	X	X
Greater prairie-chicken	*Tympanuchus cupido*	SE	Grassland, oak woodland	-	-	-	X	X	X	X	X	X

Table 5-5. Federal and State Special Status Species													
Common Name	**Scientific Name**	**Status[1]**	**Habitat Association**	**Known Current Range Within Study Area**									
				Segment 1			**Segment 2**						
				A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Reptiles													
Western massasauga	*Sistrurus tergeminus tergeminus*	SE	Bottomlands, wet grasslands	-	-	-	X	X	X	X	X	X
Fish													
Lake Sturgeon	*Acipenser fulvescens*	SE	Mississippi and Missouri Rivers	X	X	X	X	X	X	X	X	X
Topeka shiner	*Notropis topeka*	FE/SE	Small to large streams	-	-	-	X	X	X	X	X	X
Pallid sturgeon	*Scaphirhynchus albus*	FE/SE	Mississippi and Missouri Rivers	X	X	X	X	X	X	X	X	X
Shovelnose sturgeon	*Scaphirhynchus platorynchus*	FE/SA	Mississippi and Missouri Rivers	X	X	X	X	X	X	X	X	X
Flathead chub	*Platygobio gracilis*	SE	Mississippi and Missouri Rivers	X	X	X	X	X	X	X	X	X
Invertebrates													
Spectaclecase	*Cumberlandia monodonta*	FE	Mississippi River	-	-	-	X	X	X	X	X	X
Ebonyshell	*Fusconaia ebena*	SE	Mississippi and Missouri Rivers	-	-	-	X	X	X	X	X	X
Fat pocketbook	*Potamilus capax*	FE/SE	Rivers in Marion, Pike, and Ralls Counties	-	-	-	X	X	X	X	X	X

Table 5-5. Federal and State Special Status Species													
Common Name	**Scientific Name**	**Status[1]**	**Habitat Association**	**Known Current Range Within Study Area**									
				Segment 1			**Segment 2**						
				A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Higgins eye	*Lampsilis higginsii*	FE/SE	Mississippi River	-	-	-	-	-	-	-	-	-
Sheepnose	*Plethobasus cyphyus*	FE/SE	Mississippi River	-	-	-	X	X	X	X	X	X
Plants													
Eastern prairie fringed orchid	*Platanthera leucophaea*	FT/SE	Mesic to wet prairies and meadows	-	-	-	X	X	X	X	X	X

[1]FE= Federally Endangered FT= Federally Threatened FPE= Federally Proposed Endangered FT/SA=Threatened/Similar Appearance SE=State Endangered ST=State Threatened

and northern long-eared bat. All counties, with the exception of Buchanan County, also have potential habitat for gray bats. The following sections describe habitat characteristics for each species.

Mammals

Gray Bat

Gray bats are most commonly associated with caves within 2 miles of rivers, streams or lakes, where they hibernate and form maternity and nursery colonies. During summer, gray bats forage in areas with open water of rivers, streams, lakes, or reservoirs with most foraging locations relatively near caves (USFWS 2013b). Forested corridors near caves serve as important dispersal routes to foraging habitats. Gray bats have been found in at least 219 caves in Missouri. Overall the species is recovering, and numbers have increased significantly in many areas (USFWS 2009a).

In Missouri, most known gray bat caves are located south of the Missouri River and are associated with Ozark Plateau region, although a few exist north of the river (USFWS 2013b). The gray bat is known to occur in all counties, except Buchanan County (USFWS 2013b). USFWS has not designated critical habitat for the gray habitat; however, in 1982, priority caves were designated for the recovery of this species (USFWS 1982). Gray bat caves were assigned priority numbers based on biological significance, location, and vulnerability. Priority 1 caves are major hibernacula and their most important maternity colonies. Priority 2 caves are those containing fewer bats that are important for geographic or other reasons. Priority 3 caves are those that require further investigation. Priority 4 caves are all remaining known caves, most of which are of marginal consequence and require no action (USFWS 1982). None of the Priority 1, 3, or 4 hibernacula occurs within counties crossed by the Alternative Routes. However, Ralls County contains a Priority 2 hibernacula. Priority 2 hibernacula contain fewer gray bats that receive consideration when possible, especially in marginal areas of the species' range where large colonies do not exist (USFWS 1982).

Northern Long-eared Bat

Northern long-eared bats are known to occur statewide in Missouri. They roost and forage in deciduous upland and riparian forests, using snag or den trees 9 to 36 inches in diameter at breast height with loose bark, during the spring and summer. In autumn, they swarm in wooded areas surrounding caves and mines where they hibernate (USFWS 2013b).

USFWS issued a proposal to list the northern long-eared bat as endangered in October 2013, with an extended public comment period open until January 2, 2014. The primary threat to northern long-eared bats is a disease called white-nose syndrome, which has killed an estimated 5.5 million cave hibernating bats in the United States and Canada. Other threats include destruction, modification, or curtailment of its habitat or range and man-made factors affecting

its continued existence. These threats combined with white-nose syndrome heighten the level of risk. The USFWS has not proposed critical habitat for the northern long-eared bat at this time. The northern long-eared bat uses habitat similar to the Indiana bat and therefore the measures identified to avoid and minimize threats to Indiana bats would also apply to northern long-eared bats. These habitat conditions, threats, and minimization efforts are discussed below in the section for Indiana bat.

Indiana Bat

Indiana bats are known to occur statewide in Missouri where they hibernate in limestone caves or, occasionally, in abandoned mines (USFWS 2013b). In spring, reproductive females migrate from winter hibernacula to summer roost habitats where they form maternity colonies in forested habitats and they bear and raise their young. Maternity colonies specifically occur in the voids created by the exfoliating bark of dead trees greater than 9 inches in diameter at breast height that retain large, thick slabs of peeling bark. Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities (USFWS 2007).

Males and non-reproductive females typically do not roost in maternity colonies and may stay close to their hibernaculum or migrate to summer habitat. Summer roosts are typically also behind exfoliating bark of large, often dead, trees that are within canopy gaps in a forest, in a fence line, or along a wooded edge. Indiana bats forage in or along the edges of forested areas and riparian areas eating a variety of flying insects found along rivers or lakes and in uplands. Both males and females return to hibernacula in late summer or early fall to mate and enter hibernation (USFWS 2007).

Missouri is included in the Ozark-Central Recovery Unit for the Indiana bat. These recovery units serve to protect both core and peripheral populations. No designated critical habitat for Indiana bat occurs within counties crossed by the Alternative Routes. Clinton, Chariton, Macon, and Monroe counties have known summer records of Indiana bat. Indiana bat hibernacula were assigned priority numbers based on the number of Indiana bats they contained. Priority 1 hibernacula are essential to the recovery and long-term conservation of the Indiana bat and typically have winter populations with greater than 10,000 individuals. Priority 2 hibernacula typically contain between 1,000 and 10,000 bats. Priority 3 hibernacula have populations have between 50 to 1,000 bats, and Priority 4 have less than 50 bats. None of the Priority 1 through 3 hibernacula occur within counties crossed by the Alternative Routes. Missouri has 20 recorded maternity colonies of Indiana bat, including in Chariton, Macon, and Monroe counties, which are crossed by the Alternative Routes. These records are based on the presence of reproductively active females and/or juveniles between May 15 and August 15 (USFWS 2007).

Threats vary during the annual cycle. During hibernation, threats include modifications to caves and mines and human disturbance. During summer months, possible threats relate to the loss and degradation of forested habitat. Seasonal clearing restrictions, including not cutting potential roost trees, during the period when bats occupy their summer range minimizes the potential that a roost tree would be cut and greatly reduces the potential for death or injury to large numbers of bats. Migration pathways and swarming sites may also be affected by habitat loss and degradation; however, little is known about the migratory habits and habitats of the Indiana bat

Birds

Interior Least Tern

Interior least terns formerly nested along the Missouri River; however, nesting colony occurrence in Missouri is now restricted to a few sand islands along the lower Mississippi River near the Bootheel in Missouri. Nesting occurs on sand bars and islands in areas where vegetation is sparse or absent. They are rare summer residents in Missouri occurring in counties crossed by the Alternative Routes, including Buchanan, Chariton, and Clinton (USFWS 2013b). The Project is not anticipated to impact the interior least tern.

Fish

Topeka Shiner

The Topeka shiner lives in small to mid-size prairie streams in the central United States where it is usually found in pool and run areas with clear water and sand, gravel, or rubble bottoms. The Topeka shiner is restricted primarily to central Missouri with a few isolated populations in northern Missouri. According to USFWS, the Topeka shiner may still occur in Caldwell and Randolph counties (USFWS 2013b). However, in the five year review of the species conducted in 2009, only two watersheds in Missouri were documented as still having populations of the Topeka shiner, the Moniteau Creek Watershed and the Sugar Creek Watershed (USFWS 2009b). Neither of these watersheds are crossed by the Alternative Routes. Based on this information, the Topeka shiner most likely does not occur in the Project area. However, if the fish is present, the Project is still not anticipated to impact the Topeka shiner because the Project would span all streams and implement best management practices to control any potential sediment or erosion into streams.

Pallid Sturgeon

The pallid sturgeon inhabits main channels of large, excessively turbid rivers and is commonly found in areas with swift currents and a firm sand substrate. In Missouri, the pallid sturgeon is restricted to the main stem of the Missouri River and the middle and lower portions of the Mississippi River. This species is known to occur in counties crossed by the Alternative Routes, including Buchanan, Carroll, Chariton, and Livingston (USFWS 2013b). The Missouri and Mississippi rivers would be spanned, and no structures will be placed in the river. In addition,

appropriate best management practices would be implemented to mitigate any potential erosion or sediment control impacts per state land disturbance permits for construction activities. Therefore, the Project is not likely to have any impact on the pallid sturgeon.

Shovelnose Sturgeon

The shovelnose sturgeon is the most abundant sturgeon in the Missouri and Mississippi rivers, inhabiting open channels where there is a swift current over a sand or gravel substrate. This species is known to occur in counties crossed by the Alternative Routes, including Buchanan, Carroll, Marion, and Ralls (USFWS 2013b). The Missouri and Mississippi rivers would be spanned, and no structures would be placed in the river; therefore, the Project is not likely to have any effect on the shovelnose sturgeon.

Invertebrates

Spectaclecase

Spectaclecase mussels are found in large rivers having riffles and a stable bottom of large rocks or boulders where they live in areas sheltered from the main force of the river current. The species often clusters in firm mud and in sheltered areas, such as beneath rock slabs, between boulders, and under tree roots. This species is known to occur on the Mississippi River in Ralls County, which is crossed by the Alternative Routes (USFWS 2013b). The Mississippi River would be spanned, and no structures will be placed in the river; therefore, the Project is not likely to have any impact on the spectaclecase.

Fat Pocketbook

The fat pocketbook mussel prefers sand, mud, and fine gravel bottoms of large rivers. It buries itself in these substrates in water ranging in depth from a few inches to 8 feet with only the edge of its shell and its feeding siphons exposed. The fat pocketbook occurs in the upper Mississippi River. Presently, its largest populations occur in dredged ditches of the Missouri Bootheel. The fat pocketbook has been found in the Mississippi River in Ralls County, which the Alternative Routes cross (USFWS 2013b). The Mississippi River would be spanned, and no structures would be placed in the river; therefore, the Project is not likely to have any impact on the fat pocketbook.

Sheepnose

The sheepnose is a freshwater mussel found across the Midwest and Southeast in large rivers and streams, usually in shallow areas with moderate to swift currents that flow over coarse sand and gravel. Sheepnose have also been found in areas of mud, cobble, and boulders and in deeps runs of large rivers. The sheepnose is found in the east-central part of Missouri in Ralls County, which the Alternative Routes cross (USFWS 2013b). The Mississippi River would be spanned, and no structures would be placed in the river; therefore, the Project is not likely to have any impact on the sheepnose.

Plants

Eastern Prairie Fringed Orchid

The eastern prairie fringed orchid occurs in a wide variety of habitats, ranging from mesic prairie to wetlands such as sedge meadows, marsh edges, and bogs. It requires full sun for optimum growth and flowering and a grassy habitat with little or no woody encroachment. The eastern prairie fringed orchid is known to occur in Ralls County, which the Alternative Routes cross (USFWS 2013b). Grain Belt Express will work with USFWS to determine if the Project may have any potential impacts to the eastern prairie fringed orchid.

State Species

Twenty-one state-listed endangered species (ten of which are also federally listed and discussed above) have known ranges within the counties in which the Alternative Routes occur (**Table 5-5**) (MONHP 2013). Most fish species are associated with the Missouri and Mississippi rivers and are not likely to be impacted by the Project because the two rivers would be spanned and no structures would be placed in the river. Additionally, five mussel species have known ranges in the three counties adjacent to the Mississippi River crossed by the Alternative Routes and are not likely to be impacted by the Project. Grain Belt Express will implement mitigation measures, developed in coordination with MDC, to minimize any potential impacts to the state-listed endangered species from construction activities.

MONHP maintains a list of state species of conservation concern (MOHNP 2013). According to the MONHP database, 71 species of conservation concern have known current ranges within the counties crossed by the Alternative Routes. Note that many of these may be based on historic accounts and may no longer be accurate. A full list of the 71 species is included in Appendix E.

Alternative Route Comparison

Segment 1

All of the Alternative Routes would cross the Missouri River, which is designated critical habitat for the pallid sturgeon; however, no impacts are anticipated to aquatic species because the Project would span the Missouri River. Spanning all stream and river crossings reduces the need for heavy machinery or hazardous materials near riverbanks where accidental spills or erosion could occur. Other measures aimed at protecting aquatic habitats and water quality discussed in Section 5.1.1, *Water Resources*, would further minimize impacts.

No designated critical habitat occurs within the counties crossed by the Alternative Routes. Construction activities are not proposed to take place within or nearby aquatic habitats that are designated as state or federal critical habitat for protected aquatic species. Therefore, no impacts are expected to federally listed fish or state listed aquatic species from any of the Alternative Routes in Segment 1.

The removal of forested habitat was considered the main potential impact to both the Indiana bat and northern long-eared bat for the Alternative Routes. Alternative Route C crosses the most acres of forested area and would require the most tree removal. However, Alternative Routes A and B are parallel to existing linear infrastructure for a large portion of their lengths; therefore, the removal of forested areas would be an expansion of an existing ROW in those areas. Alternative Route C does not parallel existing infrastructure and would create new fragmentation in forested areas. Therefore, Alternative Route C would likely have the greatest potential impact to the bat species, whereas Alternative Route B would have the least potential impact (see **Table 5-6**).

Table 5-6. Potential Habitat of the Indiana and Northern Long-eared Bat with in Segment 1

Category	Alternative Routes		
	A	B	C
Forested Areas within the ROW (acres)	162	124	168

State-listed species of concern that are identified as occurring in counties crossed by the Alternative Routes in Segment 1 are summarized in **Table 5-5**. All Alternative Routes cross the same counties; therefore, all of the Alternative Routes have the potential to encounter state-listed species and species of concern in those counties. Alternative Route B, however, crosses the fewest acres of forested area and has the fewest acres of grassland habitat and would therefore have less potential impact to state sensitive species that use those habitats.

Segment 2

All Alternative Routes would cross the Mississippi River, which is known habitat for the pallid sturgeon, the fat pocketbook, and Higgins eye and spectaclecase mussels; however, no impacts are anticipated to fish or mussel species because all Alternative Routes would span the Mississippi River. No designated critical habitat for sensitive species is near the Alternative Routes.

All of the Alternative Routes in Segment 2 would require the removal of forested areas within the ROW. Alternative Routes H and I have the most forested acres within the ROW and Alternative Route D has the fewest. As discussed above, paralleling existing linear infrastructure can reduce the amount of new forest fragmentation. Alternative Route D would likely have the least potential impact to bat habitat because it parallels existing linear infrastructure and has the fewest acres of forested area within the ROW (see **Table 5-7**). In addition, as discussed above, Alternative Route D has the least amount of grassland habitat within the ROW and therefore is expected to have the least impact on sensitive species that use grassland habitat.

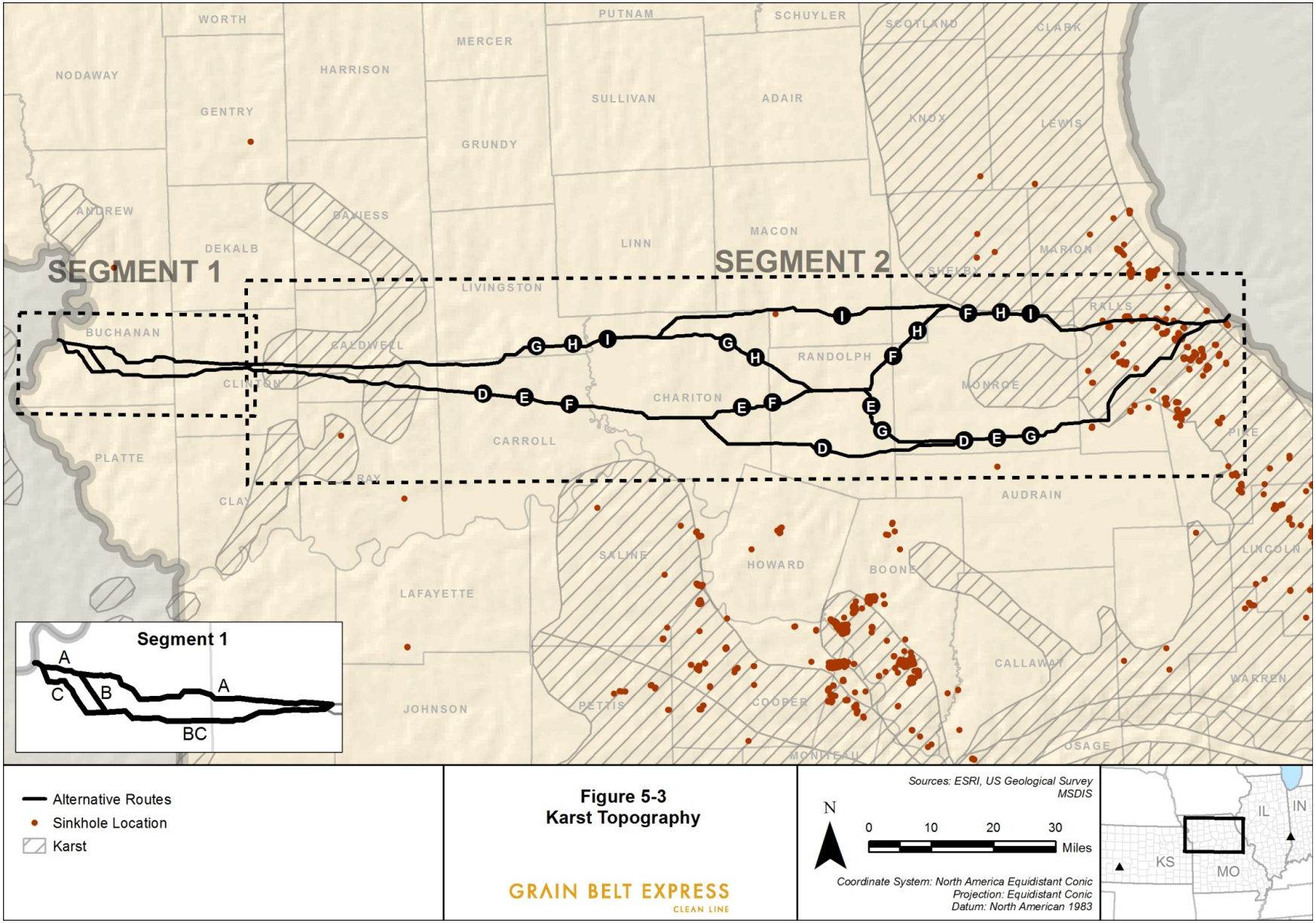
Table 5-7. Potential Habitat of the Indiana and Northern Long-eared Bat with in Segment 2						
Category	**Alternative Routes**					
	D	**E**	**F**	**G**	**H**	**I**
Forested Areas within the ROW (acres)	759	813	937	932	1,056	1,054

5.1.4 Geology and Soils

The Study Area is located within three physiographic ecoregions within the Dissected Till Plains of the Central Lowland physiographic province. Segment 1 is entirely located within the Western Cornbelt Plains ecoregion. Segment 2 is predominantly located within the Central Irregular Plains ecoregion with a small portion of its central section located in the Western Cornbelt Plains ecoregion and its eastern-most portion located in the Interior River Valleys and Hills ecoregion (U.S. Environmental Protection Agency 2010). The Interior River Valleys and Hills ecoregion represents the most sensitive geological area because it is primarily underlain by karst topography. Relatively small areas of the western-most portion of Segment 2, located within the Central Irregular Plains ecoregion, are also underlain by karst topography.

Karst topography is characterized as being formed from limestone that readily dissolves in the presence of water; caves and sinkholes are formed by this process and can sometimes be a conduit to groundwater, making these areas environmentally sensitive. **Figure 5-3** shows areas of karst topography in the Study Area. Caves and underground streams and rivers in karst areas provide habitat for animals specially adapted to this environment. Common animals including sensitive bat species that hibernate and breed in these geological formations are considered in Section 5.1.3.

The Study Area is divided into four major land resource areas with geographically similar land use, water, soil, topography, and physiography. The four major land resource areas are the Iowa and Missouri Deep Loess Hills, Iowa and Missouri Heavy Till Plain, Central Claypan Areas, and Central Mississippi Valley Wooded Slopes (USDA 2006). In general, the soil associations for each of these major land use areas suggest soils are deep and productive, and not surprisingly, much of the area is used as cropland (USDA 2013). Major soil resource concerns include erosion via wind and water, and loss of organic matter through poor management practices (USDA 2006).


SEGMENT 1
SEGMENT 2
WORTH
PUTNAM
SCHUYLER
SCOTLAND
CLARK
NODAWAY
HARRISON
MERCER
SULLIVAN
ADAIR
KNOX
LEWIS
GENTRY
GRUNDY
ANDREW
DAVIESS
LINN
MACON
DEKALB
SHELBY
MARION
LIVINGSTON
RALLS
BUCHANAN
CALDWELL
RANDOLPH
CLINTON
MONROE
CHARITON
PIKE
PLATTE
CARROLL
BAY
CLAY
AUDRAIN
SALINE
HOWARD
BOONE
LINCOLN
LAFAYETTE
CALLAWAY
WARREN
JOHNSON
PETTIS
COOPER
OSAGE
MONTEAU
Segment 1
A
C
B
A
BC
Alternative Routes
Sinkhole Location
Karst
Figure 5-3
Karst Topography
GRAIN BELT EXPRESS
CLEAN LINE
Sources: ESRI, US Geological Survey
MSDIS
N
0
10
20
30
Miles
Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983
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General Impacts and Mitigation

Transmission construction activities such as vegetation clearing, access road construction, grading, and foundation construction can impact soils by disturbing the native structure of the soil, creating areas of higher erosion potential, compaction, and lower soil permeability/fertility. The severity of soil impacts depends on several variables, including vegetation cover, the slope of the land, soil particle size, thickness of the soil profile, depth to a restrictive layer, and soil moisture content.

Unvegetated soil surfaces are more susceptible to erosion and loss of soil productivity. Removing stumps during tree clearing increases the potential for soil erosion; leaving topsoil exposed increases the potential of loss by wind and water. Best management practices to minimize erosion impacts may include leaving stumps in the ground, covering exposed soil, and reseeding after construction.

Prime farmland and/or farmland of statewide importance would be permanently removed from productivity when present at a given structure location. However, these impacts are anticipated to be minimal because only 0.009 to 0.018 acre of farmland is removed from production at any structure site, with only 4 to 7 structures typically needed per mile. Extrapolating from these estimates, the permanent impacts to soils associated with crossing a full section (1 square mile) of farmland would amount to slightly more than a tenth of an acre of the entire land area. Although additional temporary impacts would occur during construction from soil disturbing activity, normal farming and grazing could continue up to the base of each structure after construction.

Prior to construction activities, geotechnical investigations will occur to determine the presence of karst topography or caves along the Proposed Route. In the event that caves or karst topography is discovered during these investigations, special engineering considerations will be incorporated into the design and construction of the transmission line. In addition, best management practices will be implemented to minimize any erosion in areas with karst topography.

Alternative Route Comparison

As a result of the implementation of mitigation measures similar to those discussed above and the limited footprint of permanent impacts on soil productivity created by the structures themselves, any impacts to soils would likely be minor for all Alternative Routes; therefore, impacts on soil resources do not provide a usable comparison between Alternative Routes in Segment 1.

Karst topography is only found in Segment 2. Alternative Route G crosses more karst topography than the other Alternative Routes (**Table 5-8)**. In general, there are no notable differences between the Alternative Routes with respect to soil resources; however,

Alternative Route G does cross the most potential karst areas. As discussed above, areas with karst would be identified prior to construction and avoided when possible.

Table 5-8. Impacts to Karst for Alternative Routes in Segment 2

	Alternative Routes					
	D	**E**	**F**	**G**	**H**	**I**
Karst topography (miles)[1]	48.0	48.0	46.1	51.0	49.1	49.1

[1] U.S. Geological Survey (1984)

5.2 Human Uses

5.2.1 Existing Utility Rights of Way

Existing utility ROWs are considered an opportunity feature when planning new linear utility infrastructure. Paralleling existing linear utilities consolidates utility corridors, logically placing a new land use feature in close alignment with an existing similar land use feature, thereby avoiding the fragmentation of existing land uses and sensitive habitats through an area. In addition, paralleling existing transmission lines can reduce the overall impact of the new transmission line on visually sensitive areas (e.g., historic sites and outdoor recreational areas) and airfield flight zones, since any impacts of the new line are considered with respect to the impacts of the existing line. In these areas, the impacts of the new line are considered incremental to the existing impacts, rather than completely new impacts in otherwise unimpacted areas.

In addition to existing linear infrastructure, the grid-based section lines of the public land survey system and the parcel boundaries that further dissect each section (referred to as section/parcel boundaries) also served to guide the development of alignments along logical divisions of ownership. The Routing Team aligned routes along section/parcel boundaries in the absence of, or as an alternative to, parallel alignments along existing linear infrastructure if existing land use would be more impacted by the Project otherwise. This was most relevant in farmed areas, where farming operations extend to the edge of the property boundary. All Alternative Routes parallel existing electric transmission lines, pipelines, or section/parcel boundaries for some portion of their length (see **Table 5-9** and **Table 5-10**).

Segment 1

The existing network of transmission lines does not afford much opportunity for parallel alignments in this portion of Missouri because most run in a north-south direction. However, pipelines and section/parcel boundaries were followed where possible and practical. The Rockies Express/Keystone pipeline corridor was paralleled to the extent practicable.

Alternative Route A parallels approximately 6 miles of pipeline, which in combination with transmission lines, parallels the most existing linear infrastructure (**Table 5-9**). However, near St. Joseph, numerous residences and buildings close to the pipeline corridor made paralleling the pipeline difficult and frequent deviations to avoid residences were required in several areas. Alternative Route C does not parallel any existing infrastructure. Alternative Route B paralleled the greatest number of miles of transmission line.

In the absence of existing transmission and pipelines, Alternative Routes were developed as much as possible along section/parcel boundaries. All of the Alternative Routes parallel approximately the same distance of parcel boundaries.

Table 5-9. ROW Parallel in Segment 1

	A	**B**	**C**
Total length (miles)	33.0	33.3	33.9
Parallel (miles)			
Transmission line (miles)	0.5	4.4	-
Pipeline (miles)	6.3	0.7	-
Parcel boundaries (miles)	5.9	7.0	7.5
Total ROW Parallel	**12.7**	**12.1**	**7.5**
Percent Parallel			
Transmission line parallel	2%	13%	-
Pipeline parallel	19%	2%	-
Parcel boundary parallel	18%	21%	22%
Total Percent ROW Parallel	**39%**	**36%**	**22%**

Segment 2

All Alternative Routes parallel existing transmission lines at some point along the length of the route in Segment 2 (**Table 5-10**). Alternative Route G parallels the greatest number of miles of existing transmission line and Alternative Route E parallels the second most.

Paralleling existing pipelines was also considered an opportunity. Alternative Routes D, E, and F parallel existing pipelines for extended lengths along the routes with Alternative Route D paralleling the greatest number of miles of pipeline. Alternative Routes G, H, and I do not parallel any pipelines.

Alternative Route E parallels existing transmission lines and pipelines for the greatest portion of the total length. Alternative Routes D and F also parallel a large percentage of existing linear infrastructure with 32 percent and 40 percent, respectively. Alternative Routes G, H, and I parallel the least amount of existing linear infrastructure. In areas where paralleling existing

linear features was not possible, the Routing Team attempted to parallel section/parcel boundaries. Alternative Routes G, H, and I are parallel the greatest number of miles of parcel boundaries.

Alternative Routes D, E, or F would likely have the least impact on existing land use because of the use of existing linear ROWs to minimize new fragmentation in otherwise unimpacted areas.

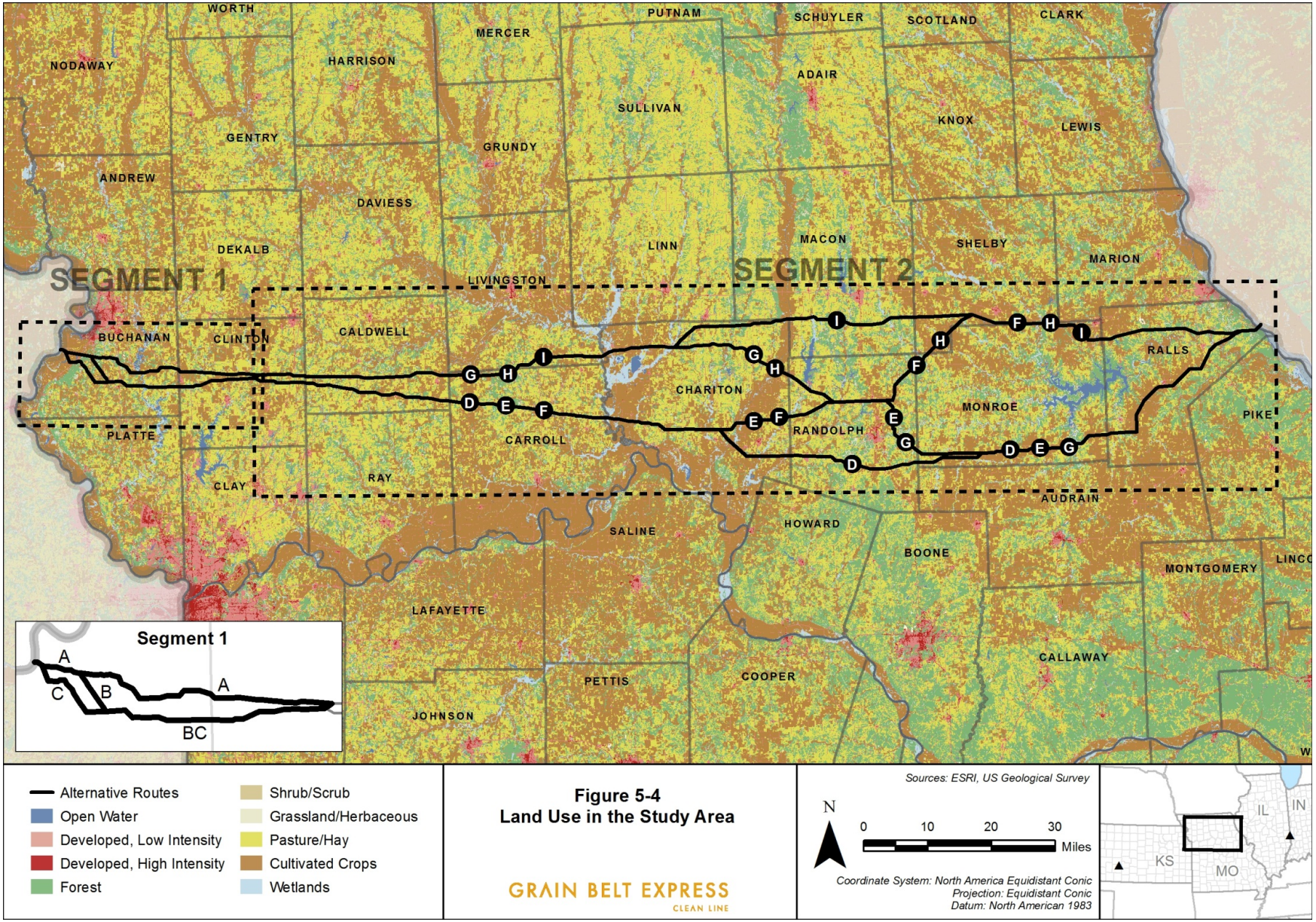
Table 5-10. ROW Parallel in Segment 2

	D	E	F	G	H	I
Length (miles)	172.4	176.5	169.4	177.5	170.4	163.2
Parallel						
Transmission line (miles)	10.3	31.0	25.7	39.0	33.6	4.3
Pipeline (miles)	44.6	39.3	39.3	-	-	-
Parcel boundaries (miles)	42.9	39.5	38.3	56.4	55.2	62.4
Total ROW Parallel	97.8	109.8	103.3	95.4	88.8	66.7
Percent Parallel						
Transmission line	6%	18%	15%	22%	20%	3%
Pipeline parallel	26%	22%	23%	-	-	-
Parcel boundary	25%	22%	23%	32%	32%	38%
Total Parallel	**57%**	**62%**	**61%**	**54%**	**52%**	**41%**

5.2.2 Agricultural Use (Farm and Pasture/Grassland)

The Alternative Routes cross 11 counties in the state of Missouri including Buchanan, Caldwell, Carroll, Chariton, Clinton, Livingston, Macon, Monroe, Ralls, Randolph and Shelby. The predominant type of land use throughout the Study Area is agricultural and includes farmlands, range or grasslands, and pastures. The main agricultural crop commodities include soybeans, corn, wheat, and cotton. The main livestock commodities include poultry, beef, and pork (USDA NASS 2013). Market value of products sold for crop and livestock sales was estimated at approximately $7.5 billion dollars in 2007 (USDA NASS 2013).

Land use is predominately cultivated fields interrupted by forests and grasslands. Grasslands are used for grazing cattle and for the production of hay to feed livestock in the winter. Most of the Study Area uses dry land farming techniques with select areas near water resources also using irrigation systems. Land use, based on data from the National Land Cover Database, is shown in **Figure 5-4** and displays the land use trends throughout the state.


WORTH
MERCER
PUTNAM
SCHUYLER
SCOTLAND
CLARK
NODAWAY
HARRISON
ADAIR
SULLIVAN
KNOX
LEWIS
GENTRY
GRUNDY
ANDREW
DAVIESS
DEKALB
LINN
MACON
SHELBY
MARION
SEGMENT 1
SEGMENT 2
LIVINGSTON
BUCHANAN
CLINTON
CALDWELL
RALLS
CHARITON
MONROE
PIKE
PLATTE
CARROLL
RANDOLPH
CLAY
RAY
AUDRAIN
SALINE
HOWARD
BOONE
MONTGOMERY
LAFAYETTE
CALLAWAY
PETTIS
COOPER
JOHNSON
Segment 1
A
C
B
A
BC
Alternative Routes
Open Water
Developed, Low Intensity
Developed, High Intensity
Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Wetlands
Figure 5-4
Land Use in the Study Area
GRAIN BELT EXPRESS
CLEAN LINE
Sources: ESRI, US Geological Survey
N
0
10
20
30
Miles
Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983
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General Impacts and Mitigation

Impacts to agricultural land (crops and pasture/grassland) would be primarily confined to the construction phase of the Project. In cropland, access into fields may be required during the growing season, which could damage crops or take an area out of production while the transmission line is being constructed. Landowners would be compensated for crop damage that relates to the construction of the transmission line. In grassland or pastureland, access across land may be required and could temporarily remove some area from grazing activities. In addition, soil compaction and erosion may be possible during construction. Best management practices would be used to mitigate impacts resulting from soil erosion or compaction. Furthermore, compensation would be part of the easement compensation terms and would pay for any damage to crops or pasture.

Center pivot irrigation systems were avoided to the extent possible when determining the Alternative Routes. None of the Alternative Routes in Segment 1 cross over known center pivots. In Segment 2, six center pivots are located along Alternative Route D. However, the transmission line should be able to span these pivots and not impact the operation of the pivot arm.

Specific to cropland areas, once the transmission line is constructed, farmers would have to farm around the transmission structures. These impacts are not expected in grassland or pasture areas since large cultivation equipment is not typically used and livestock could move freely under the transmission line. As mentioned previously, the footprint of each structure location would be permanently taken out of cropland production and could no longer be used for grazing.

Alternative Route Comparison

Segment 1

Land use type was digitized from aerial photography within the potential 200-foot ROW for each Alternative Route in Segment 1and is shown in **Table 5-11**.

Table 5-11. Agricultural Land Use in Segment 1

Land Use	Alternative Routes		
	A	B	C
Length (miles)	33.0	33.3	33.9
Agriculture/cropland (miles)	17.9	20.8	19.5
Pasture/grasslands (miles)	7.7	6.7	7.0

All Alternative Routes are similar in total length and cross similar distances of cropland and pasture/grassland. Generally, livestock grazing operations do not require large machinery for

plantings, pesticide control, or harvesting and operational impacts to these facilities are minimal. Routing transmission lines along parcel boundaries or fence lines is considered the best routing option in cropland areas (see **Table 5-10**). Routing on parcel boundaries places the disturbance between ownership, often minimizing the obstruction on farming operations for each landowner. In contrast, routing a transmission line diagonally through cultivated fields often involves support structures located in the middle of the fields rather than on the edge. This scenario results in a greater impact on farming operations because it creates a new obstacle to farm around. Thus, when possible and practical, the Routing Team attempted to place alignments along parcel boundaries in cultivated areas. This was most practical in areas with large parcels aligned closely to section/parcel boundary lines.

Segment 2

Distance across agriculture and pasture/grassland for the Alternative Routes in Segment 2 are summarized in **Table 5-12.**

Table 5-12. Agricultural Land Use in Segment 2

Land Use	D	E	F	G	H	I
Length (miles)	172.4	176.5	169.4	177.5	170.4	163.2
Agricultural (miles)	90.7	90.9	79.9	85.9	75.0	67.3
Pasture/grasslands (miles)	47.4	48.8	47.4	51.5	50.1	51.0

Alternative Route I crosses the fewest miles of agricultural land out of the six Alternative Routes. Alternative Routes E and D cross the most acres of agricultural land. Distance across pasture land is relatively similar across all Alternative Routes.

5.2.3 Populated Areas and Community Facilities

Developed lands are located near towns, which are dispersed throughout the Study Area. The Routing Team worked to develop routes that minimized impacts to residential, commercial, and developed property to the extent possible. However, this was not possible for all the Alternative Routes.

Population trends for the 11 counties crossed by the Alternative Routes are shown in **Table 5-13.** Overall, Missouri increased in population by 6.89 percent between 2000 and 2011. During the same period, most of the counties within the Study Area increased in population with the exception of Carroll, Chariton, Macon, Monroe, and Shelby (U.S. Census Bureau 2011).

Table 5-13. Population Trends			
	2000	**2011**	**Change (%)**
State of Missouri	5,595,211	6,008,984	6.89
Counties Crossed by Alternative Routes			
Buchanan	85,998	89,492	3.90
Caldwell	8,969	9,206	2.57
Carroll	10,285	9,263	-11.03
Chariton	8,438	7,717	-9.34
Clinton	18,979	20,646	8.07
Livingston	14,558	15,118	3.70
Macon	15,762	15,481	-1.82
Monroe	9,311	8,712	-6.88
Ralls	9,626	10,306	6.60
Randolph	24,663	25,218	2.20
Shelby	6,799	6,247	-8.84

General Impacts and Mitigation

As outlined in the routing criteria in Section 2.4, the Routing Team tried to avoid impacts on residences, commercial operations, and other developed land features. Major urban and developed areas were avoided to the extent feasible during the routing process.

Alternative Route Comparison

Segment 1

St. Joseph, Agency, Faucett, Gower, Plattsburg, and Turney are the largest towns/cities in proximity to Segment 1. Although the Routing Team worked to avoid St. Joseph and Agency, extended development south of these towns limited opportunities to distance the Alternative Routes from residential development. Alternative Route A is approximately 1 mile north of Gower, and Alternative Routes B and C are approximately 0.5 mile south of Gower. All of the Alternative Routes are approximately 2 miles north of Plattsburg and 2 miles south of Turney.

Table 5-14 compares the number of residences, churches, cemeteries, schools, and parcels crossed for each Alternative Route. The distance for residences, churches, cemeteries, and schools is calculated by distance from centerline, not the edge of the ROW. Parcel data were grouped by size and obtained from each county.

Table 5-14. Populated Areas and Communities Comparison for Alternative Routes in Segment 1			
	Alternative Routes		
Metric	**A**	**B**	**C**
Length (miles)	33.0	33.3	33.9
Residences within 250 feet[1]	3	-	-
Residences within 500 feet[1]	27	11	7
Churches within 1,000 feet[1]	-	-	-
Cemeteries within 1,000 feet[1]	-	-	1
Schools within 1,000 feet[1]	-	-	-
Parcels <10 acres	8	5	5
Parcels b/w 10-30 acres	20	23	11
Parcels b/w 30-80 acres	49	38	42
Parcels > 80 acres	50	49	53
Total parcels crossed	127	115	111

[1] Distance calculated from the centerline of the Alternative Routes.

None of the Alternative Routes have known churches or schools within 1,000 feet of the centerline. Alternative Route C has one cemetery within 1,000 feet; however, the Alternative Route would not cross the cemetery property. Alternative Route A follows more closely to the existing pipeline through the area, but has the most houses within 250 and 500 feet. Alternative Route B has 11 residences within 500 feet; but parallels an existing transmission line for a portion of its length to reduce the overall effect of the line by alignment through an already affected area. In addition, Alternative Routes B and C cross the fewest number of parcels and the fewest small parcels (less than 10 acres in size). In general, crossing larger parcels is preferred to crossing smaller parcels because larger parcels can, in general, accommodate the ROW of the transmission line with lesser impact to the current land use.

Based on the known residences, churches, cemeteries, schools, and parcel size, Alternative Route B would most likely result in the least impact to populated areas and communities. Although Alternative Route B has more residences within 500 feet than Alternative Route C, it is also parallel to an existing transmission line and would consolidate similar types of infrastructure to one area and limit fragmentation and visual impacts to areas that are currently unimpacted.

Segment 2

Moberly is the largest city with a population greater than 2,500 within 1 mile of Alternative Routes D, E, and G. Alternative Route D is approximately 0.5 mile south of Moberly. Towns with populations fewer than 1,000 people that are within 1 mile of Alternative Routes include

New London, Cowgill, Braymer, Turney, Sumner, Rothville, Hunnewell, Renick, Cairo, and Center. **Table 5-15** lists the towns, population, and distance to the closest Alternative Route.

Table 5-15. Towns in Proximity to Alternative Routes in Segment 2

Alternative Routes	Town	Population (2012 Census)	Approximate Distance (miles)
D	Moberly	13,987	0.5
E and G	Moberly	13,987	1.5
D, E, F	Turney	152	2
	Cowgill	191	0.5
	Braymer	828	2.5
	Cairo	295	0.5
	Renick	175	0.5
	Center	526	0.5
	New London	982	1
G, H, I	Turney	152	1
	Braymer	828	1
	Sumner	101	0.5
	Rothville	98	0.5
	Hunnewell	170	1
	Center	526	0.5
	New London	982	1

Alternative Routes D has the fewest residences within 250 and 500 feet (**Table 5-16**). Alternative Routes E and F have the most residences within 250 and 500 feet. Alternative Route D crosses the fewest number of parcels less than 10 acres in size. Alternative Route crosses the fewest number of parcels overall, which reflects the shorter length of the Alternative Route. All of the Alternative Routes are within 500 feet and 1,000 feet of several cemeteries. However, no cemeteries are physically crossed by any of the Alternative Routes, therefore, impacts are not anticipated.

Overall, Alternative Route D is most likely to result in lesser impact on populated areas and communities because it parallels existing linear infrastructure for approximately 30 percent of its length and has the fewest residences within 500 feet (**Table 5-16**).

Table 5-16. Developed Land Use For Segment 2						
	Alternative Routes					
Metric	**D**	**E**	**F**	**G**	**H**	**I**
Length (miles)	172.4	176.5	169.4	177.5	170.4	163.2
Residences within 250 feet[1]	5	11	11	10	10	11
Residences within 500 feet[1]	50	79	84	63	68	61
Churches within 500 feet	-	-	-	-	-	1
Churches within 1,000 feet[1]	1	1	1	1	1	1
Cemeteries within 500 feet	3	3	1	3	1	3
Cemeteries within 1,000 feet[1]	6	6	7	5	6	7
Schools within 1,000 feet[1]	-	-	-	-	-	-
Parcels <10 acres	13	17	20	19	22	17
Parcels between 10 and 30 acres	49	48	41	45	38	31
Parcels between 30 and 80 acres	189	190	190	205	205	177
Parcels > 80 acres	305	298	306	282	290	268
Total parcels crossed	556	554	557	551	555	493

[1] Distance calculated from the centerline of the Alternative Routes.

5.2.4 Recreational and Aesthetic Resources

Missouri hosts several natural and cultural-based recreational opportunities, including both dispersed and developed recreational areas. Examples of dispersed recreational activities include scenic driving, bicycling, backpacking, hunting, fishing, and off-road vehicle use. Developed recreation provides permanent facilities designed to accommodate activities such as camping, boat launching, sporting activities in athletic fields, or day-use activities (i.e., picnicking, visiting interpretive exhibits, and hiking/biking on trails). Predominant recreational activities include hunting, observing wildlife, siting tourist attractions, scenic driving, hiking/biking on National Historic Trails, boating activities on the reservoirs and rivers, and camping at state parks.

Aesthetics are defined as a mix of landscape visual character, the context in which the landscape is being viewed (view/user groups), and the scenic integrity of the landscape. The potential visibility and visual impact on the landscape and recreational areas from the two segments (Segment 1 and Segment 2) were reviewed through landscape character assessment, field evaluation, and environmental factor tabulations. This section presents information on the existing visual character and recreational opportunities occurring near the Alternative Routes and the associated visual impacts.

Description of Visual Character

Visual character encompasses the patterns of landform (topography), vegetation, land use, and aquatic resources (i.e., lakes, streams, and wetlands). The visual character of an area is influenced by natural systems, human interactions, and use of land. In natural settings, the visual character attributes are natural elements such as forested hillsides, open grasslands, or scenic rivers and lakes, whereas rural or pastoral/agricultural settings may include human-made elements such as fences, walls, barns and outbuildings, and occasional residences. In more developed settings, the visual character may include commercial or industrial buildings, manicured lawns, pavement, and other infrastructure.

The Study Area is generally composed of low rolling topography and elevations ranging from roughly 600 feet to more than 1,100 feet. Along Segment 1, elevations generally range from 800 feet to 1,000 feet, increasing east from the Missouri River crossing. In Segment 2, elevations range from roughly 1,100 feet decreasing to roughly 600 feet in the eastern portion near the Mississippi River. The landscape is undulating and vegetated but still allows for some uninterrupted vistas in isolated areas of flat terrain. Generally, Segment 1 increases in elevation as one travels eastward and is characterized by patches of deciduous vegetation amid generally undulating topography near the Missouri River crossing. By comparison, slightly flatter topography with increasing forest cover exists across Segment 2 until the Mississippi River crossing at the easternmost extent, at which point the topography becomes more varied with a declining elevation. Within the Study Area, visual landscapes include agricultural areas, forests and grasslands, and low to moderate density residential and industrial development. The majority of land is agricultural land intermixed with low density residential development. The photos below typify the scenic qualities of landscapes found in Segments 1 and 2.

Near the Missouri and Mississippi rivers, the topography becomes more variable, and long vistas are not always available. Steep bluffs can be found close to the rivers, contributing to the scenic views near the river crossings.