Exhibit No. 119
Issues: Routing Process,
Routing Study,
Routing Study Addendum
Witness: James G. Puckett
Type: Direct Testimony
Sponsoring Party: Grain Belt Express Clean
Line LLC
Case No.: EA-2016-0358
Date Testimony Prepared: August 30, 2016

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO: EA-2016-0358

DIRECT TESTIMONY OF

JAMES G. PUCKETT

ON BEHALF OF

GRAIN BELT EXPRESS CLEAN LINE LLC

August 30, 2016

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I. <u>QUALIFICATIONS</u>

Q. Please state your name, present position and business address.

A. My name is James G. Puckett. I am the Practice Lead for Geospatial Analysis and Cartography for the Louis Berger Group, Inc. ("Louis Berger"). My business address is 565 Taxter Road, Suite 510, Elmsford, New York 10523.

Q. What are your duties and responsibilities as Practice Lead, Geospatial Analysis and Cartography of Louis Berger?

A. I work in the Applied Sciences practice group. In that capacity, I oversee the Geospatial Analysis and Cartography practice, which provides expertise and oversight of GIS services throughout Louis Berger.

I am also an environmental scientist and planner by training and experience. I serve as the project manager for Louis Berger for the Grain Belt Express Clean Line transmission project ("Grain Belt Express Project" or "Project"), and as a member of the Routing Team, described below. As a Routing Team member, I was directly involved in the development and analysis of routes, public outreach efforts, coordination with state and federal agencies, comparison of alternatives, preparation of the Missouri Route Selection Study ("Routing Study") attached as **Schedule JGP-1**, and Missouri Route Selection Study Addendum ("Routing Study Addendum"), which is attached to my testimony as **Schedule JGP -2**.

Q. What is the purpose of your testimony in this docket?

A. I am testifying on behalf of Grain Belt Express Clean Line LLC ("Grain Belt Express" or "Company"), and the purpose of my testimony is to describe the proposed Grain Belt Express Project route in Missouri. My testimony describes in detail the routing process and serves to sponsor the Routing Study and Routing Study Addendum.

Q. Please summarize your education and professional background.

A. My *curriculum vitae* is attached to this testimony as **Schedule JGP-3.**

Q. Have you previously testified before any regulatory commissions?

A. Yes, I have previously provided testimony before the Florida Public Service Commission.

II. OVERVIEW OF THE ROUTING STUDY

Q. What is the Grain Belt Express Project?

A. As described in more detail in the testimony of Company witness Michael Skelly, the Project is an approximately 780-mile, overhead, multi-terminal ±600 kilovolt ("kV") high voltage direct current ("HVDC") transmission line and associated facilities, running from a new 345 kV substation in Ford County, Kansas to an intermediate delivery point in Ralls County, Missouri, and on to an ultimate delivery point near the Sullivan 345 kV substation in Sullivan County, Indiana.

Q. Please provide an overview of the Routing Study.

A. The Routing Study documents the route selection methodology, public and agency outreach process, and the Proposed Route identification process for the Missouri portion of the Grain Belt Express Project that extends from the Missouri River south of St. Joseph, Missouri on the Kansas/Missouri border to the Mississippi River crossing point near Saverton, south of Hannibal in Ralls County on the Missouri/Illinois border.

The overall goal of the Routing Study was to gain an understanding of the opportunities and constraints in the Study Area for the Project, to develop feasible Alternative Routes, to evaluate potential impacts, and to identify a reasonable and sound Proposed Route for the Project. Grain Belt Express defined the Proposed Route as the route that minimizes the overall effect of the transmission line on the natural and human environment and that avoids unreasonable and circuitous routes, unreasonable costs, and minimizes special design requirements.

Q. Who conducted the Routing Study?

A. The Routing Study was conducted by an interdisciplinary Routing Team. Members of the Routing Team have experience in transmission line route planning and selection, impact assessment for natural resources, land use assessment and planning, cultural resource identification and assessment, impact mitigation, and transmission engineering, design, and construction. **Appendix A** of **Schedule JGP-1** lists the Routing Team members, their business affiliation, and their respective areas of responsibility.

III. DESCRIPTION OF THE ROUTING PROCESS

a. 2014 Routing effort

Q. Please describe the Missouri routing process that was utilized in Grain Belt Express' filing 2014 in Case No. EA-2014-0207 ("2014 Case").

A. The Routing Team employed a process to identify the Proposed Route that included evolutionary and iterative phases of developing routes, reviewing routes with respect to information gathered from state and federal regulatory agencies, community leaders, and the general public, and revising the routes with more specific alignments.

Initial route development efforts started with the identification of large area constraints and opportunity features across the entire project Study Area. Examples of large area constraints in Missouri included Pershing State Park, Swan Lake National Wildlife Refuge, Mark Twain Lake and development associated with St. Joseph, Kansas City, Columbia, Jefferson City, and St. Louis. Examples of opportunity features in Missouri included an array of existing linear features including pipeline corridors, electric transmission lines, and section/parcel boundaries. Using this information, the Routing Team developed a range of Conceptual Routes, which were approximate alignments that served to focus the early data gathering, field reconnaissance, and public outreach efforts of the Routing Team.

As the Routing Team continued to collect information, coordinate with government agencies, and gather additional information, the assemblage of Conceptual Routes was narrowed and refined. These refinements ultimately eliminated the Conceptual Routes in the southern and central portions of the Study Area from further consideration due to challenges associated with a range of routing constraints, including large areas of federal land ownership, large complexes of reservoirs and recreational lakes, dense and interspersed development, and a lack of suitable crossings of the Mississippi River. The remaining routes extended northeast from Ford County, Kansas, crossed the Missouri River south of St. Joseph, Missouri, crossed the Mississippi River north of St. Louis, and continued to the Sullivan Substation on paths south of Springfield, Illinois.

Due to the multi-state nature of the Project, Alternative Routes were first developed to determine the proposed route in Kansas. Once the Proposed Route was selected in Kansas, Potential Routes in Missouri were further refined based on the known location of the Missouri River crossing. These Potential Routes were then presented to public officials and to members of the general public in a series of public open house meetings ("Open Houses") in Missouri.

Following the Open Houses, the Routing Team assembled and reviewed the input that was gathered at the Open Houses and through comments submitted through the Grain Belt Express web site, and revised the Potential Routes. In addition, a review and analysis of the five potential Mississippi River crossing locations was conducted to determine the preferred crossing location. Input from the public and government agencies, as well as engineering and natural resource considerations were factored into the selection of the Mississippi River crossing south of Hannibal. Due to the elimination of the other potential river crossing locations, several Potential Routes were removed from further consideration. A series of nine Alternative Routes was compiled from the remaining Potential Routes for analysis and comparison in the Missouri Siting Study.

The Routing Team divided the Alternative Routes into two distinct segments that had common beginning and end points: Segment 1 and Segment 2. Alternative Routes in each segment were compared against one another, and the most reasonable route from each segment was selected for compilation of the Proposed Route. In Segment 1, Alternative Routes A through C were compared and in Segment 2, Alternative Routes D through I were compared.

Q. How was agency input incorporated into the process?

A. The Routing Team coordinated with numerous federal and state agencies and local officials to gather information for the route planning process. Initial agency coordination efforts focused on introductions to the Project, data gathering, and discussions concerning likely permitting and consultation requirements. Discussions aided in the identification of routing constraints and informed the development of initial routing guidelines. A list of the agencies consulted during the process is provided in Section 3 to **Schedule JGP-1**.

In addition, agency coordination was an integral component for the selection of the Mississippi River crossing location. The U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers (St. Louis and Rock Island Districts), Missouri Department of Conservation, Missouri Department of Natural Resources, Missouri State Historic Preservation Office, and Illinois Department of Natural Resources were contacted for advice and comment on the five potential Mississippi River crossing locations that were under consideration. The input from these agencies was included in the analysis that resulted in the selection of the Mississippi River crossing south of Hannibal.

Q. How was public input incorporated into the process?

A. The Routing Team led a community outreach program that was designed to educate the public about the purpose and benefits of the Project, inform community leaders and the public about the regulatory process and Project timeline, and gather general comments on the Project and specific information that would refine the siting effort. Company witness Mark Lawlor provides a detailed description of the public outreach process in his direct testimony.

Two key components of the public outreach process that related to determining the Proposed Route were Community Leader Roundtables ("Roundtables") and Open Houses.

Q. Please describe the Roundtable process.

A. The main goal of the Roundtables was to coordinate with and gain valuable information from local leaders in each county in the Study Area. Community leaders included county and municipal elected officials, local government planners, community and business leaders, economic development experts, local utilities and cooperatives, as well as federal and state agency officials. At each meeting, members of the Routing Team presented an overview of the Project and described the routing process. After the presentation, attendees and members of the Routing Team met in small working groups to review an aerial map of the county they represented. Attendees provided information about sensitive features, planned development, and existing infrastructure in their community, and were also encouraged to draw route suggestions on the aerial maps that the Routing Team should consider in the study. In Missouri, 24 Roundtables were held, with more than 250 participants attending from more than 40 counties.

Q. What was the purpose of Open Houses?

A. The main goal of the Open Houses was to inform the general public and potentially affected landowners about the Project and to present a series of Potential Routes for their consideration and comment. At the Open Houses, attendees signed in and were given a guided presentation about the Project by members of the Routing Team. At the end of the tour, the Routing Team assisted attendees in locating their property or other features of concern on aerial photography maps displaying the array of Potential Routes under consideration. Attendees were encouraged to submit written comments about their observations, recommendations or concerns. More than 1,200 people attended the 13 Open Houses.

Following the Open Houses, the Routing Team assembled and reviewed the input gathered at the public meeting, revised the Potential Routes where necessary, and compiled a series of nine Alternative Routes for detailed analysis and comparison. The Routing Team divided the Alternative Routes into two distinct segments that had common beginning and end points: Segment 1 in western Missouri (A through C) and Segment 2 in central and eastern Missouri (D through I). Alternative Routes in each segment were compared against one another, and the most reasonable route from each segment was selected for compilation of the Proposed Route.

Q. How did the Routing Team analyze the Alternative Routes as part of the process that led to the selection of the Proposed Route?

A. The nine Alternative Routes (Alternative Routes A through I) were assessed and compared with respect to their potential impacts on natural resources (water resources, wildlife and habitats, special status species, and geology and soils), human uses (agricultural use, populated areas and community facilities, recreational and aesthetic resources, and cultural resources), and with respect to any noted engineering or construction challenges (transportation, existing utility corridors, other existing infrastructure, and the Mississippi River crossings).

From that analysis, the Routing Team recommended a combination of Alternative Routes B and D as the Proposed Route for the Project. This combination of Alternative Routes met the overall goal of minimizing impacts on the natural, human, and historic resources along the route, while best utilizing existing linear rights-of-way and avoiding non-standard design requirements.

Q. Please describe Alternative Route B.

A. Alternative Route B was selected in Segment 1. As shown in Section 6.2 to the Routing Study (**Schedule JGP-1** to my testimony), Alternative Route B parallels a combination of gas pipelines, an existing electric transmission line, and parcel boundaries. Initial alignments cross the eastern floodplain of the Missouri River in Buchanan County and enter the rolling hills beyond along the pipeline. Approximately 3 miles beyond the eastern bluffs of the river, the route turns southeast adjacent to an existing transmission line to avoid residential development along the pipeline and the town of Agency in Buchanan County. The route continues due east from this point eventually joining the pipeline corridor. Alternative Route B has a range of benefits over other Alternatives. It has no residences located within 250 feet of the route centerline, avoids the residential congestion located farther east along the pipeline corridor, and avoids crossing through Agency. Alternative Route B has the least impact on forested areas (including forested riparian and riparian areas) and parallels existing linear infrastructure, thereby reducing fragmentation of potential habitat for the Indiana bat and northern long-eared bat. Alternative Route B also reduces the fragmentation of area land use, by locating the line adjacent to existing utility infrastructure.

Q. Please describe Alternative Route D.

A. Alternative Route D was selected in Segment 2. As shown in Section 6.2.2 to the Routing Study (**Schedule JGP-1**), Alternative Route D is aligned adjacent to existing linear utility infrastructure for a significant portion of its length, paralleling the Rockies Express/Keystone pipelines for 44.6 miles and existing electric transmission lines for another 10.3 miles. Although other Alternative Routes may parallel more existing linear infrastructure, Alternative Route D has the overall fewest residences within 250 and 500 feet, reducing impacts to landowners and residences in the area. Alternative Route D is 5 miles south of the Swan Lake National Wildlife Refuge in Chariton County, which is an important migratory bird area and wetland complex. In addition, Alternative Route D minimizes impacts to potential Indiana bat and northern long-eared bat habitat by crossing fewer acres of forested habitat. Because Alternative Route D parallels a large extent of existing linear infrastructure, new fragmentation of both habitat and land use will be reduced compared to other Alternative Routes.

Q. Describe how the combination of Alternative Routes B and D compares to the other possible Alternative Route combinations.

A. The combination of Alternative Routes B and D to create the Proposed Route is reasonable and sound because the combined route best minimizes the overall effect of the Project on the natural and human environment while avoiding unreasonable and circuitous routes, unreasonable costs, and special design requirements. It was developed by an interdisciplinary team with input from numerous government agencies, local officials, and the general public.

b. <u>Landowner Requested Route Variations</u>

Q. Please describe the landowner route variation process.

A. Following the selection of the Proposed Route and filing of the Application in 2014, Grain Belt Express had many constructive discussions with landowners along the route regarding the location of the route on their individual properties. In some cases these discussions led to minor revisions in the route, which were reviewed from routing, environmental, and engineering perspectives. Some of these revisions impacted only one landowner's property, while others led to minor shifts on adjacent parcels. These minor revisions were reviewed in the context of updated datasets to ensure that they did not introduce additional impacts to the human or natural environment or violate the Routing Guidelines described in the Missouri Route Selection Study. Revisions from landowner feedback were included in the route shown to stakeholders during the Public Landowner Meetings held in June 2016.

Q. Did Grain Belt Express incorporate these variations into the updated Proposed Route that it is presenting to the Commission in this proceeding?

A. Yes, 16 variations were incorporated into the Proposed Route. These revisions are described in the Missouri Route Selection Study Addendum, **Schedule JGP-2**. Generally, these revisions involved minor shifts of the alignment to avoid landscape features identified by specific landowners on their property. These variations were typically no more than a few hundred feet from the original alignment. In most instances the overall length of the reroute was less than a mile, however some exceed a few miles in length when that was necessary to avoid adding unnecessary diversions to the route alignment that would create greater impacts.

c. <u>2016 Routing Update</u>

Q. Please summarize the 2016 Routing Study Addendum.

A. The Routing Study Addendum describes the process of reviewing the Proposed Route that was filed in the 2014 Case in relation to more current datasets and the public and agency outreach meetings that have occurred since the 2014 Case. The Routing Study Addendum includes a list of the GIS datasets that were updated, a summary of the public landowner meetings and the agency coordination discussions, and the process for reviewing the Proposed Route in the context of the updated information.

Q. Please describe the additional data that was incorporated into the routing update.

A. Many of the publicly available GIS datasets that were used during the initial routing of the Project were updated and reviewed for changes in preparation of the 2016 Routing Study Addendum, which is attached as **Schedule JGP-2. Appendix B** to this addendum contains a complete list of the updated GIS datasets. The Routing Team performed field verifications of the updated datasets along the Proposed Route in May 2016. Additionally, parcel ownership information was updated based on a review of tax cards held with each county tax assessor's office. Tax cards provide information about the legal entity that owns a particular parcel of land.

Q. What was the result of the initial data refresh and review?

A. The initial data refresh indicated that no new landscape features represented by the publicly available datasets would be impacted by the 2014 Proposed Route. At one location in Monroe County an existing transmission line has been rebuilt with a slightly different alignment. In order to maintain a parallel alignment adjacent to the existing line, the Proposed Route has been shifted to match the change in the existing line.

The ensuing outreach to federal and state agencies, and to local and regional non-governmental organizations was conducted to make sure that the route did not impact any newly designated or protected features that fall under the authority or area of concern of those entities. In some instances these entities maintain databases of sensitive features (such as threatened species occurrence locations) which are not available publicly.

Q. Please describe the Routing Team's efforts to coordinate with government agencies and non-governmental organizations ("NGO").

A. The Routing Team coordinated with numerous federal and state agencies, and environmental NGO groups to gather information for the route review process. Agency coordination efforts focused on updates on the status of the Project, data gathering, and discussions concerning likely permitting and consultation requirements. Discussions aided in verifying that newly established or identified resources are not impacted by the Proposed Route. A list of the agencies consulted during the preparation of the Missouri Route Selection Study Addendum is provided in Section 2 of **Schedule JGP-2**. Several agencies and NGOs conducted detailed reviews of the Proposed Route to ensure that no new impacts were identified. These reviews were similar in scope to reviews conducted during the original routing effort in Missouri.

Q. Was public input taken into account during this process?

A. Yes. Two primary avenues for public input were used during this process: landowner discussions and public landowner meetings. Discussions with individual landowners along the Proposed Route occurred during the 2014 Case and more recently. Some of these conversations included specific feedback regarding localized impacts on properties that can be ameliorated with micro-siting revisions. A number of these types of revisions are discussed in the Siting Study Addendum, **Schedule JGP-2.**

Public landowner meetings were held in each of the eight counties along the Proposed Route. The meetings had two primary objectives, which were to inform landowners of Proposed Route revisions and to ask for comments regarding the Proposed Route in relation to their individual properties. Attendees were encouraged to submit written routing-specific comments during the meetings.

Q. Please discuss the Route modifications that were made to the Proposed Route since the 2014 Case.

A. The Missouri Siting Study Addendum, **Schedule JGP-2**, includes a description of 16 revisions to the Proposed Route since the 2014 Case. Fifteen of these revisions resulted from discussions with landowners regarding impacts to specific landscape features on their properties which could be minimized or avoided by minor shifts in the route alignment. One additional revision resulted from a shift in an existing transmission line paralleled by the Proposed Route.

The revisions represent localized modifications to the route to improve siting of the Project on specific properties. As a result, the rationale for selecting the Proposed Route presented in the Siting Study, **Schedule JGP-1**, remains applicable and the general level of impacts described in that report still apply. Incorporating the 16 revisions described in the Siting Study Addendum, **Schedule JGP-2**, results in a Proposed Route that is 0.6 miles longer but has 10 fewer residences within 500 feet, crosses fewer parcels, has 11 fewer known archaeological sites within 1,000 feet, and does not introduce significantly different impacts in other areas.

Q. Please identify the Proposed Route that is being presented to the Commission in this proceeding.

A. The Proposed Route is comprised of Alternative Route Segments B and D as described in the Routing Study (**Schedule JGP-1**), along with the minor revisions outlined in the Routing Study Addendum (**Schedule JGP-2**).

VI. DESCRIPTION OF THE PROPOSED ROUTE

Q. Does the Routing Study contain a description of the entire length of the Proposed Route?

A. Yes. A general description of the Proposed Route is set forth in Figure 1 of **Schedule JGP-2**. Generally, the Proposed Route will begin at a crossing of the Missouri River south of St. Joseph, Missouri and cross though Buchanan, Clinton, Caldwell, Carroll, Chariton, Randolph, Monroe, and Ralls Counties to the proposed crossing location of the Mississippi River south of Saverton, Missouri in Ralls County. The intermediate converter station will be located in Ralls County in proximity to Ameren's Montgomery – Maywood 345 kV transmission line which will facilitate the interconnection to the MISO market.

Q. Did the process of choosing the Proposed Route include compiling a list of all electric and telephone lines, railroad tracks and underground facilities in Missouri that the Project will cross?

A. Yes. During the comparison of Alternative Routes, the number of electric line crossings, pipeline crossings, and railroad crossings was compared across Alternative Routes. When the Proposed Route was selected, a list of such entities was prepared for each county crossed by the Proposed Route and is attached as Exhibit 3 to the Application.

Q. Given the process followed by the Routing Team, what is your final assessment of the Proposed Route for the Grain Belt Express Project?

A. The Proposed Route for the Project is a reasonable and sound route that was derived from a robust route selection process that integrates input from government agencies, local officials, and the general public into the route development, analysis, and selection process. Given the extensive nature of these efforts, I believe the Proposed Route best minimizes the overall effect of the Grain Belt Express transmission line on the natural and human environment while avoiding unreasonable and circuitous routes, unreasonable costs, and special design requirements.

Q. Does this conclude your direct testimony?

A. Yes, it does.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Grain Belt Express Clean Line LLC for a Certificate of Convenience and Necessity Authorizing it to Construct, Own, Control, Manage, Operate and Maintain a High Voltage, Direct Current Transmission Line and an Associated Converter Station Providing an Interconnection on the Maywood-Montgomery 345 kV Transmission Line	)))))))	Case No. EA-2016-0358

AFFIDAVIT OF JAMES G. PUCKETT

STATE OF New York)
) ss
COUNTY OF Westchester)

James G. Puckett, being first duly sworn on his oath, states:

1. My name is James G. Puckett. I am the Practice Lead for Geospatial Analysis and Cartography for the Louis Berger Group, Inc.

2. Attached hereto and made a part hereof for all purposes is my Direct Testimony on behalf of Grain Belt Express Clean Line LLC consisting of 18 pages, having been prepared in written form for introduction into evidence in the above-captioned docket.

3. I have knowledge of the matters set forth therein. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded, including any attachments thereto, are true and accurate to the best of my knowledge, information and belief.

James G. Puckett

Subscribed and sworn before me this 27 day of August, 2016.

Notary Public

My commission expires: March 9, 2019

JONATHAN GONZALEZ
Notary Public - State of New York
NO. 01GO6320718
Qualified in Westchester County
My Commission Expires Mar 9, 2019

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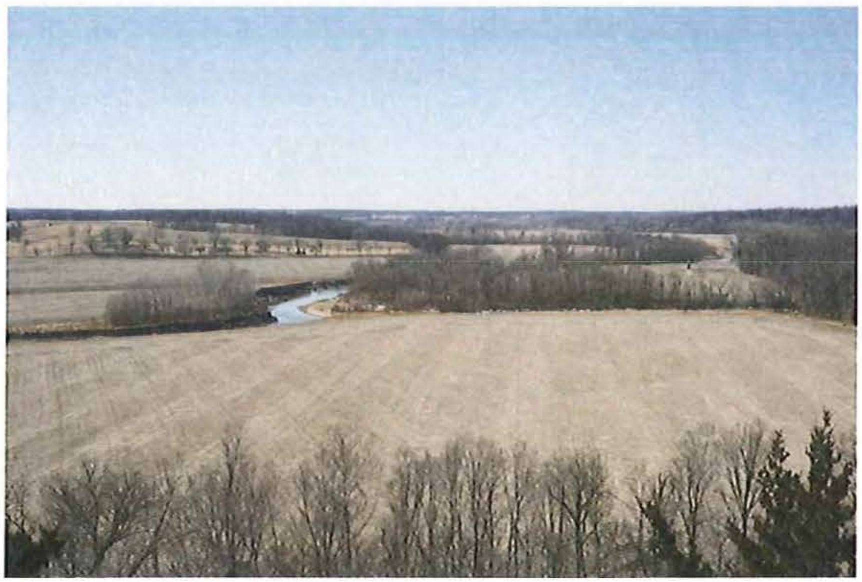
GRAIN BELT EXPRESS CLEAN LINE

MISSOURI

ROUTE SELECTION STUDY



Prepared For Clean Line Energy Partners, LLC

CLEAN LINE
ENERGY PARTNERS

Prepared By The Louis Berger Group, Inc.

THE Louis Berger Group, INC.

March 2014

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Acronyms and Abbreviations

AC	alternating current
A.D.	Anno Domini
B.C.	Before Christ
CRP	Conservation Reserve Program
DC	direct current
FAA	Federal Aviation Administration
GIS	Geographic Information System
Grain Belt Express	Grain Belt Express Clean Line LLC
Grain Belt Project	Grain Belt Express Clean Line Project
HVDC	high voltage direct current
IDNR	Illinois Department of Natural Resources
KCC	Kansas Corporation Commission
KDWPT	Kansas Department of Wildlife, Parks, and Tourism
kV	kilovolt
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MISO	Midcontinent Independent System Operator, Inc.
MONHP	Missouri Natural Heritage Program
MW	megawatt
NASS	National Agricultural Statistics Service
National Register	National Register of Historic Places
NRCS	Natural Resources Conservation Service
Project	Grain Belt Express Clean Line Project
ROW	right-of-way
SHPO	State Historic Preservation Office (Officer)
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
WRP	Wetland Reserve Program

Glossary

Alternative Routes—routes assembled from links that were refined after the Open Houses. One Alternative Route is ultimately selected as the Proposed Route.

Conceptual Routes—initial routes developed to consider a range of reasonable alignments in the Study Area. They are the first step in identifying routes based on large-scale opportunities and constraints and are aligned more generally than Potential Routes or Alternative Routes.

constraint—areas that should be avoided to the extent feasible and reasonable during the route selection study process. The constraints were divided into two groups based on the size of the geographic area encompassed by the constraint. The first group includes constraints covering large areas of land in the Study Area. The second group of constraints encompasses other features covering smaller geographic areas or point-specific locations.

general routing guidelines—a set of principles that guide the development of alignments with respect to area land uses, sensitive features, and considerations of economic reasonableness.

link—the section of a Potential Route located between two nodes.

node—a common point of intersection between two or more Potential Routes.

Open House—a public open house meeting in the Missouri study area.

opportunities—areas where the transmission line would have less disruption to area land uses and the natural and cultural environment. Opportunities typically include other linear infrastructure and utility corridors, such as the existing electric and gas transmission network, rail lines, and roads but may also include reclaimed lands or unused portions of industrial or commercial areas.

Potential Routes—Conceptual Routes are refined into Potential Routes as additional information from agency coordination, public outreach, and ongoing route revisions are considered. Potential Routes ultimately become Alternative Routes after further refinement following Open Houses.

Potential Route Network—all Potential Routes and their interconnection points (nodes).

Proposed Route—route identified by the Route Selection Study that is ultimately filed with the Missouri Public Service Commission for construction.

Refined Potential Route Network—as the Potential Route Network is refined, links are modified, removed, or added creating the refined Potential Route Network. The Refined Potential Route Network is then presented to regulators and the public for comment and input.

Roundtables—community leader roundtables.

Routing Team—the multi-disciplinary team that developed the conceptual route network, refined the Potential Routes, analyzed and compared Alternative Routes, and selected the Proposed Route. The Routing Team's experience includes transmission line route planning and selection, impact assessment for natural resources, land use assessment and planning, cultural resource identification and assessment, impact mitigation, transmission engineering and design, and construction. A list of the Routing Team members, along with a description of their individual role, is in Appendix A.

Study Area—portions of Kansas, Missouri, Illinois, and Indiana. The Study Area includes the converter station locations in Ford County, Kansas; a converter station in eastern Missouri; and a converter station near Sullivan County, Indiana.

technical guidelines—technical limitations for the Routing Team to follow related to the physical limitations, design, right-of-way requirements, or reliability concerns of the Project infrastructure.

Executive Summary

Introduction

Grain Belt Express Clean Line LLC proposes to construct a new high voltage direct current transmission line from Ford County, Kansas, to Sullivan County, Indiana. The high voltage direct current transmission line would be approximately 750 miles long and deliver approximately 3,500 megawatts of low-cost, renewable power to markets in Missouri, Illinois, Indiana, and states farther east.

The HVDC transmission line would connect to the grid at three converter stations to be constructed near 1) Sunflower Electric Cooperative's Spearville Substation in Ford County, Kansas; 2) at a point along the Maywood-Montgomery 345 kilovolt line; and 3) near American Electric Power's Sullivan Substation in Sullivan County, Indiana. Together, the HVDC transmission line, converter stations, and a series of alternating current transmission lines that will collect electricity from generators in Kansas (AC Collector System) comprise the Grain Belt Express Clean Line Project.

Grain Belt Express retained The Louis Berger Group, Inc., in late 2010 to support the siting, public outreach, and regulatory process for the Project. Together, staff from The Louis Berger Group, Inc., and Grain Belt Express conducted a Route Selection Study to identify a Proposed Route for the Grain Belt Express HVDC transmission line in Missouri. The Proposed Route was considered by the Routing Team to be the route that minimizes the overall effect of the transmission line on the natural and human environment while avoiding unreasonable and circuitous routes, unreasonable costs, and special design requirements.

Routing Process

The Routing Team employed a route selection process that involved iterative phases of information gathering, outreach, route development, and route review and revision. The assemblage of routes under consideration was referred to with terminology representing each major phase of route development from the earliest Conceptual Routes, to Potential Routes, to Alternative Routes, and ultimately to the selection of the Proposed Route.

Initial route development efforts started with identifying large area constraints and opportunity features across the entire Project Study Area. Using this information, the Routing Team developed a range of Conceptual Routes, which were approximate alignments that focused the early data gathering, field reconnaissance, and public outreach efforts of the Routing Team. During this step, Roundtables were held in portions of the Study Area in each county with Conceptual Routes. The Roundtable meetings were held to gather input from local officials, economic development representatives, and community leaders on area constraints, opportunities, and Conceptual Route alignments in those areas that provided the most suitable routing options for the Project. Fifty-seven Roundtable meetings were held across the Study Area. Upon completion of these Roundtables, the Routing Team had collected information from more than 740 community leaders in the Study Area. In Missouri, 24 Roundtables were held, with more than 250 participants attending from more than 40 counties.

As the Routing Team continued to collect information, coordinate with regulatory agencies, and gather additional information, the assemblage of Conceptual Routes was narrowed and refined. These refinements ultimately eliminated the Conceptual Routes in the southern and central portions of the Study Area from further consideration due to challenges associated with a range of routing constraints, including: large areas of federal land ownership, large complexes of reservoirs and recreational lakes, dense and interspersed development, and a lack of suitable crossings of the Mississippi River.

The remaining routes in the northern portion of the Study Area were considered Potential Routes and extended northeast from Ford County, Kansas; crossed the Missouri River between Kansas City and the Nebraska state line; crossed the Mississippi River north of St. Louis; and continued to the Sullivan Substation remaining south of Springfield, Illinois. The Potential Routes were further refined and presented to state and local agency officials and the general public at a series of Open House meetings. At the Open Houses, the Routing Team provided information about the Project and collected feedback to help further refine the Potential Routes. More than 1,200 people attended the 13 Open House meetings in Missouri.

Following the Open Houses, the Routing Team assembled and reviewed the input gathered during and after the meetings, revised the Potential Route Network where necessary, and reviewed the potential Mississippi River crossing locations. Several potential river crossing locations were presented at the Open House meetings and reviewed with state and federal regulatory agencies. Once the preferred Mississippi River crossing location was determined, Alternative Routes were developed for analysis and comparison across Missouri. The Routing Team divided the Alternative Routes into two distinct segments that had common beginning and end points: Segment 1 (A through C) and Segment 2 (D through I). Alternative Routes in each segment were compared against one another, and the most suitable route from each segment was selected for compilation of the Proposed Route.

Alternatives Analysis and Selection of the Proposed Route

The Alternative Routes (Alternative Routes A through I) were assessed and compared with respect to their potential impacts on natural resources (water resources, wildlife and habitats, special status species, and geology and soils), human uses (agricultural use, populated areas and community facilities, recreational and aesthetic resources, and cultural resources), and any noted engineering or construction challenges (transportation, existing utility corridors, and other existing infrastructure).

From that analysis, the Routing Team recommended a combination of Alternative Routes B and D as the Proposed Route for the Project. This combination of Alternative Routes met the overall goal of minimizing impacts on the natural and human environment along the route, while best utilizing existing linear rights-of-way and avoiding non-standard design requirements.

Alternative Route B was selected as the Proposed Route in Segment 1. The route follows the existing Rockies Express/Keystone gas pipelines, an existing transmission line, and section/parcel boundaries for 36 percent of its total length. In addition, no residences are located within 250 feet of the Alternative Route B, and it avoids the residential congestion located along the gas pipeline further east and north of the town of Agency. Alternative Route B had the least amount of potential impact to forested areas, which also results in the least potential impact to Indiana bat and northern long-eared bat summer roosting habitat. Alternative Route B also reduces the fragmentation of area land use, by locating the line adjacent to the existing utility infrastructure.

Alternative Route D was selected in Segment 2. It follows the Rockies Express/Keystone pipelines, existing transmission lines, and section parcel boundaries for approximately 57 percent of its total length. Alternative Route D has the least number of residences within 250 and 500 feet. Alternative Route D is also located approximately 5 miles south of the Swan Lake National Wildlife Refuge, which is an important area for migratory birds. In addition, the area around Swan Lake National Wildlife Refuge has large complexes of wetlands, some of which are protected under the Natural Resource Conservation Service's Wetland Reserve Program. Considering Alternative Route D parallels existing linear infrastructure for a significant portion of the total length, new fragmentation in forested areas would be minimized. Furthermore, Alternative Route D also has the fewest acres of forested habitat within the right-of-way, which results in the least potential impact to the Indiana bat and northern long-eared bat habitat.

The combination of Alternative Routes B and D comprise a Proposed Route for the Project that is reasonable and sound because: 1) the selection of the Proposed Route integrated input from government agencies, local officials, and the general public into the route development, analysis, and selection process; and 2) the Proposed Route best minimizes the overall effect of the Grain Belt Express transmission line on the natural and human environment while avoiding unreasonable and circuitous routes, unreasonable costs, and special design requirements.

1. Introduction

1.1 Project Overview

Grain Belt Express Clean Line LLC (Grain Belt Express) proposes to construct a new high voltage direct current (HVDC) transmission line from Ford County, Kansas, to Sullivan County, Indiana. The HVDC line would be approximately 750 miles long and deliver approximately 3,500 megawatts (MW) of low-cost, renewable power to markets in Missouri, Illinois, Indiana, and states farther east. HVDC is the ideal technology for transferring a large amount of power over long distances for several reasons, including electrical reliability and land use efficiency.

The HVDC transmission line would connect to the grid at three distinct locations. The proposed converter stations would be constructed near 1) Sunflower Electric Cooperative's Spearville Substation in Ford County, Kansas; 2) near Ameren Missouri's Maywood-Montgomery 345 kilovolt (kV) line in Ralls County, Missouri; and 3) near American Electric Power's Sullivan Substation in Sullivan County, Indiana. The converter station in Ford County, Kansas, would convert the alternating current (AC) electricity from new wind generators in the local area to direct current (DC) electricity for delivery by the HVDC line. The proposed converter stations near the Missouri/Illinois border and near the Sullivan Substation in Indiana would convert DC electricity to AC electricity for delivery to the local AC electric grid.

Together, the HVDC transmission line, converter stations, and a series of AC transmission lines that would collect electricity from generators in Kansas (AC Collector System) comprise the Grain Belt Express Clean Line Project (Grain Belt Project or Project) (**Figure 1-1**). The primary focus of this study will be on the siting effort associated with the HVDC transmission line.

Figure 1-1. Project Overview Diagram

1.2 Overview of the Regulatory Process

Grain Belt Express is seeking approval to own, construct, and operate the HVDC transmission line in each state crossed by the Project, including Kansas, Missouri, Illinois, and Indiana. Regulatory approval has been secured in Kansas and Indiana. Regulatory proceedings associated with the approval of the Project are being hosted independently by each state utility commission per specific regulatory requirements in that state. Approval from the Illinois Commerce Commission will be requested following the filing with the Missouri Public Service Commission. Once approvals for the Project are received from each state, site-specific permitting and consultation efforts concerning wetlands, cultural resources, highway crossings, and others will be initiated with the appropriate state and federal agencies.

In Missouri, the regulatory process for approval to construct the Project will require submitting an application for a transmission line Certificate of Convenience and Necessity. The application will include a description of the Proposed Route in Missouri; the location of the intermediate converter station in Ralls County, Missouri. The buffer area will allow for micro-siting efforts during engineering and landowner negotiations. The buffer around the Proposed Route is narrower in some locations due to land use constraints, such as an incorporated town, state park, or federal land, which makes that area less suitable for a transmission line. This study will be presented as part of the Certificate of Convenience and Necessity application process for the HVDC portion of the Grain Belt Express Project in Missouri.

1.3 Project Timeline and Routing Process Overview

Grain Belt Express began formal development of the Project in July 2010. Soon after, Grain Belt Express contracted with The Louis Berger Group, Inc., to support the siting, public outreach, and regulatory process for the Project. Staff from The Louis Berger Group, Inc., and Grain Belt Express (the Routing Team) began compiling information about the Study Area by coordinating with various regulatory agencies and identifying Conceptual Routes (see Section 2.2 for a description of route development) for the Project.

In spring 2011, the Routing Team began hosting a series of community leader roundtables (Roundtables) (see Section 3.3.1) in southern Missouri and Kansas to gather information regarding local area constraints, regulatory concerns, and development plans from county officials, mayors, economic development coordinators, regional planners, environmental organization leaders, and federal and state agency officials. Throughout the summer of 2011, the Routing Team continued to consider routing concepts, coordinate with agencies, and review possible routing options in the field between the western converter station proposed near Spearville, Kansas, and an eastern delivery point to be located near the St. Francois Substation in Missouri.

In July 2011, the Midcontinent Independent System Operator, Inc. (MISO)[1] provided Grain Belt Express with preliminary Systems Planning Analysis results from the interconnection studies of the Project. The results showed that the upgrades necessary to deliver 3,500 MW to the St. Francois Substation in Missouri would make the Project economically infeasible. The results of this analysis required Grain Belt Express to identify an additional connection point on the electric grid that could accept a large portion of power delivered by the Project, in addition to maintaining a delivery point in Missouri and MISO. After identifying the Sullivan Substation near the Illinois/Indiana border as a logical and suitable location for the Project's final delivery point, Grain Belt Express initiated a feasibility study in August 2011 with PJM Interconnection, Inc.

In fall 2011, the Routing Team expanded the Study Area to account for the change in the Project's eastern delivery point and began to develop Conceptual Routes for the newly reconfigured Project. Under the new configuration, the eastern endpoint was shifted 85 miles north, allowing for possible routes north of Kansas City and St. Louis, in addition to potential routing options in southern Kansas and Missouri. The expanded Study Area also included a new range of reasonable interconnection points for the intermediate converter station in Missouri (see Section 5.3).

During winter 2011, the Routing Team developed a range of Conceptual Routes in the Study Area for the reconfigured Project. By spring 2012, the Routing Team began a series of Roundtable meetings in locations along the northern portion of the Study Area in Kansas, Missouri, and Illinois, and in southern Illinois, gathering information to add to the information previously gathered across southern Kansas and Missouri to reach St. Francois. Fifty-seven Roundtable meetings were held across the Study Area. By the time these Roundtables were completed, the Routing Team had collected information from more than 740 community leaders in the Study Area. In Missouri alone, representatives from more than 40 counties, totaling more than 250 participants, attended 24 Roundtables.

During summer and fall 2012, the Routing Team continued to coordinate with state and federal regulatory agencies concerning key constraint areas, routing opportunity features, and potential suitable crossing locations of the Missouri, Mississippi, and Illinois rivers. The Routing Team continued to review and refine the network of Conceptual Route alignments, and by fall 2012, it had eliminated the southern and central Conceptual Routes to focus analysis and Potential Route development efforts on the northern portion of the Study Area. The refined Study Area encompasses the area around Spearville, Kansas; north of the Flint Hills and Kansas City and south of the Nebraska state line; east toward the Mississippi River between St. Louis, Missouri, and Quincy, Illinois; and then east across Illinois (on a general trajectory south of Springfield) toward the Sullivan Substation in Indiana, south of Terre Haute. Numerous conceptual routes

[1] Formerly the Midwest Independent Transmission System Operator, Inc.

were formed across the Study Area and multiple Missouri and Mississippi river crossing locations were evaluated to determine reasonable alignments across the rivers into Missouri and Illinois.

In summer 2013, the proposed route in Kansas was selected. The Proposed Route crossed the Missouri river and entered Missouri south of St. Joseph along the Rockies Express/Keystone Pipeline corridor. This location became the official starting point of the otential Routes under evaluation in Missouri.

The Routing Team planned and hosted 12 Open House meetings (see Section 3.3.2) throughout the northern portion of the Study Area in Missouri to present Potential Routes to local landowners and the general public in late summer 2013. An additional Open House was also held in December, southeast of Moberly, to inform the public and receive feedback on a Potential Route that was added to the network. More than 1,200 members of the public attended the Open Houses in Missouri; the attendees were asked to provide comments on the Project and the Potential Routes.

During summer and fall 2013, the Routing Team reviewed and replied to hundreds of public comments from the Open Houses in Missouri and comments submitted online, by mail, or by telephone. The Routing Team reviewed input from the public and considered specific sensitive features and areas of concern, resulting in further refinement of the Potential Routes for the Project. Grain Belt Express continued coordination with state and federal regulatory agencies and non-governmental groups associated with historic and natural resources during this period.

By late fall 2013, the Routing Team had refined the assemblage of Potential Route alignments and identified Alternative Routes from the Missouri River to the Mississippi River. The Routing Team continued to coordinate with and update state and federal regulatory agencies to determine a preferred Mississippi River crossing location. Next, a preferred river crossing was identified, and Alternative Routes were assembled from the Potential Route Network. After analyzing and comparing the Alternative Routes, a Proposed Route through Missouri was selected. This report presents the process, activities, analysis, and decision rationale for selection of the Proposed Route.

1.4 Project Description

1.4.1 Line Characteristics

The Grain Belt Express Project would be constructed as ±600 kV HVDC transmission line that would be capable of delivering 500 MW of power to the intermediate converter station in Missouri and 3,500 MW of power to the Sullivan Substation. The HVDC transmission line facility consists of the primary conductors that carry the electricity, metallic return conductors, shield wires that protect the line from lightning strikes, structures that support the conductors and wires, and foundations that support the structures.

Up to eight primary conductors would be arranged in two bundles of three or four conductors, representing the positive and negative poles of the HVDC line. Each conductor would be roughly 1.5 inches in diameter and composed of aluminum wire strands surrounding inner strands of steel. Each conductor bundle would be suspended at the structures by insulators arranged in either a "V-string" or "I-string" configuration. The metallic return conductors would be located above the pole conductors and would be supported at the structures by insulators rated to approximately 90 kV. At the top of the structures would be two shield wires. One or both of these shield wires may be optical ground wires that provide both lightning protection and fiber optics for communications involved in the control and protection of the line and converter stations.

Grain Belt Express is proposing the use of steel lattice, lattice mast, and/or steel monopole transmission structures for the majority of the Project. In some instances guyed lattice structures may be used. Grain Belt Express may use all three structure types for the Project, based on conditions at specific locations or in particular segments of the line.

Figure1-2 presents schematics of the three typical structure types showing standard dimension ranges. These ranges are approximate and subject to final engineering.

1.4.2 Right-of-Way Characteristics

The HVDC portion of the Grain Belt Express Project would be constructed within a 150- to 200-foot-wide right-of-way (ROW), which would be primarily composed of easements across private land. The ROW would be cleared to its full width of tall growing vegetation (taller than 10 feet) or as necessary for the safe and reliable operation of the transmission line. Farming and grazing land uses are typically compatible and can continue under the transmission line. Only the area at the base of each structure would be removed from existing land use (roughly 0.018 acre for a typical lattice structure or 0.0009 acre for a typical monopole or steel lattice mast structure).

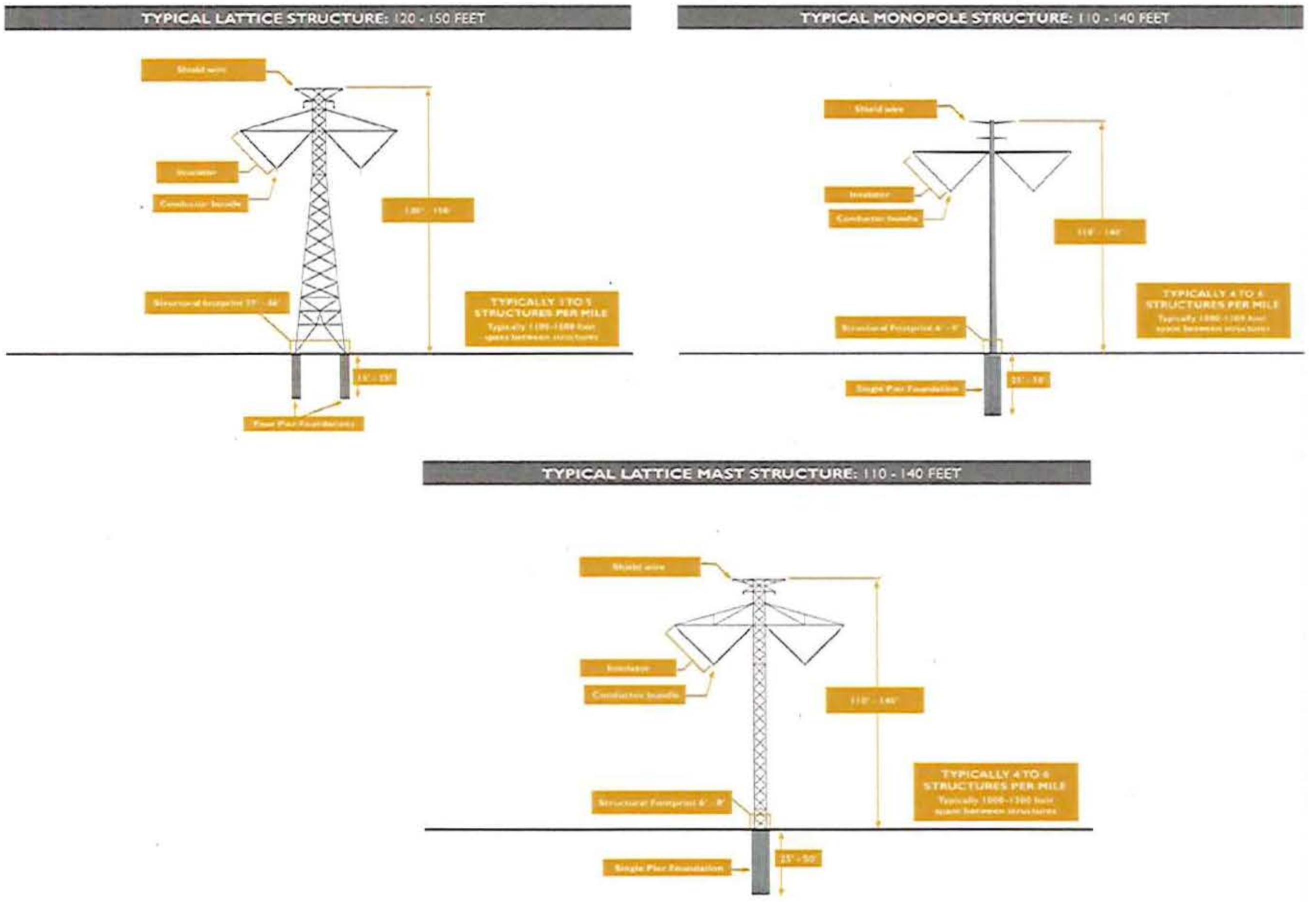


Figure 1-2. Typical Structure Types

1.4.3 Converter Stations

As mentioned previously, three HVDC converter stations are components of the Grain Belt Express Project. A converter station at the western end, where the wind energy is generated in Kansas, would convert power from AC to DC. The other two converter stations would invert power from DC into AC for delivery to customers through the existing AC electric grid. The Grain Belt Express Project would deliver power to the AC grid in two locations, one in Missouri and one near the Illinois/Indiana border, to serve consumers in the MISO and PJM Interconnection, Inc., markets, respectively.

The intermediate converter station would be located near the intersection of the existing Ameren Missouri's Maywood-Montgomery 345 kV transmission line and the Proposed Route in Ralls County, Missouri. A converter station for an HVDC transmission line looks similar to a typical large electric substation; however, there is also a building that contains the converter power electronics in an enclosed environment. Each converter station would require roughly 40 to 60 fenced-in acres and be located near its point of interconnection to the AC grid. Section 5.3 discusses the potential sites for the intermediate converter station in Missouri.

1.4.4 Project Vicinity

The Project would be constructed between Ford County, Kansas, and Sullivan County, Indiana (**Figure 1-3**). Land use in the area is dominated by a combination of rural agricultural land uses (active farm and ranch lands) in the west and along the north with a progressive transition to more heavily forested landscapes farther east and south in Missouri and Illinois. Four major rivers, the Arkansas, Missouri, Mississippi, and Illinois, cross the area and provide water for agricultural lands.

Major cities from west to east include Dodge City, Wichita, and Topeka, Kansas; St. Joseph, Kansas City, Springfield, Columbia, Jefferson City, and St. Louis, Missouri; and Quincy, Springfield, and Belleville, Illinois. Kansas City and St. Louis are by far the largest cities in the Study Area; together, they are home to nearly a million residents in the cities proper with estimates up to five million when combining the populations of both metro areas.

Major large land area attractions and recreational resources include the Flint Hills (Tall Grass Heartland); the Mark Twain and Shawnee National Forests; Mark Twain Lake; the general region of the Ozarks within which the forests lie; and a widely distributed array of federally and state-managed reservoirs that provide outdoor recreation, flood protection, and water sources.

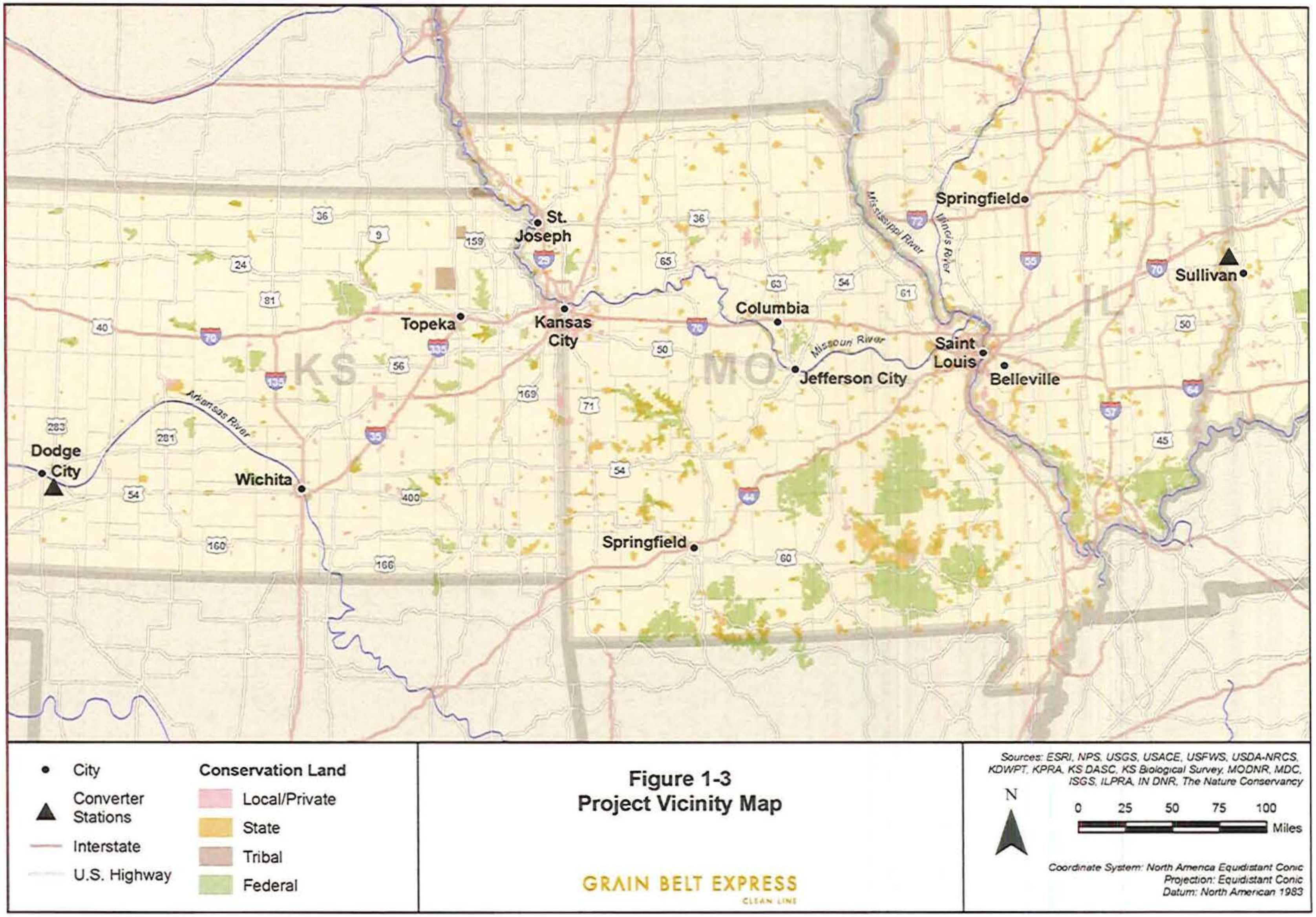


Figure 1-3
Project Vicinity Map

2. Routing Process

2.1 Goal of the Route Selection Study

The route selection study was conducted to identify the route for the Grain Belt Express Project transmission line. The overall goal of this Route Selection Study is to gain an understanding of the opportunities and constraints in the Study Area, develop feasible Alternative Routes, evaluate potential impacts, and identify a Proposed Route for the Project. The Proposed Route is defined as the route that minimizes the overall effect of the transmission line on the natural and human environment, avoids unreasonable and circuitous routes and unreasonable costs, and minimizes special design requirements.

This document describes the route selection methodology, public and agency outreach processes, and the Proposed Route identification process for the Missouri portion of the Grain Belt Express Project that extends from the Missouri River to the Mississippi River.

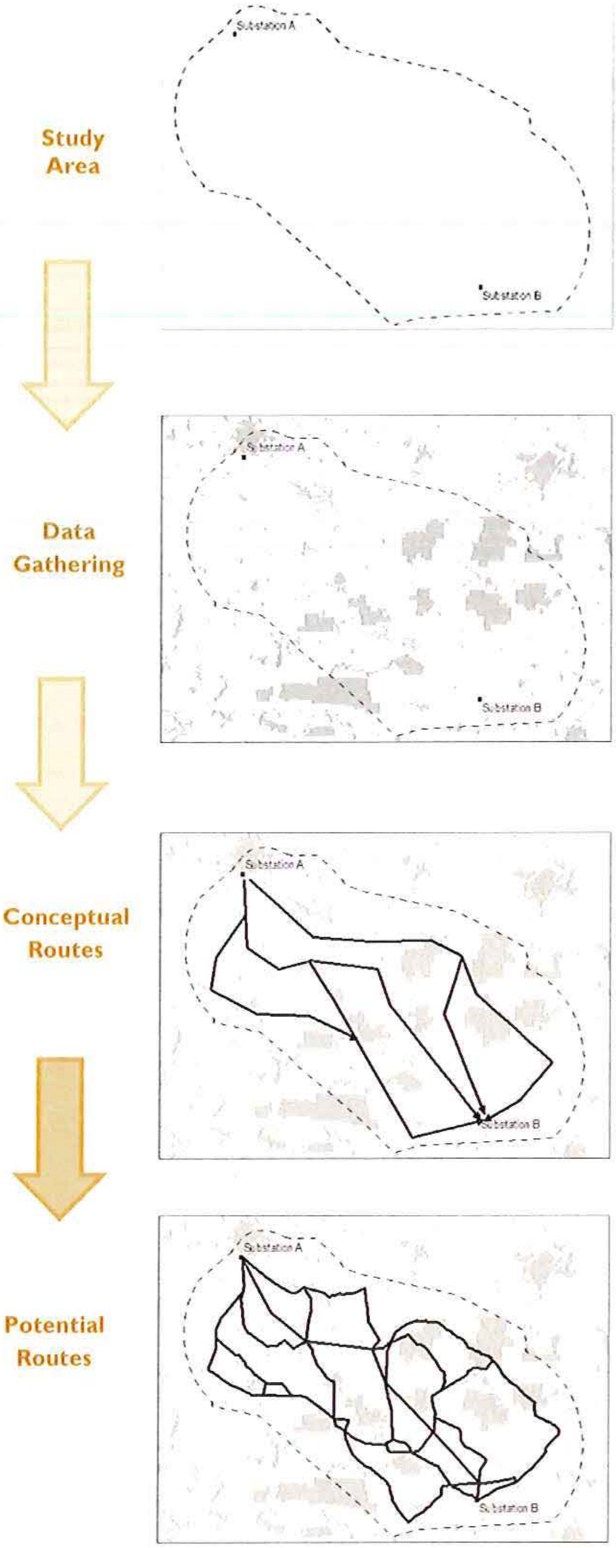
2.2 Process Steps and Terminology

The route development process is inherently iterative with frequent additions or deletions of line segments and revisions to existing alignments as new constraints, opportunities, and inputs are received. Because of the evolutionary nature of the route development process, the Routing Team uses specific vocabulary to describe the routes at different stages of development.

Initial route development efforts start with identifying large area constraints and opportunity features within the **Study Area**, which encompasses the endpoints of the project and areas in between. These areas are typically identified using a combination of readily available public data sources.

The Routing Team uses this information to develop **Conceptual Routes** adhering to a series of general routing and technical guidelines (see Section 2.4). Efforts are made to develop Conceptual Routes throughout the Study Area to ensure that all reasonable alignments are considered. Alignments are approximate at this stage, but are revised after ongoing review and analysis and with input from the public, regulators, and stakeholders. During this step, Roundtables are held in each county with a Conceptual Route to gain more information about the Study Area.

As the Routing Team continues to collect information, coordinate with regulatory agencies, and gather additional site-specific information, Conceptual Routes are refined. The revised Conceptual Routes are considered **Potential Routes**.



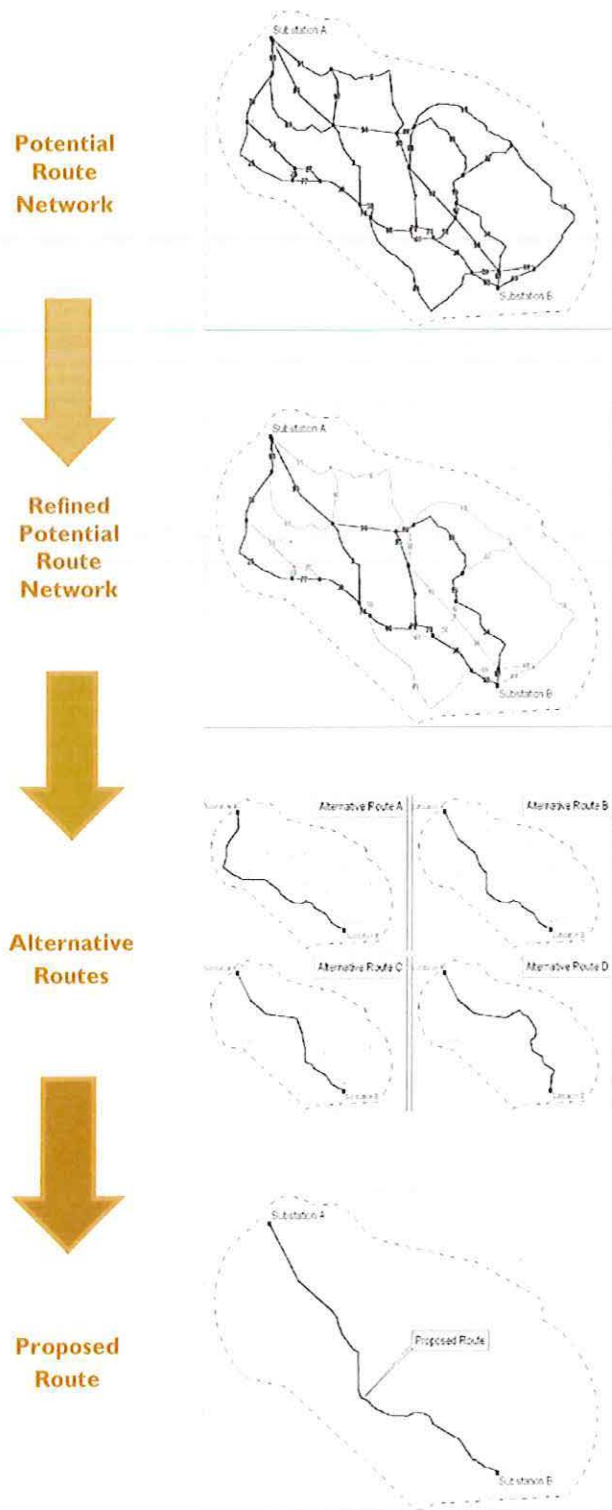
Where two or more Potential Routes intersect, a **node** is created, and between two nodes, a **link** is formed. Together, the Potential Routes and their interconnected links are referred to as the **Potential Route Network**. The links are numbered for identification, and evaluated independently and collectively for refinements.

As the Routing Team continues to gather information and review the links of the Potential Route Network, links are modified, removed, or added. After an iterative process, a **Refined Potential Route Network** is presented to regulators and the public at Open Houses. Attendees provide input on Potential Route links and additional site-specific information for the Routing Team to consider.

After public input is incorporated, the links of the Potential Route Network are further refined and compared and a selection of the most suitable links is assembled into **Alternative Routes**.

Alternative Routes are routes that begin and end at similar locations for direct comparison. Potential impacts are assessed and compared with land uses, natural and cultural resources, and engineering and construction concerns.

Ultimately, through analysis and comparison of the Alternative Routes, a **Proposed Route** is identified. The Proposed Route minimizes the effect of the Project on the natural and human environment, while avoiding circuitous routes, extreme costs, and non-standard design requirements.



*Please note the above graphics are for illustration purposes only and do not reflect actual routes.

2.3 Routing Team Members

A multidisciplinary Routing Team performed the Route Selection Study. Members of the Routing Team have experience in transmission line route planning and selection, impact assessment for natural resources, land use assessment and planning, cultural resource identification and assessment, impact mitigation, transmission engineering and design, and construction. The team's objective is to identify a route that would provide a reasonable balance between impacts on local communities and the natural environment, while applying appropriate routing and technical guidelines, as addressed in detail below. **Appendix A** lists the Routing Team members and their respective areas of responsibility.

The team worked together during the route selection study to:

- Define the Study Area
- Develop routing guidelines
- Collect and analyze environmental and design data
- Identify routing constraints and opportunities
- Consult with resource and permitting agencies
- Develop and revise the route alternatives
- Analyze and report on the selection of a Proposed Route

2.4 Routing Guidelines

As described above, the overall goal of the Route Selection Study is to identify a Proposed Route that minimizes the overall effect of the transmission line on the natural and human environment, avoids unreasonable and circuitous routes and unreasonable costs, and minimizes special design requirements. Routing guidelines help the Routing Team reach that goal by setting forth general principles that guide the development of alignments considered in the study.

The Routing Team considered two types of Routing Guidelines: General Guidelines and Technical Guidelines. General Guidelines establish a set of principles that guide the development of alignments with respect to area land uses, sensitive features, and considerations of economic reasonableness. Technical Guidelines provide the Routing Team with technical limitations related to the physical limitations, design, ROW requirements, or reliability concerns of the Project infrastructure.

2.4.1 General Guidelines

The following are General Guidelines used for the Grain Belt Express Project:

a. Minimize route length, circuity, cost, and special design requirements

b. Maximize the separation distance from and/or minimize impacts on residences

c. Maximize the separation distance from and/or minimize impacts on schools, hospitals, and other community facilities

d. Minimize the removal of existing barns, garages, commercial buildings, and other nonresidential structures

e. Minimize impacts on agricultural use, including the operation of irrigation infrastructure, where possible

f. Avoid crossing cemeteries or known burial places

g. Minimize crossing designated public resource lands, such as national and state forests and parks, large camps and other recreational lands, designated battlefields or other designated historic resources and sites, and state designated wildlife management areas

h. Minimize crossing large lakes, major rivers, and large wetland complexes

i. Minimize impacts on critical habitat, protected species, and other identified sensitive natural resources

j. Minimize substantial visual impacts on residential areas and public resources

2.4.2 Technical Guidelines

The following are Technical Guidelines used for the Grain Belt Express Project:

a. Minimize the crossing of 345 kV and 500 kV transmission lines

b. Minimize paralleling corridors with more than one existing 345 kV or above circuit

c. Maintain 200 feet of centerline-to-centerline separation when paralleling existing transmission lines of 345 kV or above

d. Maintain 150 feet of centerline-to-centerline separation when paralleling 138 kV or lower voltage transmission lines

e. Minimize turning angles in the transmission line greater than 45 degrees

f. Minimize placing structures on sloping soils more than 30 degrees (20 degrees at angle points)

g. Avoid underbuild arrangements with existing AC infrastructure

h. Maintain a safe operational distance from existing wind turbines

2.5 Data Collection

The following sources of information were used to support the analysis in the Route Selection Study.

2.5.1 Digital Aerial Photography

Aerial photography is an important tool for route selection. The primary sources of aerial imagery used in the route identification, analysis, and selection effort for the Project include the National Agricultural Imagery Program's:

- 2010 color aerial photography and
- 2012 color aerial photography

Aerial photography from these sources was viewed using Geographic Information System (GIS) software (ArcMap v10.1). Updated information, such as the location of residences and other constraints, was annotated to the photography by using either paper maps (at the public meetings) and transferred into the GIS, or digitizing the data directly into the GIS during field inspections.

2.5.2 GIS Data Sources

The study made extensive use of information from existing GIS data sets from many sources, including federal, state, and local governments (**Appendix B**). Much of this information was obtained from official agency GIS data access websites and government agencies. The Routing Team digitized information from paper-based maps, completed aerial photo interpretation, conducted interviews with stakeholders, and completed field reconnaissance.

2.5.3 Route Reconnaissance

Routing Team members examined Potential Routes by automobile from points of public access and correlated observed features to information identified on aerial photography, U.S. Geological Survey 7.5 minute topographic maps in digital format, road maps, and the range of GIS sources. Prior to field reconnaissance, some key features, such as residences, outbuildings, recognized places of worship, cemeteries, and commercial and industrial areas, were identified and mapped in GIS using aerial photography. Residences were categorized as either occupied or unoccupied. In instances where it was unclear whether or not a residence was occupied, it was assumed to be occupied. These features were then verified and added to the GIS database using laptops running GIS software supported by real-time Global Positioning System during field reconnaissance efforts.

In addition to automobile reconnaissance, the Routing Team also conducted a helicopter review to examine the Proposed Route from the air to determine the presence or absence of features not visible from the ground-based reconnaissance efforts.

2.6 Routing Constraints

The Routing Team identified and mapped routing constraints in the Study Area. These constraints were defined as areas that should be avoided to the extent feasible during the route selection study process. The constraints were divided into two groups based on the size of the geographic area encompassed by the constraint. The first group included constraints covering large areas of land in the Study Area. The Routing Team considered large-area constraints as unfavorable or incompatible for developing routes and avoided those areas to the extent possible.

The constraint list was revised as the Routing Team developed greater familiarity with the Study Area and gathered additional data through agency and public meetings. The list of large-area constraints consists of:

a. Urban areas, including cities, towns, villages, and other built-up areas
b. Federal lands, including national forests, national parks, national wildlife areas, lands administered by the U.S. Army Corps of Engineers (USACE) for flood control, and military facilities
c. State forest and park lands and wildlife management areas
d. Conservation lands and lands designated for their natural importance or scenic value
e. Native American reservation lands
f. Areas near airports and airstrips
g. National Register of Historic Places (National Register) Historic Districts and adjacent areas
h. Large recreational sites
i. Large lakes and reservoirs that could not be spanned with the structures set well back from the shores
j. Large wetlands or wetland complexes

The second group of constraints encompasses other features covering smaller geographic areas or point-specific locations. As noted previously, Conceptual Routes were developed to avoid large-area constraints. The alignments were then refined to create Potential Routes that avoided, to the extent possible and practical, point-specific constraints, including but not limited to:

a. Individual occupied[2] residences (including houses, permanently established mobile homes, and multi-family buildings)

b. Commercial and industrial buildings

c. Oil and gas wells and their associated storage tanks and pumping facilities

d. Irrigation facilities

e. Recorded and designated historic buildings and sites, including any specified buffer zone around each site

f. Recorded sites of designated threatened, endangered, and other rare species or unique natural areas and the specified buffer zone around each site

g. Small wetlands or playas

h. Developed recreational sites or facilities

i. Communication towers

j. Wind turbines

k. Designated scenic vista points

2.7 Routing Opportunities

Routing opportunities were identified by the Routing Team as locations where the proposed transmission line might be located with less disruption to surrounding land uses and the natural and cultural environment. Opportunity features typically included other linear infrastructure and utility corridors, such as the existing electric and gas transmission networks, rail lines, and roads, but may also include reclaimed lands or unused portions of industrial or commercial areas.

Existing transmission lines were considered an opportunity if they were aligned in a suitable direction. Paralleling existing transmission lines is a common practice used when routing new transmission lines and is supported by many state utility commissions, state and federal regulatory agencies, and the Federal Energy Regulatory Commission (FERC 1970). 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 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), avian resources, and airfield flight zones, since any impacts of the new line are considered with respect to the impacts of the existing line. In

[2] See Section 2.5.3, *Route Reconnaissance*.

these areas, the impacts of the new line are considered incremental to the existing impacts, rather than completely new impacts in otherwise unimpacted areas.

Major pipelines were also considered an opportunity feature, especially in areas where existing transmission lines were not available and in forested areas where the pipeline has an established and cleared ROW. Like transmission lines, pipeline ROWs are cleared linear corridors of existing disturbance, where construction of buildings and other non-pipeline facilities are prohibited. Paralleling these features consolidates linear ROWs with similar construction and use limitations, thereby avoiding the fragmentation of land uses through an area.

Roads are typically considered as a logical linear opportunity for planning transmission lines and are commonly paralleled by lower voltage transmission and distribution lines. However, for higher voltage lines with larger structures and longer spans, alignments along roads often conflict with the residential and commercial development.

Rail lines present a similar type of opportunity feature; one that can be limited by adjacent development. Communities and industrial facilities (including grain elevators) are often located along rail lines, making it difficult to parallel them for any significant distance. However, when feasible, both roads and rail lines were considered.

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.

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3. Agency and Public Outreach

3.1 Regulatory Agency Coordination

The Routing Team contacted numerous federal, state, and local agencies to gather information for the route planning process. Coordination efforts focused on introductions to the Project, data gathering, and discussions concerning likely permitting and consultation requirements. Discussions were also held with Missouri Department of Conservation (MDC), Missouri Department of Natural Resources (MDNR), Missouri State Historic Preservation Office (SHPO), U.S. Fish and Wildlife Service (USFWS), Illinois Department of Natural Resources (IDNR), and USACE regarding the crossing location of the Mississippi River. The agencies were asked to review the potential river crossing locations and identify any information that would be helpful in selecting a preferred crossing. The outcome of these discussions helped to select the final crossing location and is discussed in Section 4.3.

The agencies consulted are provided in the list below. Copies of correspondence with federal and state agencies are provided in **Appendix C**.

Federal Agency and Regulatory Authorities:

- U.S. Environmental Protection Agency, Region 7
- U.S. Fish and Wildlife Service
  - Midwest Region, Columbia Ecological Services Office
  - Mountain-Prairie Region, Kansas Ecological Services Field Office
  - Midwest Region, Rock Island Ecological Services Field Office
  - Midwest Region, Marion Ecological Services Sub-Office
- U.S. Army Corps of Engineers
  - Kansas City District (Kanopolis Office)
  - Rock Island District
  - Louisville District
  - St. Louis District
  - Tulsa District

- National Park Service
  - Fort Larned National Historic Site
  - National Historic Trails
    - California National Historic Trail
    - Santa Fe National Historic Trail
    - Oregon National Historic Trail
- Natural Resources Conservation Service

State Agency and Regulatory Authorities:

- Missouri
  - Missouri Public Service Commission
  - Missouri Department of Conservation
  - Missouri Department of Transportation
  - Missouri Department of Natural Resources
    - State Historic Preservation Office
    - Division of Environmental Quality
- Kansas
  - Kansas Corporation Commission
  - Kansas Department of Transportation
  - Kansas Department of Wildlife, Parks and Tourism
  - Kansas Historical Society
  - Kansas Forest Service
  - Kansas Department of Agriculture
  - Kansas Department of Health and Environment
- Illinois
  - Illinois Commerce Commission
  - Illinois Department of Agriculture
  - Illinois Department of Natural Resources, Historic Preservation Office
  - Illinois Department of Natural Resources
  - Illinois Department of Transportation

- Indiana
  - Indiana Utility Regulatory Commission
  - Indiana Department of Environmental Management
  - Indiana Department of Natural Resources
    - Division of Fish and Wildlife
    - Division of Historic Preservation and Archeology

3.2 Non-Government Organizations

In addition to state and federal agencies, the Routing Team coordinated with members of several natural and historic conservation groups during the process. These contacts provided valuable additional information sources for identifying sensitive natural resource habitats and historic resources in the Study Area. These groups included:

- The Nature Conservancy, Missouri, Kansas, and Illinois Chapters
- National Pony Express Association
- Oregon-California Trails Association
- Sierra Club, Kansas and Missouri Chapters
- Audubon Missouri
- Missouri Coalition for the Environment
- Missouri Prairie Foundation
- Environment Missouri

3.3 Community Outreach Activities

The Routing Team led a community outreach program designed to educate the public about the purpose and benefits of the Project, inform community leaders and the public about the regulatory process and Project timeline, and gather general comments on the Project and specific information that would refine the siting effort.

An important part of initiating the outreach program was to identify key community leaders in each county that might experience Project construction. To this end, Grain Belt Express staff met with local county officials throughout the Study Area early in the development process to introduce the Project and identify key planning, economic development, and community leaders in each county. These contacts provided insight into local planning issues and development efforts.

Two rounds of public outreach meetings were conducted for the Grain Belt Express Project: Roundtables and Open Houses. The Routing Team planned meeting locations within the Study Area so that potential attendees would be within a 30-mile radius of at least one meeting location. In addition, Grain Belt Express staff held five local business opportunity meetings in Missouri to explore opportunities to work with local businesses during the development, construction, and maintenance phases of the Project.

3.3.1 Roundtables

The main goal of the Roundtables was to coordinate with and gain valuable information from community leaders in each county in the Study Area, including local, county, and municipal elected officials, local government planners, community and business leaders, economic development experts, local utilities and cooperatives, as well as federal and state agency officials. At each meeting, members of the Routing Team presented an overview of the Project and described the routing process. After the presentation, attendees and members of the Routing Team broke into small working groups to review aerial maps of the Study Area counties. Attendees were encouraged to write on the maps and to provide and verify specific information about sensitive features, planned development, and existing infrastructure in their community. Attendees were also encouraged to draw route suggestions on the aerial maps that the Routing Team should consider in the study, based on current and future opportunities and constraints. After the meetings, the constraints identified and routes suggested were digitized, reviewed, and/or incorporated into the routing process. Copies of the invitations for the meetings can be found in **Appendix D**.

In Missouri, 24 Roundtables were held with collectively more than 250 participants attending from more than 40 counties. **Table 3-1** shows the locations and attendance for each Roundtable.

Table 3-1. Roundtable Locations and Attendance		
Location	**Date**	**Attendance**
Nevada	June 15, 2011 (AM)	9
Carthage	June 15, 2011 (PM)	6
Greenfield	June 16, 2011 (AM)	15
Hermitage	June 16, 2011 (PM)	6
Buffalo	June 17, 2011 (AM)	14
Waynesville	June 28, 2011 (AM)	9
Rolla	June 28, 2011 (PM)	13
Houston	June 29, 2011 (AM)	9
Centerville	June 29, 2011 (PM)	6
Farmington	June 30, 2011 (AM)	23
Potosi	June 30, 2011 (PM)	11
St. Joseph	March 5, 2012 (PM)	16
Hamilton	March 6, 2012 (AM)	10
Carrollton	March 6, 2012 (PM)	18
Moberly	March 7, 2012 (AM)	18
Mexico	March 7, 2012 (PM)	21
Bowling Green	March 8, 2012 (AM)	11
Hannibal	March 8, 2012 (PM)	12
Macon	May 7, 2012	5
Livingston	June 29, 2012	4
Camden County	July 12, 2012	5
Holt County	October 12, 2012	4
Andrew County	October 29, 2012	4
Monroe	December 12, 2012	6
Total		**255**

The Roundtables provided the Routing Team an avenue to gain community perspectives on new or planned infrastructure in relationship to their county or jurisdiction through face-to-face communication. Generally, the community leaders at the Roundtables helped to identify large area constraints or opportunities in their county or jurisdiction. Community leader input also helped identify potential future land use plans, such as the construction of new water storage facilities; communication towers; or new industrial, commercial, or residential development, and they helped identify and verify the approximate location of existing features, such as historic sites, mining activities, communication towers, airstrips, schools, and churches.

The Routing Team considered data provided by community leaders at the Roundtables in its route development and selection efforts.

3.3.2 Open Houses

In July, August, and December of 2013, Grain Belt Express hosted 13 Open Houses in Missouri along the Potential Route Network; 12 of those meetings occurred in July and August. At the Open Houses, Grain Belt Express representatives provided information about the Project and collected feedback to help refine the Potential Routes and ultimately select a single Proposed Route to file for approval with the Missouri Public Service Commission. After the gathered information was reviewed, the routing options near Moberly were reconsidered and a new Potential Route was added to the network to provide additional options for Alternative Route development. Since the new Potential Route was outside of the previously notified area for the Open Houses in July and August, the Routing Team decided that an additional Open House would be helpful to get public feedback. This additional Open House was held in December and followed the same invitation process and format as the original Open Houses in July and August.

Meeting notification for the Open Houses included individual mailings sent to landowners, newspaper advertisements, coordination with local community leaders, and posts on the Project website. Mailings were sent to property owners (as identified in the local county tax and parcel information received from each county) within an approximately 2.5-mile-wide 'planning corridor' surrounding each Potential Route. Portions of the planning corridors that included major developed and/or incorporated areas were typically removed from mailing lists because these areas were not suitable for route development and the intent of the notification effort was to invite landowners with property that may be directly affected by the Project. Invitations were sent to more than 11,500 people within the planning corridors. Copies of the invitations can be found in **Appendix D**.

More than 1,200 people attended the 13 Open Houses in Missouri. **Table 3-2** contains the locations and attendance for each Open House.

At each Open House, members of the Routing Team greeted and signed in meeting attendees. At sign in, attendees were provided a comment card and asked to fill in their address and contact information at the top of their comment card. The comment card was perforated, and after signing in, the top of the card was removed to document an individual's attendance. The lower portion of the comment card included several questions for attendees to answer and a space to write in general comments about the Project. Attendees were encouraged to turn in this portion prior to leaving the meeting, but were also provided the opportunity to mail comments back to the Routing Team. The upper and lower portions of the comment card were labeled with the same unique number to identify the attendee. In this way, landowner attendance was tracked, and once filled out and submitted, the lower body of the comment card could be linked back to the individual landowner's contact information.

Table 3-2. Open House Locations and Attendance		
Location	**Date**	**Attendance**
Salisbury	July 15, 2013 (PM)	159
Chillicothe	July 16, 2013 (AM)	78
Carrollton	July 16, 2013 (PM)	106
Hamilton	July 17, 2013 (AM)	91
Cameron	July 17, 2013 (PM)	172
St. Joseph	July 18, 2013 (AM)	75
Macon	July 29, 2013 (PM)	106
Moberly	July 30, 2013 (AM)	66
Mexico	July 30, 2013 (PM)	158
Hannibal	July 31, 2013 (AM)	65
Monroe City	July 31, 2013 (PM)	113
Bowling Green	August 1, 2013 (AM)	77
Moberly	December 4, 2013 (PM)	22
Total		**1,288**

After attendees signed in, they were given a guided tour of the Project on poster boards set up on easels. The tour presented information regarding the purpose of the Project, Project benefits, the routing process and criteria, physical characteristics of the line, easement and compensation information, and the Grain Belt Express Code of Conduct. These guided tours typically lasted 15 minutes and were conducted in small groups to allow attendees the opportunity to ask questions and receive immediate answers from members of the Routing Team.

At the end of the tour, Routing Team members assisted attendees in locating their property or other features of concern on aerial photography maps displaying the array of Potential Route links under consideration. Each map presented a specific portion of the line with information on identified constraints, land areas, and existing infrastructure presented at a scale of 1 inch = 1,500 feet. Participants were provided the opportunity and encouraged to document the location of their houses, places of business, properties of concern, or other sensitive resources on the printed maps. Routing Team members worked with landowners and ensured that each comment or group of comments provided by an attendee was also referenced to the number on the attendee's individual comment card (by recording it on or next to the attendee's comments on the map).

One or two digital mapping stations were also provided at each Open House to allow attendees the opportunity to find their lands and document their concerns directly in the GIS database. Each digital mapping station was run by a GIS technician and contained all of the data presented on the printed maps and a full parcel database to help search for parcels that owners could not find on the printed maps. The GIS station was most often used and most efficient for those attendees who were not familiar with their properties from an aerial map perspective, owned a multitude of properties in the area, or had brought a list of properties by either parcel identification number or section/township/range for consideration.

After the Open Houses, all of the maps used to collect comments were scanned, geo-referenced, and integrated into the GIS database. The locations of specific comments provided by attendees, denoted by the commenter's unique comment card identification number, and were digitized and linked to the information provided on the individual's complete comment card. All comments received via the comment cards were recorded and categorized in a database for review and correlation with mapped comment locations.

The comment card included a question related to opportunity features. In developing Potential Routes, the Routing Team looked at paralleling several linear features including transmission lines, gas pipelines, parcel boundaries, roads, and rail lines. To gain greater perspective on these opportunity features, the comment card contained a question asking the public which types of features would be preferred for parallel alignments. **Figure 3-1** below shows the summary of responses to this question. In general, the public preferred paralleling transmission lines, pipelines, parcel boundaries, and roads/highways.

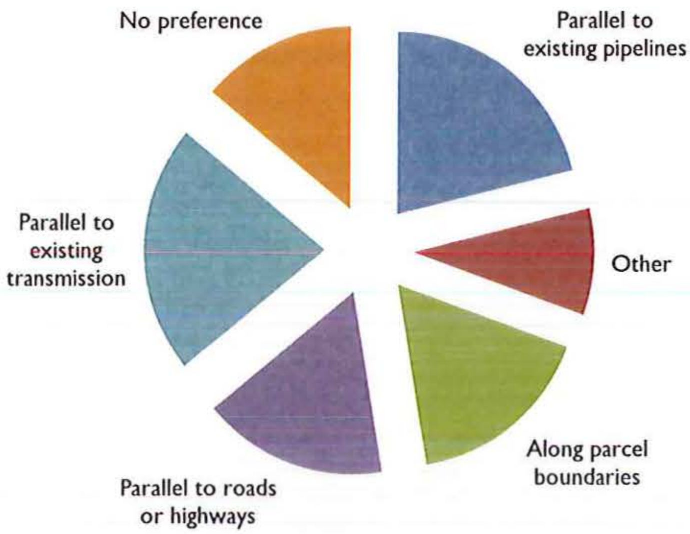

Figure 3-1. Summary of Public Response to Parallel Options

Summary of Public Comments

Generally, the members of the public who attended the Open House meetings helped to identify small area constraints or opportunities on their properties or in their communities. Meeting attendees provided specific information regarding the location, or planned location of elements such as residences, barns or outbuildings, irrigation facilities, historic markers, cemeteries, schools, and airfields. They also provided information regarding current land use such as agriculture uses, rangeland, and recreational areas. Similar comments were also collected from the public through the Project website, mailed letters, emails, and a toll-free phone number. The maps with the Potential Routes presented at the Open Houses were also posted online, so stakeholders could review the Potential Routes and provide comments even if they were unable to attend the Open Houses. More than 300 comments were received following the Open Houses, and members of the Routing Team responded to individuals posing a question or specific concern.

Categories were created in order to capture the main concerns or issues raised through public comments and included: aesthetics, the need to keep the public informed, ROW, electric and magnetic fields, roject need, safety, farm/rangeland, noise, sensitive species and habitats, health, other, state commission, historic/cultural, property values, vegetation management, irrigation, recreation, and water resources. The categories that were recorded most often included ROW, property values, aesthetics, and farm/rangeland concerns.

A summary of all comments received (via email, website, comment card, phone call, and letter) is shown below in **Figure 3-2.** The Routing Team reviewed and considered the comments as it refined Potential Routes.

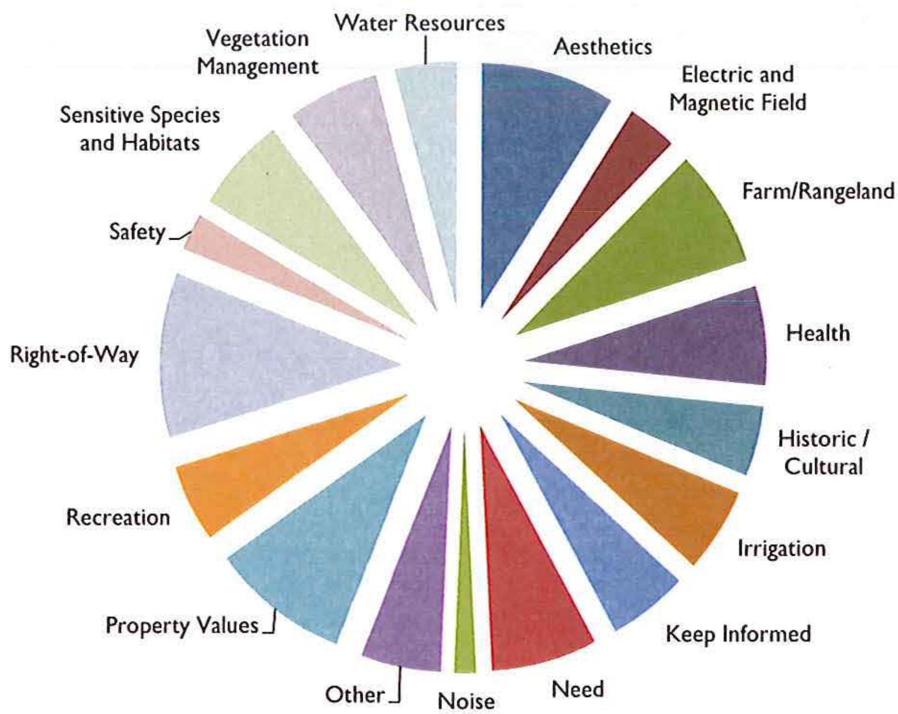

Figure 3-2. Summary of Public Comments

4. Route Development

As described in Section 2.2, the route development effort is an iterative process with a set of Conceptual Routes that are further refined to become a network of Potential Routes. The network of Potential Routes are then analyzed, compared, and refined to be assembled into Alternative Routes. Finally, comparative potential impacts are evaluated for each Alternative Route to identify a Proposed Route.

Conceptual Routes were initially developed and compared across all four states to identify the most suitable location for the Project from a high level. The Conceptual Routes were then further refined to become Potential Routes, Alternative Routes, and a Proposed Route in each state. While this report was being prepared, the KCC approved the Kansas proposed route (KCC 2013, Docket # 13-GBEE-803-MIS). Conceptual Routes in Illinois have not been refined to Potential Routes at this time, but will undergo the process in 2014-2015.

At each stage of development, the route alignments became more specific and the data analysis more resolute. The following sections provide discussions of each phase of route development and present a summary of routing decisions and analysis that led to the subsequent refinement stage.

4.1 Study Area

The Study Area for the Grain Belt Express Project is generally defined as the geographic area encompassing the two end-point converter stations in Ford County, Kansas, and Sullivan County, Indiana, and logical interconnection locations for the third, intermediate converter station near the Missouri/Illinois border (**Figure 4-1**). The presence and extent of certain relevant resources within the Study Area were also considered while delineating the Study Area boundary. One of the major factors that guided the definition of the Study Area boundary is the presence of opportunity features, particularly existing linear ROWs, including electric transmission line and pipeline ROWs. Siting new transmission lines parallel to existing linear features is a common practice in transmission line siting and supported by many state and federal regulatory authorities (see Section 2.7). Incorporating the location and trajectory of existing linear utility corridors in the delineation of the Study Area ensures that Potential Routes parallel to existing lines are considered.

Although the term Study Area boundary suggests that the Study Area is maintained throughout the study process as a fixed boundary, in practice this is not usually the case. As the routing study progresses, the Routing Team identifies additional opportunities and constraints, and the Study Area boundary is modified, as necessary.

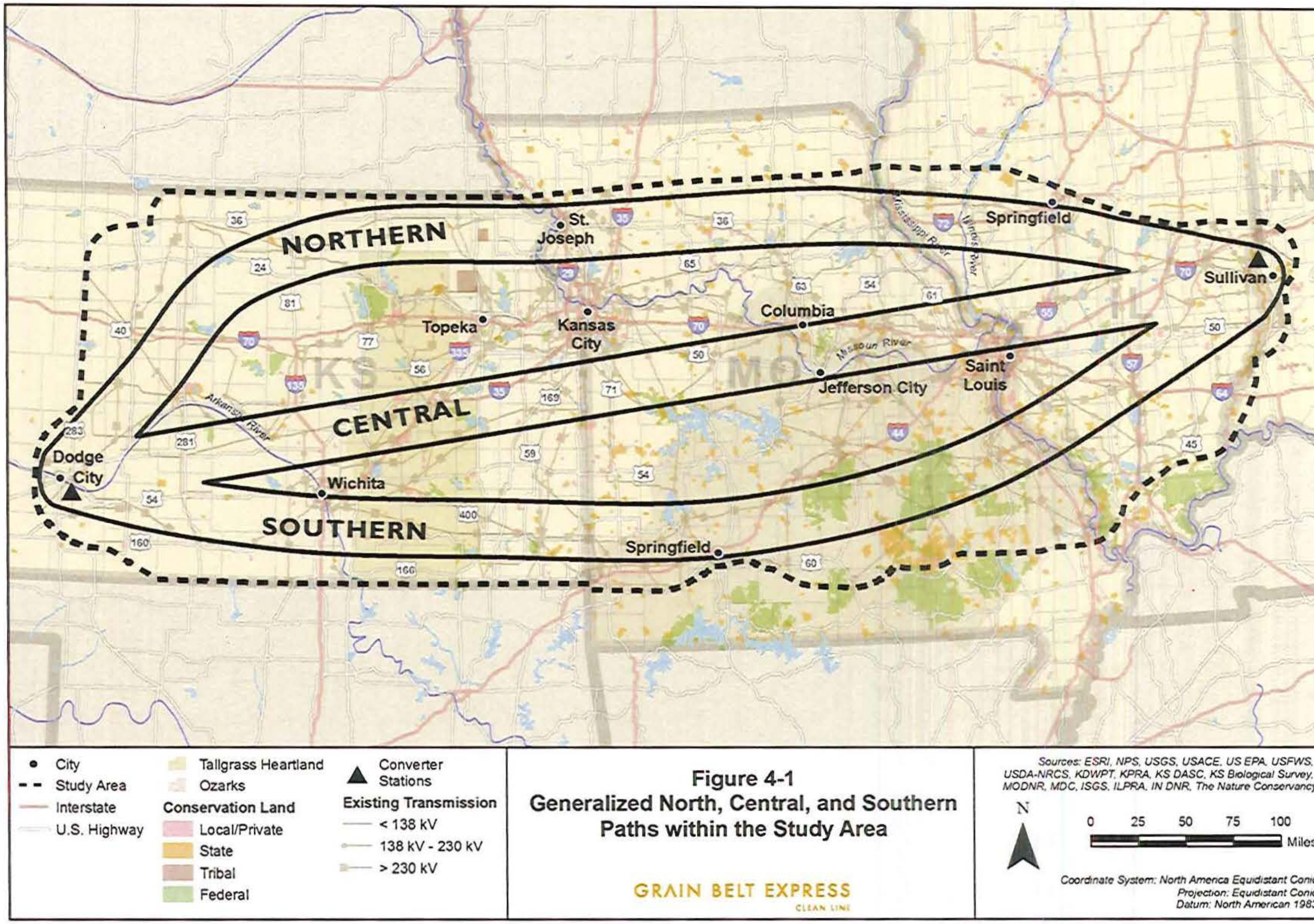

Figure 4-1
Generalized North, Central, and Southern Paths within the Study Area

4.2 Conceptual Route Development in the Study Area

Conceptual Routes are the first step in the route development effort. As the name suggests, Conceptual Routes are developed as broad routing 'concepts' that typically avoid large area constraints or incorporate notable opportunity features in the Study Area. In practice, the transition from Conceptual Routes to Potential Routes falls along a continuum. However, for the purpose of this study and to provide for clarity in referencing different decision phases of the effort, routing decisions that impacted route planning across all four states are presented under the Conceptual Route development process.

The Routing Team developed an array of initial Conceptual Routes for the Grain Belt Express Project in Kansas, Missouri, Illinois, and Indiana. The following sections provide a summary of the Conceptual Routes that the team considered, including the basis for the routing concept, key constraints and opportunities encountered, and the decision whether to eliminate or continue refinement of each Conceptual Route. For simplicity and clarity, the Conceptual Routes are grouped based on their relative geography in the Study Area (see **Figure 4-1**). Conceptual Routes in the northern portions of the Study Area followed paths that led north of Kansas City and St. Louis to reach the eastern converter station location. Conceptual Routes in the central portion of the Study Area generally followed paths north of Wichita, south of Kansas City, and north of St. Louis, and Conceptual Routes in the southern portion of the Study Area generally followed a trajectory either north or south of Wichita and the reservoir system in Missouri but crossed into Illinois south of St. Louis.

4.2.1 Conceptual Routes — Northern Portion of the Study Area

Conceptual Routes along the northern portion of the Study Area were developed to consider alignments that crossed the Missouri River between Kansas City and the Nebraska state line, crossed the Mississippi River north of St. Louis, and continued to the Sullivan Substation remaining south of Springfield, Illinois (**Figure 4-2**). Residential density along the northern Conceptual Routes is relatively minimal, and most large area constraints were readily avoidable. However, three major river crossings, sensitive grassland habitats, and numerous historic sites and trails represented notable challenges to the route development effort through this portion of the Study Area.

Large area constraints in the northern portion of the Study Area in Kansas include: multiple federally owned reservoirs and state conservation lands; two national wildlife refuges; several army bases; and the towns of Topeka, Lawrence, Salina, Hays, and Great Bend. In addition, the Flint Hills Ecoregion, one of the largest intact areas of tallgrass prairie in North America, occupies a significant portion of the Study Area in Kansas. In Missouri, large area constraints include: developed areas along U.S. Highway 36 and numerous conservation easements associated with the Grand River and Swan Lake National Wildlife Refuge, Mark Twain National

Wildlife Refuge, Thomas Hill Reservoir, Mark Twain Reservoir, the Missouri National Guard Macon Training Site, two state parks, and several state conservation areas. In Illinois, dense development around Quincy, Springfield, and Effingham presented challenges for routing the Project, as well as conservation easements along the Illinois River, the Meredosia National Wildlife Refuge, and Lake Shelbyville.

Opportunity features in the northern portion of the Study Area include the existing network of transmission lines and an array of interstate pipelines passing from southwest to the northeast in Kansas and from west to southeast in Missouri. Section lines and parcel boundaries also served to guide the development of route alignments by allowing alignments to follow along ownership boundaries when possible. Several rail lines and state or federal highways were also considered in the initial development of Conceptual Routes; however, restrictions on overhanging state ROW combined with the close relationship between roads, rail, and commercial or residential development limited the development of reasonable alignments along many of these features.

The Routing Team considered a variety of different route options to exit the western converter station in Kansas toward the northern portion of the Study Area. Route development in this area of Kansas is encumbered by extensive farmlands and irrigation facilities; the physical congestion of existing wind generation facilities, transmission lines, substations, and residences; and sensitive lesser prairie-chicken habitat that surrounds the Spearville area along its eastern and northern periphery. However, several suitable route options were developed along section/parcel boundaries to the north and east and along existing transmission lines to the northeast toward Great Bend.

Conceptual Routes north of Great Bend continued either along section/parcel boundaries west of U.S. Highway 183, north along an existing 115 kV transmission line near U.S. Highway 281, or northeast along the Natural Gas Pipeline of America pipeline corridor to Concordia. Conceptual Routes were initially developed between Cheyenne Bottoms Wildlife Area and Quivira National Wildlife Refuge but were eliminated from further consideration following agency coordination with the Kansas Department of Wildlife, Parks, and Tourism (KDWPT) and USFWS because of concerns relating to migratory birds and the federally listed endangered whooping crane. In addition, Conceptual Routes initially formed along Interstate 70 were also eliminated from further consideration due to the frequent diversions required for development along the interstate and proximity to Fort Riley Army Installation. These routes would also cross the Tallgrass Heartland of the Flint Hills, a highly scenic area viewed by 12,000 to 20,000 travelers a day.

From Concordia to the Missouri River, three main west-to-east Conceptual Routes were developed with periodic north-to-south interconnections between each route. The Routing Team considered three primary Missouri River crossing locations near St. Joseph, Missouri:

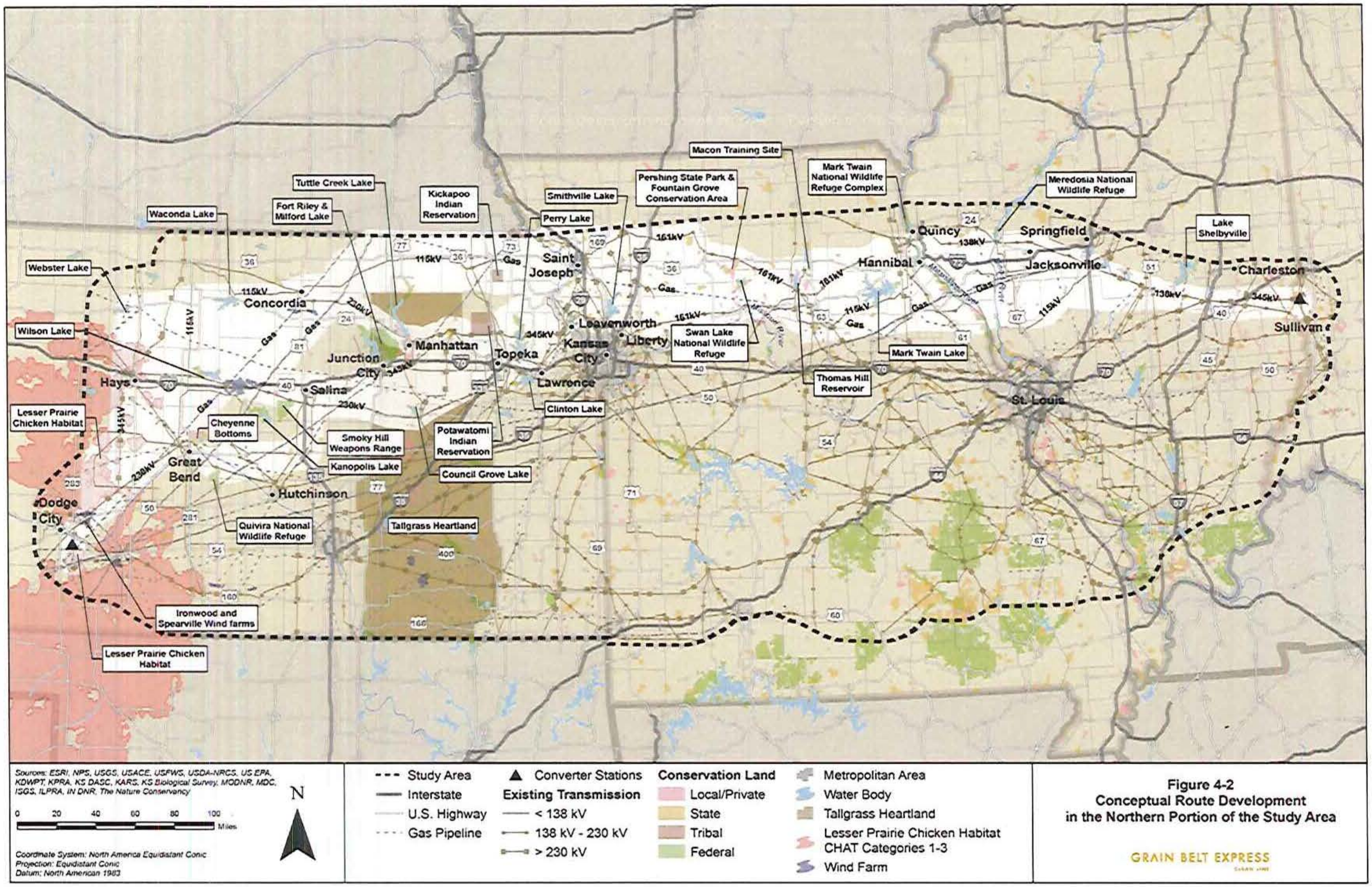

Figure 4-2
Conceptual Route Development in the Northern Portion of the Study Area

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two on a trajectory north of the city and one to the south. The two northern river crossings were developed at locations that avoided a series of MDC lands in the floodplain on the eastern bluffs of the river and crossed at locations that readily provided access to parallel a 345 kV line toward St. Joseph. The southernmost crossing was developed to parallel the Rockies Express/Keystone Pipeline corridor from near Fairview, Kansas, up to and across the Missouri River.

St. Joseph's residential and commercial development served as the primary constraint on the eastern bluffs of the Missouri River. The steep topography beyond the floodplain quickly shifts land use from floodplain farmland to a combination of forest-covered hillsides and moderate to high-density residential development. The Routing Team initially developed alignments from the two northern river crossings along the Cooper – St. Joseph 345 kV line north of the city. However, fingers of residential and commercial development extending northward from the city along Interstates 229 and 29 prevented suitable parallel alignments along the line through this area. Ultimately, the Routing Team developed routing alignments that diverged from a parallel alignment near Amazonia and continued farther east before angling south to continue along the east side of St. Joseph, paralleling the existing Hawthorne – St. Joseph 345 kV transmission line toward the southeastern corner of Buchanan County.

The Routing Team developed a network of Conceptual Routes starting at the Rockies Express/Keystone Pipeline crossing of the Missouri River. Similar to the northern crossing, steep topography beyond the floodplain quickly shifts land use from floodplain farmland to a combination of forested hills and moderate density residential development. A network of routes was developed from this southern crossing location eastward, through the farmlands in the Missouri floodplain and into the sporadic residential development along the bluffs and in the subsequent valleys eastward. Conceptual Routes were developed through this area along pipeline or existing transmission lines to the southeast to pass through the residential development along the bluffs and around the community of Agency, Missouri, located farther east.

Conceptual Routes beyond St. Joseph and east across Missouri were developed around three primary concepts: an alignment based on the section/parcel boundary just south of U.S. Highway 36; a route that continued parallel along the Rockies Express/Keystone Pipeline corridor; and an alignment that paralleled existing transmission lines to the north that looped between St. Joseph, Fairport, Jamesport, Brookfield, and Marceline, Missouri. The Routing Team ultimately removed this latter route alignment from further consideration because the benefits of paralleling the existing transmission lines through this area did not outweigh the likelihood of impacts associated with frequent diversions to avoid residences near Gallatin and Jamesport, multiple transmission line crossings, and crossings of several private and federal conservation easements and Pershing State Park.

Extensive federal, state, and private conservation areas line the banks of the Grand River just east of Highway 65. Two key breaks in these conservation lands along the river were considered for crossing the Grand River and its floodplain forests. The first crossing was identified just north of the Swan Lake National Wildlife Refuge and south of the town of Sumner. The second crossing was identified approximately ten miles south along the Rockies Express/Keystone Pipeline corridor.

East of the Grand River, conceptual routes were developed to avoid the Thomas Hill Reservoir and the conservation lands surrounding it by passing north or south around the reservoir. Conceptual Routes south of Thomas Hill Reservoir paralleled an existing 161 kV transmission line that angles southeast of the reservoir before turning east, just south of Cairo. Conceptual Routes north of Thomas Hill Reservoir avoided conservation lands and the Army National Guard's Macon Training Site, located just east of the reservoir.

In Monroe and Ralls counties, Mark Twain Lake encompasses a large area of land that includes a state park, federal land managed by the USACE, and a patchwork of private conservation easements. Conceptual Routes were developed north and south of the lake. Routes developed along the north side connected to potential Mississippi River crossings near Quincy, Illinois and Hannibal, Missouri. Routes that continued south of the lake—both through Monroe County and along the Rockies Express/Keystone Pipeline farther south in Audrain County—connected to potential river crossings near Hannibal, Louisiana, and Clarksville, Missouri.

The Routing Team considered numerous Mississippi River crossing locations during the Conceptual Route development phase both north and south of St. Louis, from roughly Quincy, Illinois to Grand Tower, Illinois. Conceptual Routes in the northern portion of the Study Area fell between a 75-mile stretch of the Mississippi River from Quincy, Illinois, to Winfield, Missouri. Initial siting efforts focused on locations along the river with existing infrastructure crossings but soon expanded to considered all areas where residential development, sensitive habitats, public lands, and cultural resources were limited. Of the many crossings of the Mississippi River considered, the Routing Team identified six potential crossings from which the preferred crossing location was ultimately selected (see Section 4.3.2 for a discussion of Mississippi River crossings).

Once across the Mississippi and Illinois rivers, the Routing Team developed a network of Conceptual Routes that continued east along existing transmission and pipeline corridors, and along section/parcel boundaries toward the Sullivan Substation. In general, land use in the area is agricultural with an increasing prevalence of forested lands further south near St. Louis. Major communities in the northern portion of the Study Area in Illinois included Quincy, Jacksonville, Springfield, Chatham, Pana, and Effingham.

Minimal or easily avoidable large public land areas exist through this portion of the Study Area, and a range of opportunity features are available to develop Conceptual Routes across the state. However, in general, residential development tended to be higher in the northern portion of the Study Area in Illinois when compared to Missouri or Kansas.

4.2.2 Conceptual Route Development — Central Portion of the Study Area

The central portion of the Study Area essentially consists of those routes that generally followed the most direct path from the western converter station to Sullivan Substation while still considering various opportunity features and avoiding constraints. As **Figures 4-1** and **4-3** readily show, Conceptual Route development efforts through this portion of the Study Area were greatly affected by almost every major metropolitan area, and its associated suburban development sprawl, in the Study Area.

The primary path for exiting the western converter station in the central portion of the study area was along a 115 kV transmission line to Stafford. One other conceptual route was initially considered immediately south of Cheyenne Bottoms but was later eliminated due to concerns from KDWPT and USFWS (see Northern Conceptual Route Discussion).

From Stafford, Conceptual Routes either continued northeast to Hutchinson along existing transmission lines or due east along section/parcel boundaries for more than 75 miles to approximately 7 miles south of Newton. The routes to Hutchinson continued north along an existing 345 kV line between Hutchinson and the Summit Substation and then east through the Tallgrass Heartland along existing transmission lines. Maintaining parallel alignments along this route became increasingly difficult as residential development adjacent to the existing line increased in the satellite communities south of Topeka and Kansas City.

Conceptual Routes from Newton continued either northeast across the Tallgrass Heartland parallel to an existing 345 kV line eventually connecting with the routes described above through Carbondale or east to parallel a 115 kV line across the Tallgrass Heartland. Continuing east of the Tallgrass Heartland, Conceptual Route development became encumbered by development protruding south of Kansas City and the Harry S. Truman Reservoir to the east and south. Attempts were made to develop Conceptual Routes through this area along existing transmission lines that connect the outer suburbs of Gardner, Spring Hill, Raymore, and Pleasant Hill and along a pipeline that passed between Waverly, Kansas, and Holden, Missouri; however, these routes were later eliminated due to the spread and density of residential development and the numerous diversions from parallel alignments along transmission lines, pipelines, and section/parcel boundaries required to avoid individual residences.

East of the Kansas-Missouri state boundary and dense residential development south of Kansas City, the Conceptual Routes split with the northernmost routes following an existing gas pipeline corridor northeast toward Warrensburg, diverting to find a suitable crossing of the Missouri River and picking up the gas line corridor again north of the Missouri River and south of Franklin. The southernmost Conceptual Routes in this area attempted to follow 161 kV transmission lines around the north shores of the Truman Reservoir and Lake of the Ozarks, although frequent diversions from a parallel alignment were necessary due to residential development and recreational areas adjacent to the reservoirs. Additional Conceptual Routes were developed north of the lakes and south of Warrensburg and Sedalia.

Conceptual Routes following the gas line corridor past Franklin continued north of Columbia and into the northern Conceptual Route area. Increased residential development linking Columbia, Jefferson City, and communities on the north shore of the Lake of the Ozarks, and increased conservation land along the section of the Missouri River from Arrow Rock to Jefferson City decreased routing opportunities and suitable crossings of the Missouri River in this area. The Conceptual Routes that were developed followed primarily parcel boundaries or connected sections of existing transmission lines heading east or northeast for relatively short distances. The terrain between the reservoir complex in the south and the Missouri River in the north became increasingly more variable, and land use became more heavily forested as the Conceptual Routes proceeded east into the Ozark Mountains.

The Conceptual Routes just north of the Lake of the Ozarks turned northeast along 69 kV and 138 kV transmission lines toward Jefferson City and Chamois or toward Owensville. Due east from there, the larger metro area of St. Louis dominates the landscape with development extending far to the west and south of the city preventing the development of Conceptual Routes in these areas. The Conceptual Routes crossed the Missouri River by Chamois and angled northeast across an increasingly agricultural landscape when compared to the Ozark region to the south.

As the Conceptual Routes approached the Mississippi River, the Routing Team identified existing transmission line crossings near Bolter Island and Iowa Island, due north of St. Charles. Conceptual Routes using existing transmission line crossings closer to St. Louis were not feasible due to the density of residential and commercial development outside of St. Louis and significant federal, state, and private conservation lands around the confluence of the Missouri, Mississippi, and Illinois rivers.

Conceptual Routes in the central portion of the Study Area in eastern Missouri continued north to blend into the northern portion of the Study Area or crossed the Mississippi River at locations not occupied by public lands or historic communities. East of the Mississippi and Illinois rivers, the Conceptual Routes converged south of Litchfield to parallel existing 345 kV transmission lines northeast toward Pana, Illinois, in the northern portion of the Study Area or east toward the eastern converter station, staying north of Effingham and south of Charleston, Illinois.

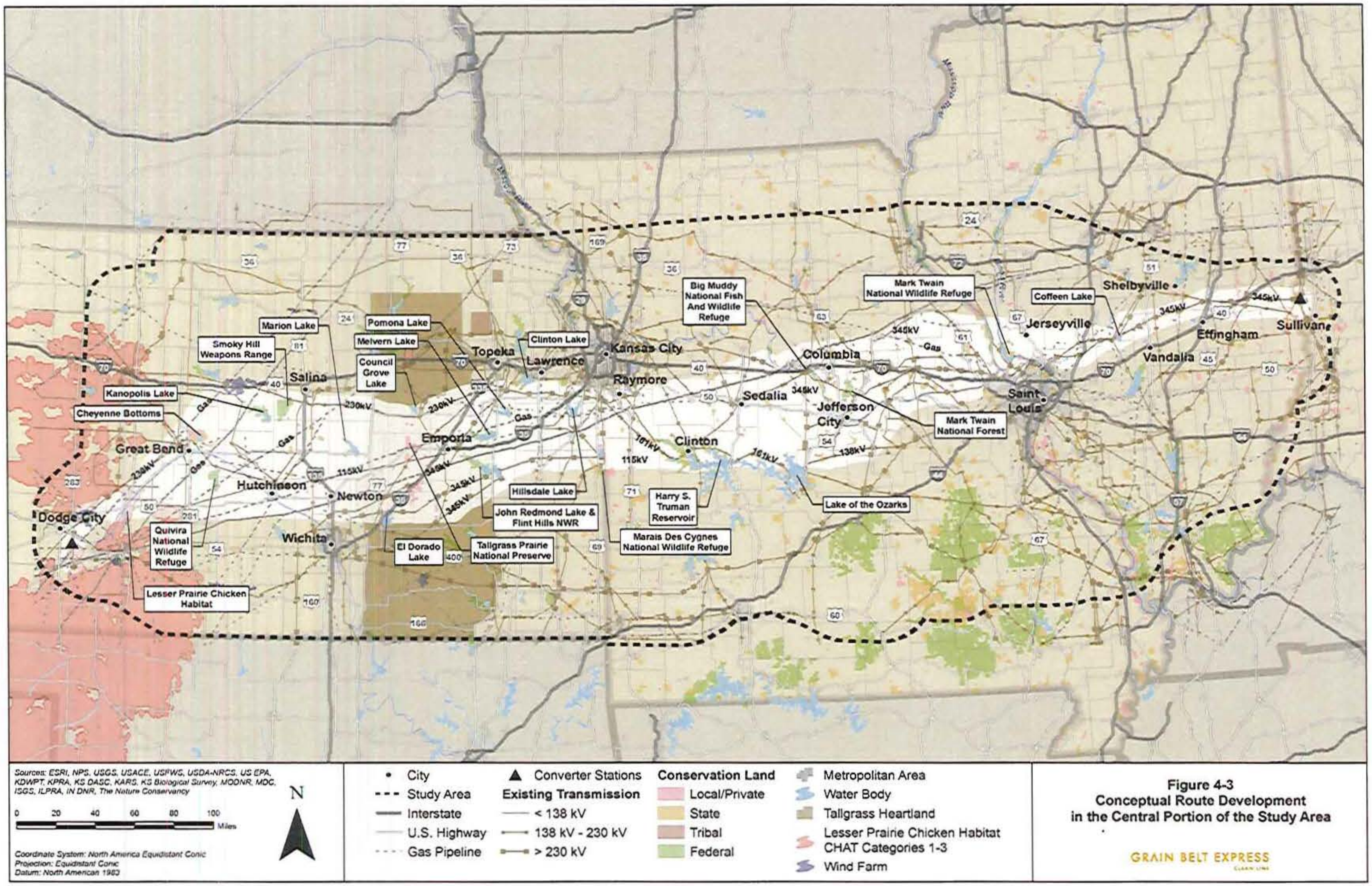

Figure 4-3
Conceptual Route Development in the Central Portion of the Study Area

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4.2.3 Conceptual Routes — Southern Portion of the Study Area

The southern portion of the study area include routes north and south of Wichita, north of Springfield, and south of St. Louis. Constraints in the southern portion of the Study Area include: Wichita and its associated suburban sprawl, the extensive airfields in and around Wichita, the ecologically unique and scenic Tallgrass Heartland, the expansive Harry S. Truman reservoir, Lake of the Ozarks, Pomme De Terre, Stockton Lake, Mark Twain National Forest, and land administered by the Department of Defense and the National Park Service.

Conceptual Routes exiting the western converter station primarily followed either section lines through farm lands east of Wichita, and/or paralleled existing transmission lines north and south of the Wichita metro area. Routing opportunities near Wichita were highly encumbered by the expansive suburbs both north and south of the city, as well as an abundance of airfields associated with Wichita's extensive aviation industry. These two factors led to routes that were developed either north along existing 345 kV lines that crossed midway between Wichita and Newton or south of the city along section/parcel boundaries 10 and 20 miles south of the city. As a result, Conceptual Routes were developed along each of the four 345 kV transmission lines east of Wichita that transect the Tallgrass Heartlands in this area (see **Figure 4-4**). Beyond the Tallgrass Heartlands, Conceptual Route alignments continued along existing transmission lines or section/parcel boundaries. Although route development through this area was comparatively simple given the low number of residences and public lands, significant oil and gas development and numerous wind farms hindered route development in some areas.

The Conceptual Routes in southeastern Missouri were primarily developed along roads, section/parcel lines, and paralleling existing transmission. Land use in southwestern Missouri is similar to that in eastern Kansas with farms and grasslands primarily used for grazing. The prevalence of grassland areas was specifically noted by MDC as a focus for preservation of grassland/prairie habitat and reintroduction of greater prairie chickens in the area. The Routing Team attempted to avoid these areas and/or parallel existing transmission lines where possible through this area.

Continuing east, terrain becomes more variable with less land suitable for agricultural use and a greater proportion of land under forest cover. An increase in large parcels of publicly owned lands, recreational areas, and reservoirs coincides with this physiographic change and greatly affected Conceptual Route development. Most notably, the irregular sprawl of the extensive Harry S. Truman, Lake of the Ozarks, Pomme De Terre, and Stockton Lake reservoirs significantly limited the potential for reasonable alignments south of Jefferson City and north of Springfield. Through this area, the most suitable alignments were either along the northern edge of the Harry S. Truman and Lake of the Ozarks reservoirs; weaving south of the Harry S. Truman and Lake of the Ozarks reservoirs and north of Stockton Lake and Pomme De Terre;

or following a southern path along an existing 345 kV transmission line between Springfield, Missouri, and Lake Stockton.

Farther east, the large land holdings of the Mark Twain National Forest and interspersed holdings of the Department of Defense, National Park Service, and state of Missouri affected Conceptual Route development. Routes developed through this area primarily followed alignments that diverted either north of the main body of the Mark Twain National Forest (Houston/Rolla and Salem/Potosi Ranger Districts) or south along a trajectory between the National Forest System lands and the Ozark National Scenic Riverway. An alignment was also considered that loosely paralleled the north side of Interstate 40 (along a lower voltage transmission line) for more than 150 miles. Direct parallel along Interstate 40 was avoided because of the significant residential and commercial development along its path and in recognition of its role as part of the historic Route 66 corridor. Remnants of this historic travelway through the Ozarks are found just off Interstate 40 and have been designated as scenic roads by the state of Missouri.

As described in Section 3, the intermediate converter station for the southern portion of the Study Area routes was proposed to be at or near the St. Francois Substation in the northeast corner of St. Francois County, Missouri. The extensive network of public lands west of this area guided and limited route development. Approaches to the converter station were forced to either: 1) follow along a northern trajectory, ultimately turning south into the converter station area once west of the Potosi Ranger District of the Mark Twain National Forest; or 2) follow a path from the southwest after weaving through the patchwork of state parks and National Forest System lands (between the Salem and Fredericktown Ranger Districts) forming the Heart of the Ozarks recreational attractions.

While the extensive network of public lands in the area limited route development opportunities in many places, it also had a compounding effect of concentrating development to the areas in between. This effect was found throughout the Ozarks region, most notably in the area immediately adjacent to the St. Francois Substation. In this area, several large state parks (the St. Joe and St. Francois State Parks) and a dense stretch of intervening development (Farmington, Leadington, Park Hills, Deslodge, and Bonne Terre) served as major constraints to identifying suitable routes into the St. Francois Substation area.

Conceptual Routes east of the midpoint converter station location were largely guided by the identification of suitable Mississippi River crossing locations. The Routing Team focused on the area south of St. Louis and north of the Shawnee National Forest that occupies the east shore of the river from Grand Tower, Illinois, to roughly the Kentucky border. Few existing utility crossings of the river were found in this area, and extensive development extending south of St. Louis combined with large federal and state conservation areas—largely associated with the Mark Twain National Wildlife Complex—made many crossing locations unsuitable. The

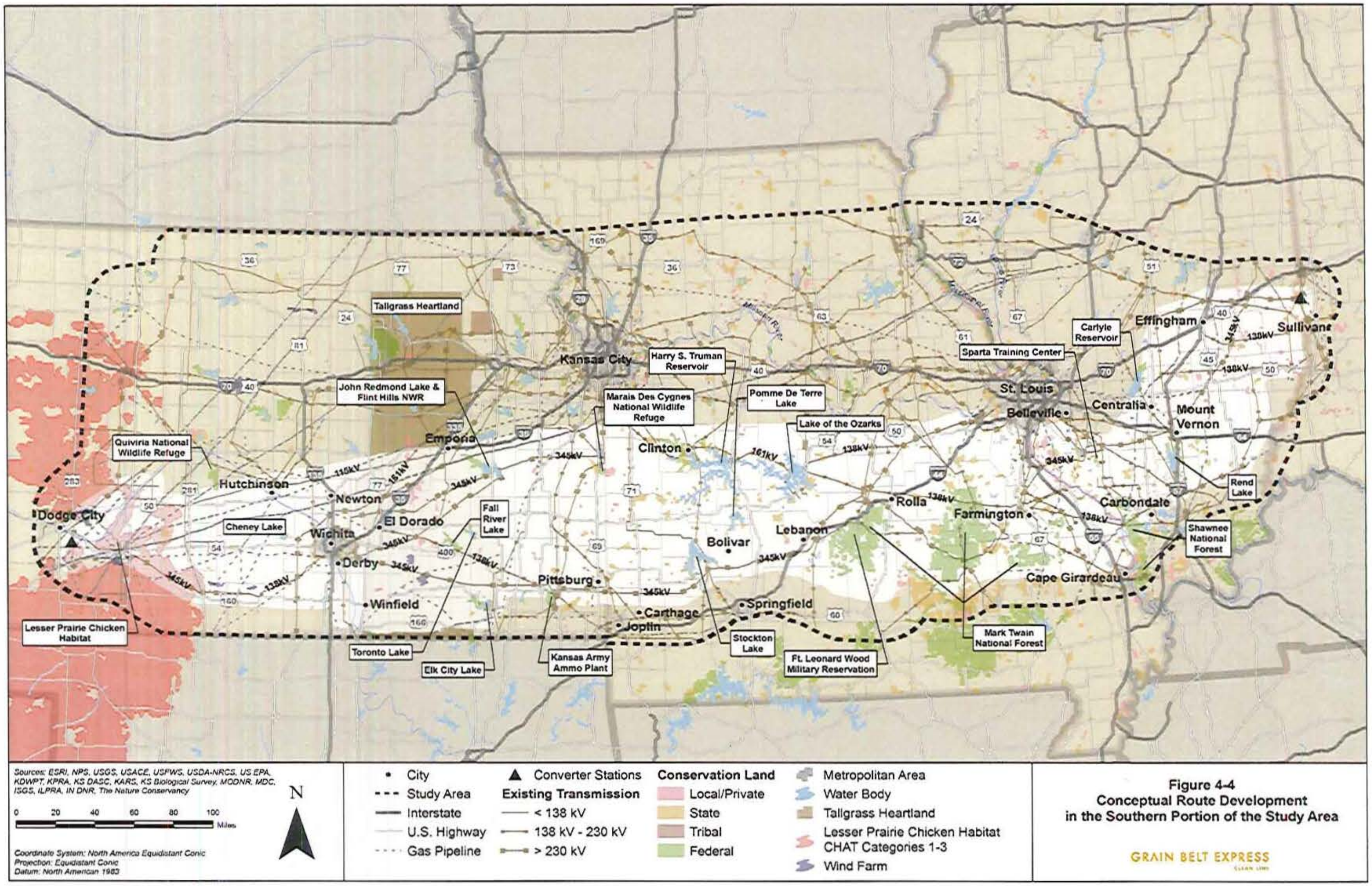

Figure 4-4
Conceptual Route Development in the Southern Portion of the Study Area

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Routing Team considered crossings near Barnhart, along the northern edge of the Mark Twain National Wildlife Refuge; north of the Rush Island Power Plant adjacent to the recently constructed 345 kV line crossing; near Chester, Illinois, at the crossing of Missouri State Route 51; and farther south near Grand Tower, Illinois. Each of these crossings was either highly encumbered by nearby development (Barnhart and Chester crossings) or a combination of state and federal conservation lands (the Shawnee National Forest lands near Grand Tower and the Mark Twain National Wildlife Refuge Complex near Rush Island).

Once in Illinois, the network of Conceptual Routes south of St. Louis continued east and northeast toward the eastern converter station, generally east of the suburbs of St. Louis and Carlyle Lake. Three major Conceptual Routes were developed from the Mississippi River crossing to Sullivan Substation with additional route links developed to connect sections of the three or to avoid highly constrained areas. Two of these major Conceptual Routes followed a series of existing transmission lines across the state. The first route followed the existing 345 kV lines from Rush Island to Baldwin, West Mt. Vernon, Louisville, Newton, Casey, and into Sullivan Substation. The second route followed a more southerly path along a mixture of 345 kV and 138 kV lines from Grand Tower to West Frankfort, Norris City, Albion, Olney, Lawrenceville, Hutsonville, and into Sullivan Substation in Indiana. The third Conceptual Route followed a pipeline from southwest of Steelville, Illinois, and continued northeast past Oakdale, Nashville, and Centralia before turning east at Kinmundy and joining the first Conceptual Route near Louisville, Illinois.

In general, the density of residential and commercial development in Illinois was highest near East St. Louis, in the suburbs extending east of the city toward Belleville, and along the Interstate 70 and U.S. Highway 40 corridor.[3] In addition, residential development near Centralia, Mt. Vernon, and West Frankfort also encumbered route development forcing the development of several new routes that only loosely parallel existing section/ parcel boundaries. Overall, residential density was highest in Illinois in the central and southern portions of the Study Area, when compared to the northern portion of the Study Area.

4.2.4 Comparison of Conceptual Routes in the Study Area

Once the network of Conceptual Routes for the entire Study Area was developed, the Routing Team conducted a comparative review of the Conceptual Routes. The analysis considered the likelihood for potential impacts from the Project through comparisons of key environmental, land use, and engineering factors for a given route or segment of route.

[3] Like the remnants of Historic Route 66 found along Interstate 40 in Missouri, historic features of the Historic 'National Road' created in 1806 by legislation signed by President Thomas Jefferson are found along the Interstate 70/40 corridor. This corridor is listed as a National Scenic Byway by the U.S. Department of Transportation, Federal Highway Administration.

Initially, comparisons were conducted at the individual Conceptual Route or route segment level to eliminate routes that were not likely suitable as a result of new insight derived from ongoing public and agency coordination efforts, newly acquired data sources, or route reconnaissance efforts. Similar to a fatal flaws analysis, this effort removed those Conceptual Routes that were not likely to reasonably meet the routing guidelines, or simply resulted in likely impacts that were inconsistent with the majority of other routes considered. Several of these removals were referenced in the preceding sections.

The Routing Team then compared the overall feasibility of siting the Project in either the northern, central, or southern portion of the Study Area based on major differences between groups of Conceptual Routes in each. These analyses identified the broad scale challenges and limitations of each portion of the Study Area, and ultimately led to the selection of the portion of the Study Area that the Routing Team would continue to pursue by developing Potential Routes.

Residential density was one of the most notable differences between the northern, central, and southern portions of the Study Area. Given the importance of residences in the siting process, it was a key factor in the comparison. During the development of Conceptual Routes, the Routing Team recognized significant differences in the density of residential development and its effect on developing reasonable alignments along existing transmission lines and pipelines and allowing for relatively straight alignments along section/parcel boundaries.

At the four-state scale, digitizing individual residences was not practical, so the Routing Team used census information to provide numerical evidence to support the challenges it observed during development of the Conceptual Routes. The 2010 census data include an estimate of the number of residences within each census block, allowing the Routing Team to derive a residential density (residences/square mile). The results of this analysis, with an overlay of the three generalized portions of the Study Area, are presented in **Figure 4-5**. To provide the color categorization for the density ranges, the Routing Team evaluated the difficulty of developing routes in areas with varying numbers of residences per square mile. This was accomplished by sampling Public Land Survey System sections (each roughly 1 square mile) throughout the Study Area, assessing the overall difficulty of routing a transmission line through it, and then counting the number of houses to derive a density.

As is clearly shown in **Figure 4-5**, the Conceptual Routes through the central portion of the Study Area in Missouri, although generally shorter, impact areas with significantly greater residential density. Areas of higher residential density begin south of Kansas City and continue to Sedalia, Columbia, Jefferson City, St. Peters, and the metro area north of St. Louis. Moreover, where low residential areas appear in the central portion of the Study Area south of Kansas City, reservoirs and conservation areas occupy key areas. In addition to high residential densities, the Conceptual Routes in the central portion of the Study Area also had fewer miles

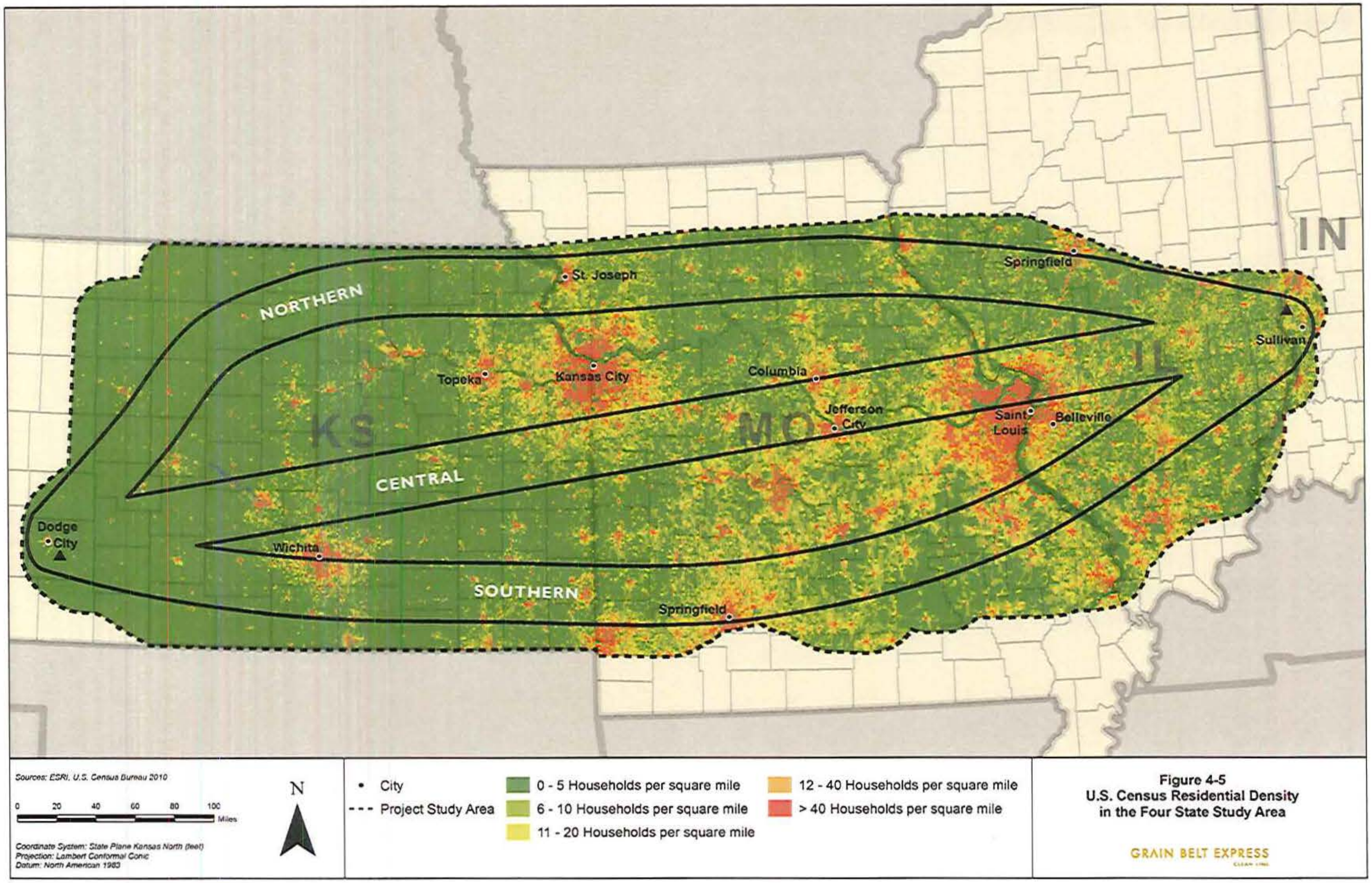

Figure 4-5
U.S. Census Residential Density in the Four State Study Area

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parallel to existing transmission lines or pipelines; fewer suitable crossings of the Missouri River that did not impact either federal, state, or private conservation lands; and no suitable locations for crossing the Mississippi River without diverting north to reach crossings in the northern portion of the Study Area—all of these issues increased overall length. For these reasons, the Routing Team removed the Conceptual Routes in the central portion of the Study Area from further consideration and did not hold Roundtables in these areas.

Conceptual Routes in the southern portion of the Study Area also had higher residential densities in Missouri and Illinois than in the northern portion of the Study Area. Residential density north of Springfield, Missouri, along Interstate 44 (Lebanon and Rolla), and into the St. Francois Substation near Farmington made Conceptual Route development difficult. In addition, the extensive and irregular sprawl of the Harry S. Truman, Lake of the Ozarks, Pomme De Terre, and Stockton Lake reservoirs significantly limited the potential for reasonable alignments. The presence of the U.S. Department of Agriculture, Forest Service's Mark Twain National Forest, U.S. Army's Fort Leonard Wood, National Park Service's Ozark National Scenic Riverway, and extensive state and private conservation lands in the southern portion of the Study Area further constrained the development of reasonable Conceptual Routes. Discussion with MDC and USFWS revealed the southern portion of the Study Area to be least suited for Conceptual Route development because of the amount of land already protected for sensitive species and habitats.

Despite these notable challenges in the southern portion of the Study Area, the Routing Team considered the southern portion more reasonable than the central portion of the Study Area and held a series of Roundtables in southern Illinois to add to data gathered at Roundtables from southern Kansas and Missouri. However, additional routing challenges were identified during meetings with community leaders and regulatory agency representatives in Illinois, and based on further review and consideration of the few suitable Mississippi River crossings south of St. Louis, the Conceptual Routes in the southern portion of the Study Area were also removed from further consideration.

Ultimately, the Routing Team considered the Conceptual Routes in the northern portion of the Study Area to be the most suitable for the Project and focused its route development efforts there. As is clearly shown in **Figure 4-5**, Conceptual Routes through the northern portion of the Study Area fall largely within areas with low overall residential density for the majority of the route. In addition, although public lands and reservoirs are common in the northern portion of the Study Area, they tend to be smaller and more dispersed, preventing the concentration of residential development in the lands between and generally provide multiple routing options to consider through an area. At the same time, sensitive habitats are generally limited in northern Missouri and Illinois, and those that are present are either largely avoidable or would result in impacts that could be minimized or mitigated. Lastly, an array of opportunity features of different types are available for the development and refinement of Potential Routes, and multiple suitable river crossing locations were identified for each of the major river crossings.

4.3 Potential Routes

4.3.1 Developing the Potential Route Network

Once the Routing Team focused on the northern portion of the Study Area, the Study Area was effectively reduced for the continued siting of the Project and additional route revisions.

Because of the multi-state nature of the Project, Alternative Routes were developed and analyzed in Kansas first to determine the Proposed Route (detailed in the Kansas Route Selection Study, 2013). Once the Kansas Proposed Route was selected, Potential Routes in Missouri were refined based on the known location of the Missouri River crossing. Additional agency coordination and field reconnaissance was conducted to further refine Potential Routes.

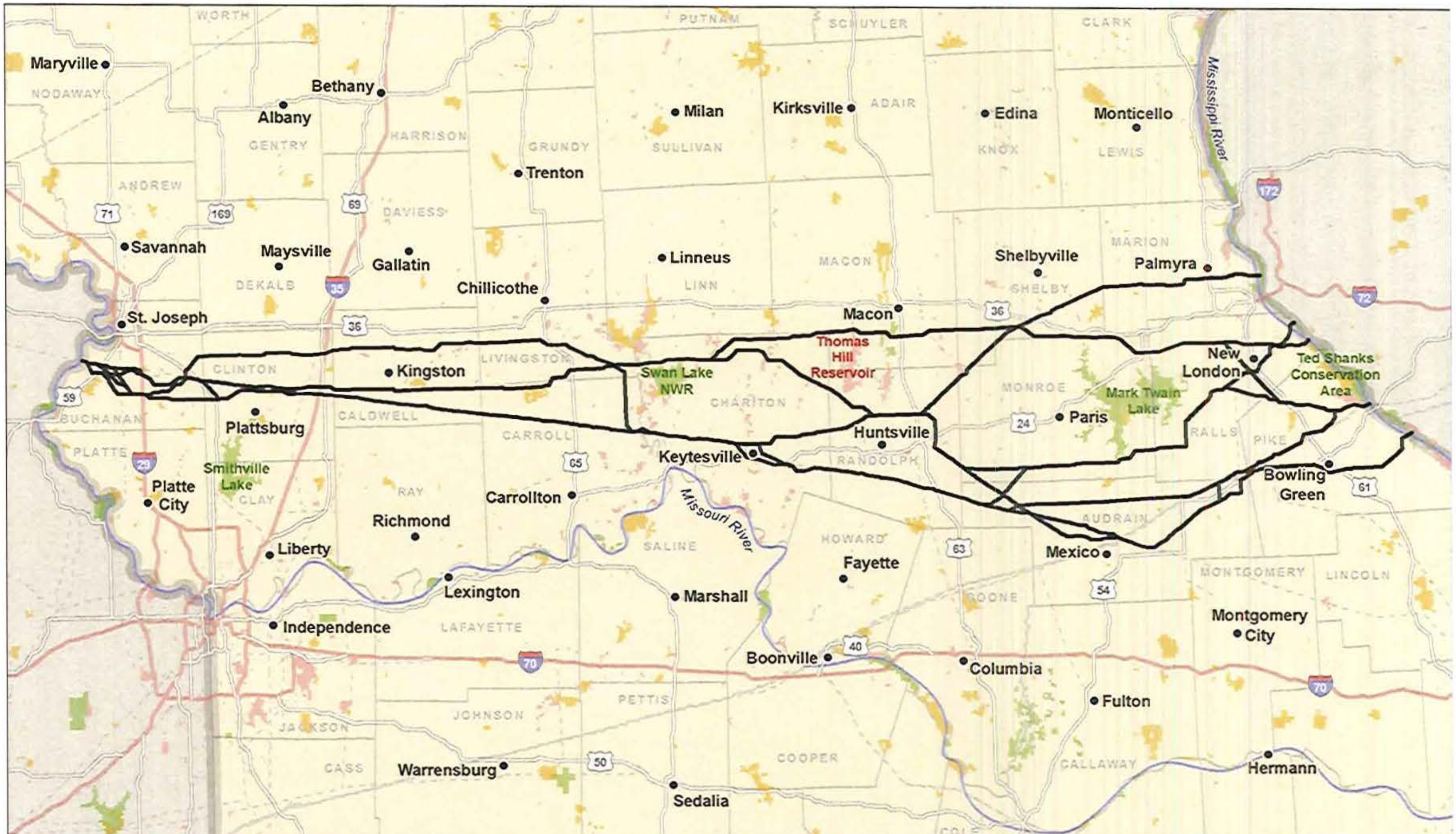
In some cases, input from regulatory agencies informed route revisions; in others cases, comparative review of routes with similar start and endpoints eliminated or forced the revision of other routes. Potential Routes were added or modified as a result of suggestions received at the Roundtables. Ultimately, the Routing Team identified the Potential Route Network (**Figure 4-6**) that would be suitable for presentation to the general public at Open House meetings. As discussed in Section 3.3.2, the Routing Team assisted attendees in locating their property or other features of concern on aerial photography maps showing the array of Potential Routes under consideration. Participants were provided pens and markers and were encouraged to document the location of their houses, places of business, properties of concern, or other sensitive resources on the printed maps. After the Open Houses, all of the maps were scanned, geo-referenced, and integrated into the GIS database, and comments received via comment card were correlated with landowner addresses.

4.3.2 Revisions to the Potential Route Network

The Routing Team spent several months reviewing the hundreds of comments received during and after the Open House meetings (see Section 3.3), making adjustments to individual route segments and refining the Potential Route Network. Below is a discussion of the key revisions made to the Potential Route Network after the Open Houses.

Key Revisions to Potential Route Links

Revisions were made to the Potential Routes following Open Houses in Missouri to respond to comments, consider new information, and as a result of ongoing reviews of engineering challenges and solutions. Most of these revisions were relatively small (on the order of 50 feet to about 200 feet); however, several were larger in scale (on the order of miles) and deserve



- City
- Potential Routes
- Interstate Highway
- U.S. Highway

Conservation Land

- Local/Private
- State
- Federal
- Gas Pipeline

Figure 4-6
Potential Route Network

GRAIN BELT EXPRESS
CLEAN LINE

Sources: ESRI, NPS, USGS, USACE, USFWS, USDA-NRCS, MDC, MO DNR, MSDIS, The Nature Conservancy

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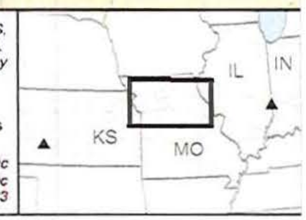
0 10 20 30 Miles

Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983



specific mention for those who may have reviewed slightly different alignments at the Open House meetings (see **Figure 4-7**).

1. *Southeast of Moberly*: After the Open Houses, a new Potential Route link was added southeast of Moberly that connected the Potential Route along the Rockies Express/Keystone Pipeline to Potential Routes in southern Monroe County. The new link provided a more direct path to the other potential routes, eliminated the circuity of the Potential Route near Mexico, and decreased the overall length of routes in this area. An additional Open House (as discussed in Section 3.3.2) was held for this new Potential Route.

2. *East of Rothville*: The Potential Route presented at the Open Houses diverted from the transmission line to the northeast approximately 2 miles before heading east for 3.5 miles to the Thomas Hill 161 kV transmission line. The Potential Route paralleled the Thomas Hill line for less than 1 mile before deviating southeast for 1 mile to avoid Natural Resources Conservation Service (NRCS) wetland conservation easements. The Potential Route then rejoined the Thomas Hill 161 kV transmission line and continued to parallel the existing transmission line southeast.

   The Routing Team evaluated the area and determined the Potential Route did not need to divert as far north in this area and could be refined to provide a better trajectory to the Thomas Hill 161 kV transmission line and avoid NRCS conservation easements. Thus, the Potential Route was shifted 0.5 mile north and then east along section/parcel boundaries for approximately 2.5 miles before shifting north another 0.5 mile, just east of Missouri Highway 5. After approximately 1.5 miles, the Potential Route moved south to follow section/parcel boundaries to the east for approximately 2 miles. The route then turned southeast and east to begin paralleling the Thomas Hill 161 kV transmission line. By refining the route in this location, the Routing Team was able to eliminate the circuity of the route and decrease its overall length.

3. *Center to New London*: The Potential Route presented at the Open Houses paralleled an existing 115 kV transmission line diagonally to the northeast from the town of Center to a point southwest of New London. During the Open Houses, the Routing Team discovered that the existing transmission line was being relocated to parallel Missouri Highway 19. Therefore, the Potential Route as shown at the Open Houses would not be parallel to the existing line as intended. The Routing Team opted to reevaluate the area to determine if another location was more suitable for the Potential Route. Residential development north of the town of Center along Missouri Highway 19 did not provide adequate space for both the relocated transmission line and the Potential Route. Therefore, routes along the highway were not carried forward north of Center. A new Potential Route was added that parallels Missouri Highway 19 to a point just south of Center before turning east for 2.5 miles and northeast for 7.5 miles where it rejoins the original Potential Route that was

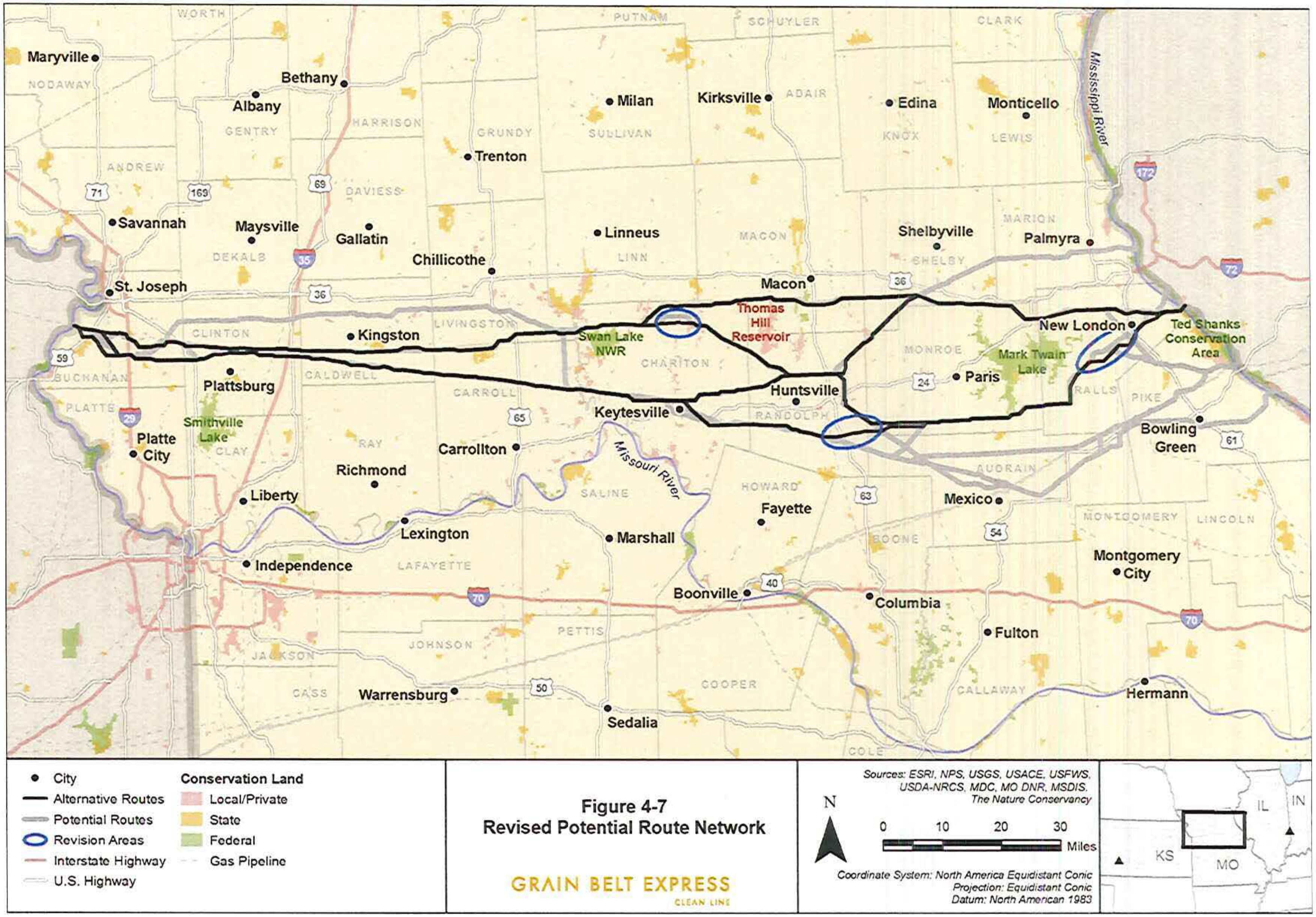


Figure 4-7
Revised Potential Route Network

presented at the Open Houses.

Potential Route Links Removed from Further Consideration

Following the Open Houses, the Routing Team reviewed the Potential Route Network in detail with respect to a variety of environmental and land use factors, public input on area constraints near the Potential Routes, and engineering input, and began eliminating those Potential Route links that were considered less suitable for the Project.

Potential Route links in Segment 1 were encumbered by residential development near St. Joseph. Potential Route links in this area were refined to minimize the number of residences near the Potential Routes, while still maximizing the use of existing linear features. In addition, one Potential Route link was removed due to a private airstrip that was identified near a Potential Route and perpendicular to the end of the runway. Individual Potential Route links in Segment 1 that would likely result in greater impacts were removed from the network. The resulting configuration of routes is presented in **Figure 4-7**.

Potential Route links in Segment 2 generally followed three main alignments across the remainder of Missouri. The northernmost Potential Routes were developed to consider alignments near U.S. Highway 36, but ultimately followed along section/parcel boundaries just south of the highway due to residential and commercial development. The southernmost Potential Routes were developed to consider suitable alignments along the existing Rockies Express/Keystone Pipeline corridor. Lastly, Potential Routes were developed along a central path following section/parcel boundaries between the northern and southern Potential Routes.

Numerous Potential Route links were also considered that connected these three main west-to-east routes. In general, Potential Route links in Segment 2 of the Study Area were encumbered by development near U.S. Highway 36, Moberly, and Hannibal, as well as by numerous public lands and conservation easements along the Grand River, Mark Twain Lake, and the Mississippi River. The Potential Routes in Segment 2 were also highly dependent on the identification of a suitable crossing location for the Mississippi River. For example, Potential Route links in Audrain County were ultimately removed from further consideration in part because they unnecessarily increased the circuity and length of the line (in addition to having more homes in close proximity) given the trajectory of the river crossings under consideration.

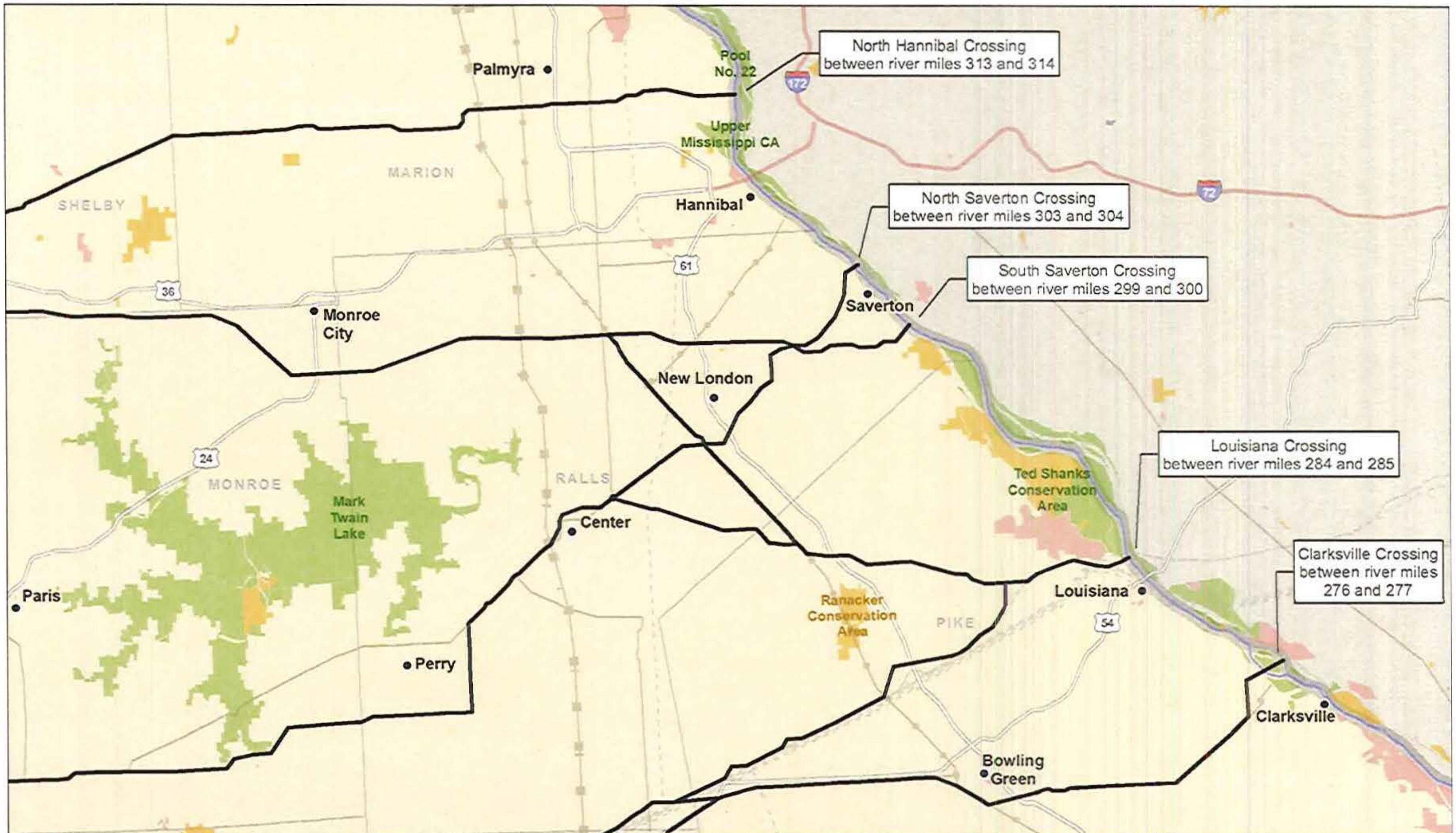
Identification of the Mississippi River Crossing Location

Although many river crossings were considered during the Conceptual Route phase, Potential Route crossings of the Mississippi River were primarily focused between a stretch of the Mississippi River from Hannibal to Clarksville, Missouri. Initial siting efforts focused on locations along the river with existing infrastructure crossings. However, those few sites that were identified with existing crossing locations were either encumbered by residential and commercial development, existing infrastructure, sensitive cultural and recreational resources, or environmentally sensitive federal lands. Thus, the Routing Team also considered an array of crossing locations where no existing infrastructure currently crosses the river. For these crossings, the team considered a variety of factors in the identification of these crossings, including (but not limited to): potential for impacts on public land resources, existing irrigation infrastructure, sensitive species habitats, historic resources, and the technical design requirements of the crossing itself.

Of the many potential Mississippi River crossings considered, the Routing Team identified five from which the preferred crossing location was ultimately selected (**Figure 4-8**). The northernmost crossing was just north of Hannibal, Missouri, while the southernmost was just north of Clarksville, Missouri. All potential river crossing locations were presented at the Open Houses for comment and feedback. In addition, several agency meetings were held with MDNR, MDC, USFWS, USACE (Rock Island and St. Louis Districts), IDNR, and Missouri SHPO to discuss each river crossing and receive feedback for incorporation into the final decision. A brief description of each river crossing along with the feedback received from the agencies is discussed below.

1. *Northern Hannibal Crossing (River Mile 313–314)*: The northernmost river crossing is located approximately 3.5 miles north of Hannibal, Missouri. This location crosses approximately 14,300 feet of floodplain on the Missouri side before crossing the Mississippi River with an approximate span (from bank to bank) of 5,800 feet. On the Illinois side, the Potential Route crosses approximatley16,150 feet of floodplain. The Potential Route crosses McDonald and Schaffer islands, both of which are administered by USACE Rock Island District. Land use on either side of the river within the floodplain is agricultural with few residences located near the Potential Route. Outside the floodplain, the topography increases with steep slopes and varying terrain.

   The agencies identified several potential concerns with this crossing. USFWS raised an increased concern for the Indiana bat (a federally listed endangered species) along all of the northern river crossings (including this crossing and the two crossings north and south of Saverton). Forested lands along the northern crossings have a higher potential occurrence for both winter hibernacula and summer maternity colony presence. In addition, USACE Rock Island District noted its ownership of the two islands and stated that these areas are leased to USFWS and the state of Illinois. USACE also noted that crossing Pool 22 may be incompatible with its current designated use as a Natural Area.



- City
- Potential Routes
- Interstate Highway
- U.S. Highway

Conservation Land
- Local/Private
- State
- Federal

- Gas Pipeline

Existing Transmission
- < 138 kV
- 138 kV - 230 kV
- > 230 kV

Figure 4-8
Potential River Crossings

GRAIN BELT EXPRESS
CLEAN LINE

Sources: ESRI, NPS, USGS, USACE, USFWS, USDA-NRCS, MDC, MO DNR, MSDIS, The Nature Conservancy

N

0 2 4 6 8 Miles

Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983

2. *North Saverton (River Mile 303–304)*: A second potential river crossing approximately 1 mile north of Saverton was considered. This crossing includes steep slopes and topography in a densely forested area on the Missouri side, but does not include any floodplain area outside of the edge of the river. The approximate span length across the river is 4,000 feet. On the Illinois side, the route crosses approximately 26,450 feet of floodplain. Landownership on the Missouri side of the river is private and the route crosses the Camp Oko-Tipi, a non-profit youth camp. USACE Rock Island District administers land on the Illinois side of the river and the route crosses an unnamed island. This Potential Route is approximately 2 miles north of the Saverton lock and dam. The USFWS noted the pool, which forms at the head of the lock and dam, is used by wintering and migratory waterfowl.

   USACE Rock Island District stated that the land administered by USACE is leased to USFWS and the state of Illinois. In this area, the land use designation is Wildlife Management/Reserve Forest, and USACE maintains the timber rights. Like the northernmost crossing, USFWS also stated this Potential Route may have a higher potential occurrence of both Indiana bat winter hibernacula and summer roosting habitats. In addition, several archaeological sites would require further investigation for this crossing alternative.

3. *South Saverton (River Mile 299–300)*: The third crossing is approximately 2.5 miles south of the town of Saverton. Like the previous crossing, this Potential Route goes from steep topography with dense forest cover to crossing 500 feet of floodplain and the Mississippi River. The Potential Route has an approximate span of 3,370 feet across the river and crosses approximately 36,750 feet of floodplain on the Illinois side. Land ownership on both sides of the river is private; however, the Anderson Conservation Area owned by MDC is located just south of the crossing on the Missouri side of the river. The route also crosses land on the Missouri side of the river owned by Knox County Stone Company, which has an active quarry located just north of the route. A structure would be required on Jim Young Island, which would reduce both the overall span length between structures and their required height.

   USACE St. Louis District has jurisdiction over this river crossing (and all crossings further south), although the Rock Island District maintains jurisdiction over the land on the Illinois side of the river. USACE St. Louis District stated a preference for this crossing location.

   Similar to the two crossings discussed previously, USFWS noted a higher potential occurrence of both winter hibernacula and summer roosting habitat. In addition, the Saverton lock and dam, a National Register Historic District (also known as Lock and

Dam No. 22) is located approximately 1.5 miles north of the crossing location and USFWS noted this as a concern for potential impacts to bald eagles. In particular, the USFWS noted concerns related to potential collision issues with the transmission line. Due to these potential impacts to bald eagles in the area south of Saverton Lock and Dam, the USFWS requested a crossing north of the lock and dam be selected.

The crossing location in this area has some flexibility and would require additional engineering prior to determining the exact location. Archaeological sites would re uire further investigation for this crossing alternative.

4. *Louisiana (River Mile 284–285)*: This river crossing, located approximately 1.25 miles north of the town of Louisiana, Missouri, is the only crossing that paralleled an existing linear feature across the river (a gas pipeline). The Potential Route crosses very little floodplain on the Missouri side and transitions from steep slopes down to the river. The Potential Route crosses the southern edge of Blackburn Island, parallel to the existing gas pipeline. Once on the Illinois side of the river, the Potential Route crosses 28,000 feet of floodplain. The total span across the river at this location is 3,200 feet. Structures would be placed on Blackburn Island, which would reduce the span length between structures crossing the river and decrease their required height.

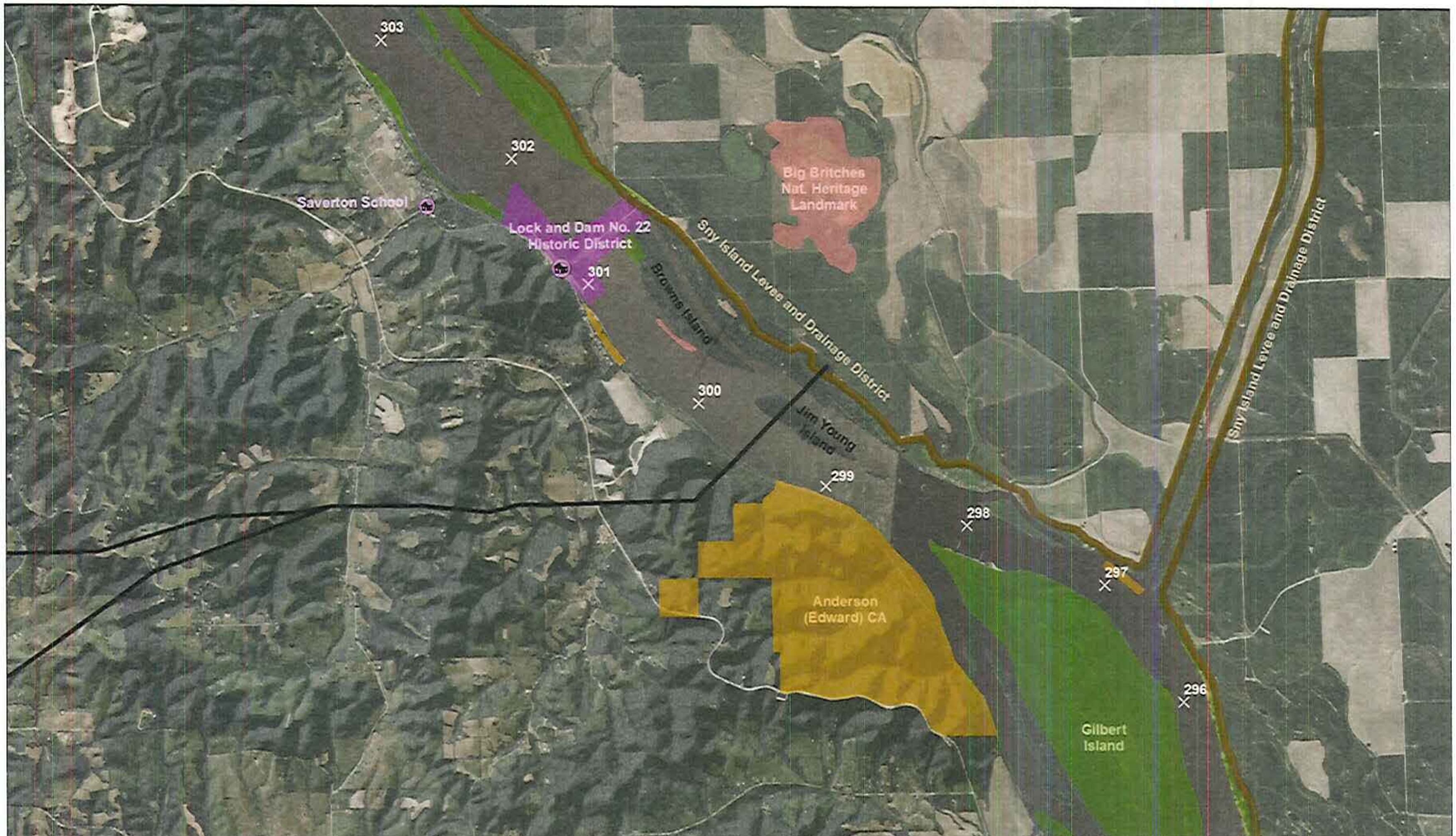
   Both USFWS and MDC stated this particular location is known for the presence of bald eagles as well as numerous migratory birds, and USFWS expressed concern about potential avian impacts. In addition, USACE St. Louis District and MDC discouraged the use of this crossing because of public land associated with the Ted Shanks Conservation Area on Blackburn Island. The conservation area is undergoing a large-scale environmental restoration project for forests and wetlands and further impacts on the island are discouraged. In addition, it was noted that bald eagles, herons, and egrets are known to nest on the island. Although this Potential Route parallels an existing pipeline, USACE noted that impacts from the transmission line may be greater because permanent vegetation clearing would be required to maintain appropriate electrical clearances.

   The town of Louisiana is the most densely populated area of the five crossings and contains a historic downtown that is included in the National Register. In addition to the above considerations, the Missouri Department of Transportation is evaluating whether to rebuild the bridge at Louisiana in its current location or re-locate the bridge. Therefore, potential conflicts may arise if the bridge is relocated close to the Potential Route crossing.

5. *Clarksville (River Mile 276–277)*: The final river crossing that was presented at the Open Houses is approximately 3 miles north of Clarksville. The topography is steep and rapidly transitions to the river without crossing floodplain area on the Missouri side. The Potential Route crosses over Pharrs Island before reaching the Illinois side of the river and crossing 24,950 feet of floodplain. The crossing in this location would span approximately 7,950 feet of the river and would require a structure s on Pharrs Island to decrease the overall span length between structures and their height. Pharrs Island is surrounded by a bullnose that was constructed to increase habitat for waterfowl and fisheries. The island includes suitable habitat for bald eagle nesting and roosting, as well as Indiana bat habitat. It also provides recreational uses for waterfowl hunting with numerous blinds scattered on the island. In addition to Pharrs Island, a state wildlife management area just south of the crossing location is managed for waterfowl and other migratory birds. Additionally, numerous cultural sites have been identified along this stretch of the Mississippi River and the Missouri SHPO believes more sites may exist along the bluffs on the Missouri side.

Once all the information was reviewed, the preferred river crossing location was determined to be the South Saverton crossing between river miles 299 and 300 (**Figure 4-9**). This crossing location was preferred by USACE St. Louis District and had the fewest conflicts associated with current land use of any the crossings. Although the USFWS considered this crossing less desirable due to potential for bald eagle impacts, residential development in this location is low with a quarry bordering the north side of the route and the Anderson Conservation Area on the south side. From an engineering perspective, the South Saverton crossing offered some flexibility in the exact alignment across the river and would allow a structure to be placed on Jim Young Island to reduce span length and structure height. In addition, this crossing is located south of the lock and dam where the river is narrower, which also would help reduce structure height. Collision may be considered a potential risk for bald eagles as well as other avian species at waterbody crossings such as at the Mississippi River. Grain Belt Express will implement an Avian Protection Plan in accordance with the Avian Power Line Interaction Committee guidance to minimize any potential impacts to avian resources.

The selection of the preferred river crossing location allowed other Potential Route links to the river crossings to be removed from consideration. The result was a refined route network with Alternative Routes from a specific Missouri River crossing location (identified in the Kansas Siting Study) to a specific Mississippi River crossing location. Section 4.3.3 below discusses the Alternative Routes carried forward in this siting study.



Potential Routes
National Register of Historic Places Site
National Register of Historic Places District
Levee District
River Mile Markers
Conservation Land
Local/Private
State
Federal

Figure 4-9
Mississippi River Crossing

GRAIN BELT EXPRESS
CLEAN LINE

Sources: ESRI, FEMA, USACE, USFWS, MO Dept. of Conservation, IL DNR

N

0 0.5 1 Miles

Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983

MARION ADAMS IL RALLS PIKE MONROE MO PIKE AUDRAIN

4.3.3 Description of Alternative Routes

The Routing Team compiled the remaining links in the Refined Potential Route Network into Alternative Routes (**Figure 4-10**). To accommodate a reasonable comparison between Alternative Routes, the Routing Team divided the routes into two distinct segments, Segment 1 (Alternative Routes A–C) (**Figure 4-11**) and Segment 2 (Alternative Routes D–I) (**Figure 4-12**).

Each segment begins and ends at a common point for all of the Alternative Routes within that segment, which provides for a reasonable comparison between each of the Alternative Routes. From each of the segments, one Alternative Route is ultimately selected, and when both Alternative Routes are connected, the Proposed Route is formed. Segment 1 begins at the Missouri River crossing south of St. Joseph and terminates in Clinton County, just southwest of Turney, Missouri. Segment 1 carries forward three Alternative Routes for consideration. Segment 2 begins at the termination point of Segment 2 and covers the remaining portion of Missouri to the Mississippi River crossing. Segment 2 carries forward six Alternative Routes. The Alternative Routes are the focus of the comparative analysis presented in Chapter 5. Below is a description of each Alternative Route.

Segment 1

Alternative Route A

Alternative Route A (**Figure 4-10**) crosses the Missouri River close to the Rockies Express/Keystone Pipeline, just south of the Jentell Brees access area on County Road 207 in Buchannan County. After crossing the Missouri River and the Halls Levee, the route turns southeast continuing for approximately 1mile and then turns east crossing County Road 54 SW. The route continues east over County Road 41 SW before dropping south a half section across U.S. Highway 59. The route continues east for approximately 1 mile before running parallel, south of the Rockies Express/Keystone Pipeline for approximately 5 miles to U.S. Interstate 29. Prior to crossing Interstate 29, the route turns southeast around several residences before continuing toward the intersection of State Route H and County Road 65 SE, just southwest of the town of Agency. The route turns east crossing over the intersection of State Routes MM and H and the Platte River then moves north a half section crossing agriculture and pasture lands. Just before State Route E, the route turns northeast and crosses over the St. Joseph Light and Power Company's 345 kV transmission line and Mt. Moriah SE Road. The route then turns east, continuing 2 miles to U.S. Highway 169. North of Gower, the route turns southeast and parallels the Gower – Plattsburg 115 kV transmission line for approximately 0.5 mile before turning east where it follows along section/parcel boundaries across agricultural land toward the intersection of NW 29th Street and NW Perkings Road. The route continues east parallel to the Rockies Express/Keystone Pipeline for approximately 6 miles before crossing over the gas pipeline near Missouri Highway 33. The route continues east for 0.5 mile along section/parcel boundaries, dropping south a half section and ending near the intersection of NE 228th Street and Breckenridge Road.

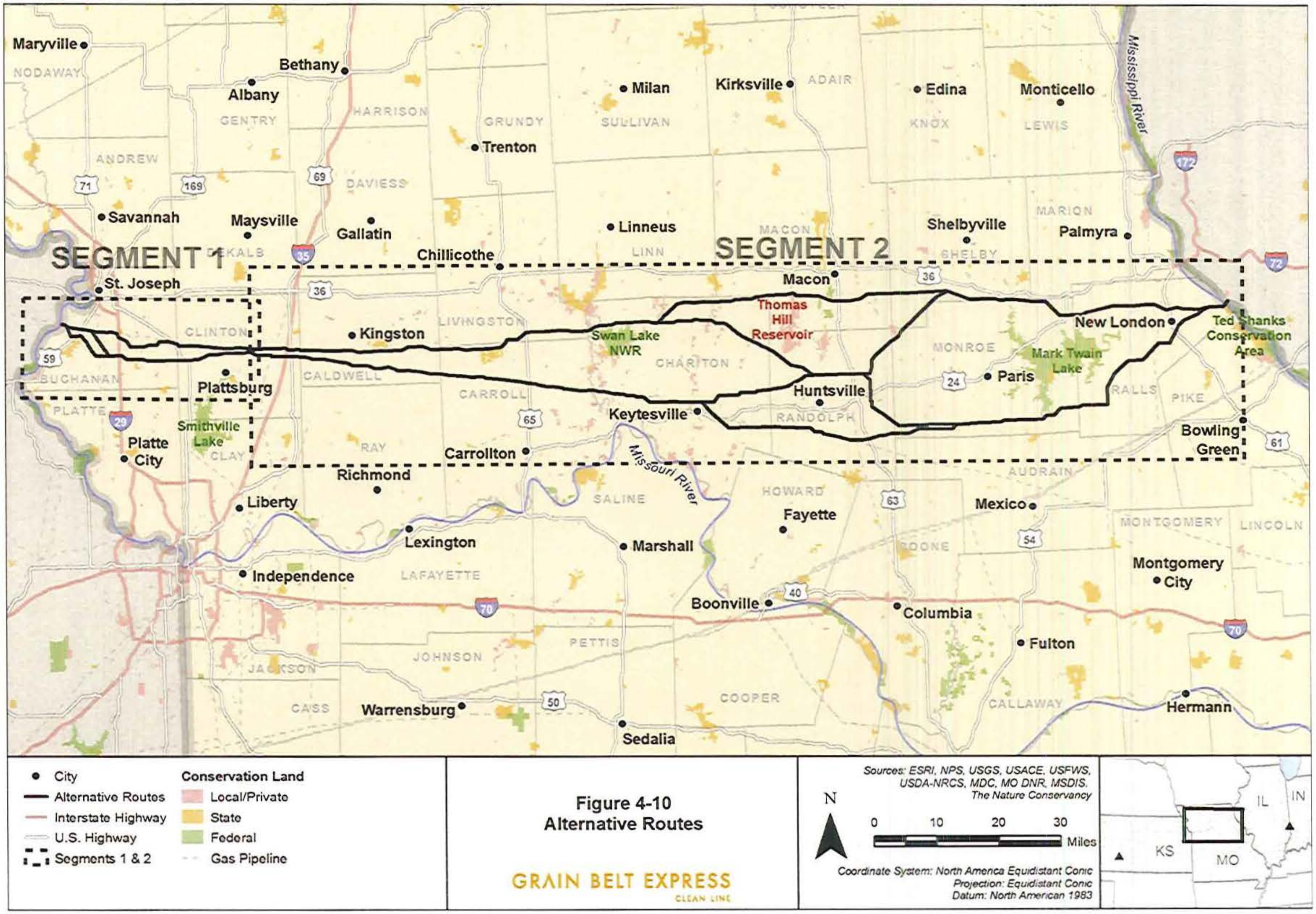


Figure 4-10
Alternative Routes

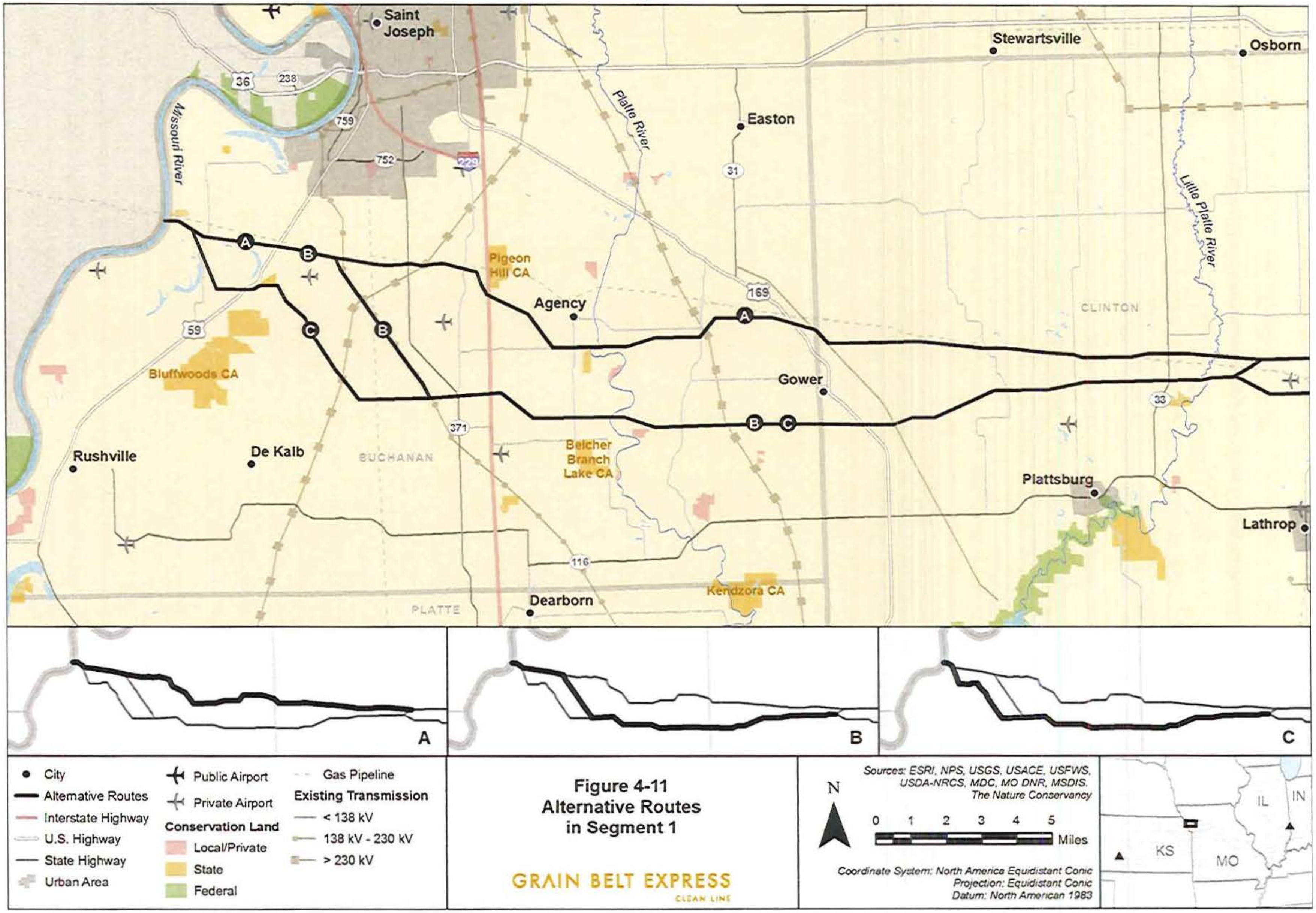


Figure 4-11
Alternative Routes in Segment 1

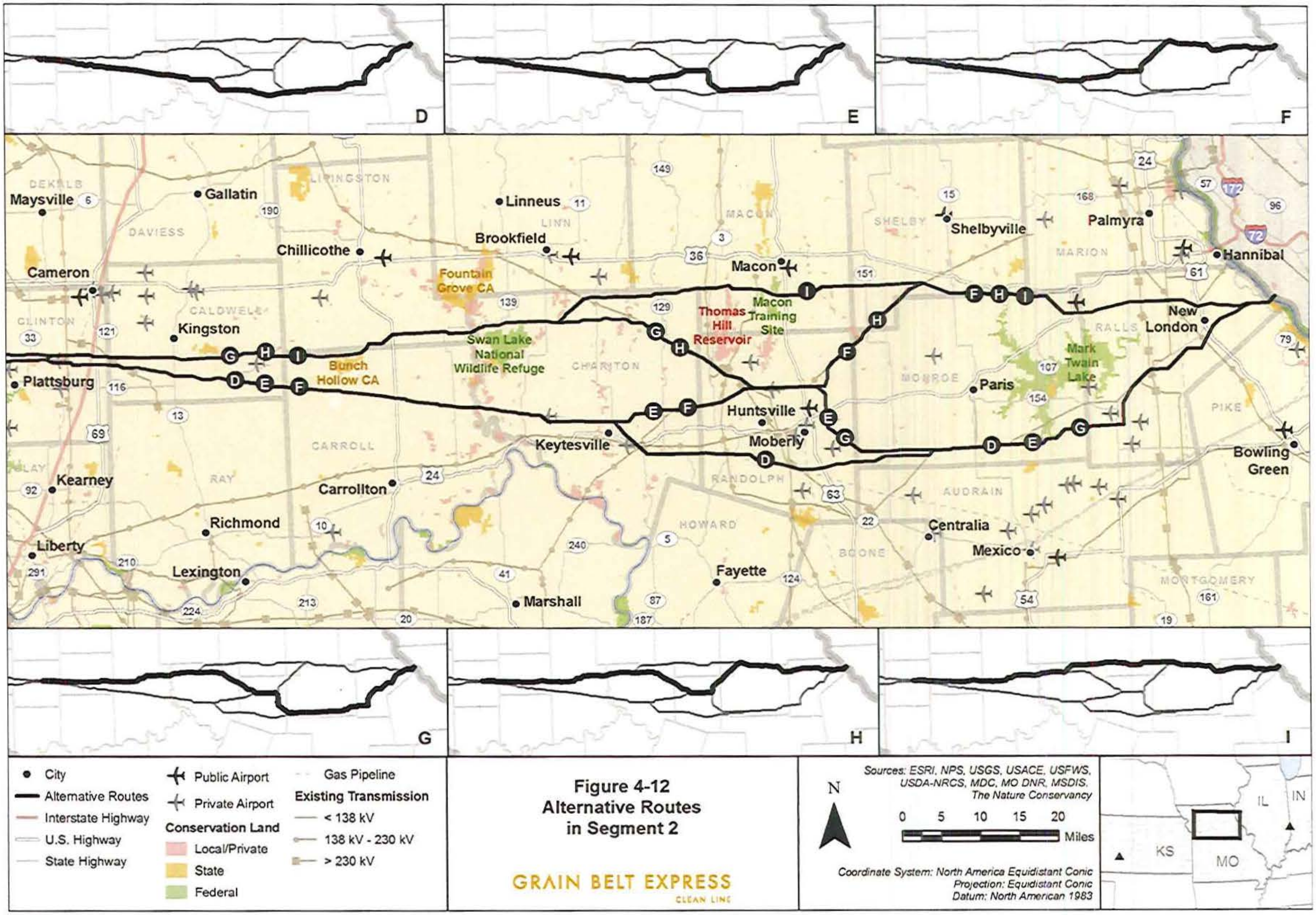


Figure 4-12
Alternative Routes
in Segment 2

Alternative Route B

Alternative Route B (**Figure 4-10**) follows the same path as Alternative Route A for the first 5 miles before diverting south-southeast to parallel the west side of the exiting Nashua – Lake Road 161 kV transmission line for 4.5 miles. Just northwest of the town of Faucett, the route turns east crossing the existing transmission line and continuing approximately 2 miles to Interstate 29. After crossing Interstate 29, the route shifts slightly south for approximately 0.5 mile then turns, heading southeast crossing Tillery SE Road for approximately 1 mile. Near County Road Kelley SE, the route turns east again continuing 2.5 miles crossing the Platte River. The route shifts south a quarter section crossing County Road 95 SE then continues east over the Hawthorne – St. Joseph 345 kV transmission line to U.S. Highway 169 just south of Gower. After crossing U.S. Highway 169, the route continues east over Castile Creek and NW Poage Road then turns northeast for approximately 0.5 mile. The route then turns to the east for approximately 1 mile. After crossing County Road 326, the route again turns northeast for approximately 1 mile before crossing NW Prairie View Road. The route continues northeast for approximately 1 mile before turning east along section/parcel boundaries for approximately 2 miles. The route crosses over NW Country Land Road, moves north a quarter section and continues along section/parcel boundaries before terminating 0.5 mile east of NE Dixon Road.

Alternative Route C

Alternative Route C (**Figure 4-10**) follows the same path as Alternative Routes A and B for the first mile before diverting in a more south-southeast direction. The route continues south-southeast for approximately 2 miles, crossing County Road 54 SW and Crockett SW Road. It turns east after crossing Cottonwood SW Road continuing 1 mile before crossing U.S. Highway 59 and St. Joseph Sub railroad. The route continues east for approximately 0.5 mile before turning northeast for a short distance and then turning east again for 0.5 mile. Alternative Route C then turns southeast, and crosses State Route JJ, County Roads Dittemore SW and SW 25, and the intersection of Lower Dekalb SW and Bethel SW roads. The route continues in a south-easterly direction crossing the Iatan – St. Joseph 345 kV transmission line. Just south of intersection State Route V and County Road Call SW, the route turns continuing east across agriculture and pasture lands and merges with Alternative Route B to follow the same path to the termination point.

Segment 2

Alternative Route D

Alternative Route D (**Figure 4-11**) begins near the intersection of NE 288th Street and NE Crowley Corner Road approximately 2 miles southwest of the town of Turney in Clinton County. The route continues due east for a short distance before it drops south a section and continues east along section/parcel boundaries south of the Lathrop Substation. The route crosses State Route A and the Fairport – Lathrop 161 kV transmission line and continues east a short distance before turning southeast for approximately 2 miles to Interstate 35. The route crosses Interstate 35 and continues east for approximately 1 mile before paralleling the Rockies Express/Keystone Pipeline on the south side for approximately 3 miles before shifting south a half section and crossing the intersection of State Route Z and Ore Road. The route continues east along section/parcel boundaries for approximately 2 miles before turning southeast to parallel the south side of the gas pipeline for another 4 miles until it turns southeast for approximately 1 mile before crossing Missouri Highway 13. In an effort to parallel section/parcel boundaries, the route turns east for approximately 6.5 miles to just north of the town of Cowgill. It then turns southeast, crossing the gas pipeline once more, and continues east for nearly 1 mile before turning southeast again to parallel the south side of the gas pipeline for 12.5 miles. Near the intersection of State Route C and County Road 151 in Carroll County, the route crosses over the gas pipeline and continues to parallel on the north side for approximately 9 miles to U.S. Highway 65.

After crossing U.S. Highway 65, the route crosses over and continues to parallel the gas pipeline on the south side for approximately 9 miles before crossing back to the north side to avoid impacting an Emergency Watershed Protection Easement. The route continues paralleling the gas pipeline on the north side for approximately 6 miles before crossing back to the south side to avoid a residence located near the gas pipeline. The route maintains this parallel alignment for approximately 6 more miles. Near the intersection of Powell Avenue and Hickory Grove Road, the route turns east along section/parcel boundaries for approximately 5.5 miles. It then turns southeast (east of Keytesville) for approximately 6 miles before turning east and crossing over the gas pipeline. Because of residential development along the gas pipeline, the route deviates north of the pipeline and heads southeast for approximately 7 miles before beginning its parallel alignment again on the north side for approximately 4 miles. The route then turns due east crossing over the Thomas Hill 345 kV transmission line, and continues east over U.S. Highway Business 63 and the St. Louis District Railroad, approximately 1 mile south of Moberly and just north of the town of Renick. The route then angles northeast and then turns due east 0.5 mile north of the intersection of State Route Y and County Road 1039. The route continues east along section/parcel boundaries for approximately 2.5 miles then moves north a half section crossing over Missouri Highway 151. It continues east along State Route M for 5 miles before picking up the parallel alignment to the Thomas Hill 115 kV transmission line for 9.5 miles.

South of the intersection of State Route D and County Road 779, the route and the 161 kV line split and the route continues east along pasture and agricultural land. At the intersection of State Route D and County Road 624, the route turns northeast then east again approximately 1 mile north of the town of Santa Fe. The route crosses the South Fork Salt River then turns northeast before the intersection of State Routes D and E. After approximately 1.5 miles, the route turns east again continuing along section/parcel boundaries for 3 miles before moving north a half section and continuing due east crossing over Missouri Highway 19 in Ralls County.

Approximately 1 mile east of Missouri Highway 19, the route makes a 90 degree turn continuing north along Wyoming and York roads. The route turns northeast and parallels Missouri Highway 19 for 6 miles before diverting north and east around the town of Center. The route turns east and continues east for 2.5 miles, crossing over Missouri Highway 19. The route then turns northeast for 2 miles, east for 2.5 miles, and finally northeast for another 3.5 miles. The route crosses over the Ameren Missouri 161 kV transmission line and U.S. Highway 61 before turning east-northeast and crossing the Salt River. It continues east-northeast with slight deviations for approximately 5 miles, then it turns east near the intersection of Oakhill and Malaruni roads. After crossing Missouri Highway 79, approximately 2 miles south of Saverton, the route continues east approximately 0.5 mile before turning northeast for approximately 0.5 mile prior to reaching the Mississippi River.

Alternative Route E

Alternative Route E (**Figure 4-11**) follows the same alignment as Alternative Route D to the point just north of Keytesville. Here, Alternative Route E continues east along the north side of Dooley Ford Road. At the intersection of State Route UU and Scribner Road, the route turns northeast crossing over Log Cabin Lane and then turns east crossing the Chariton River. The route continues due east for approximately 3 miles along section/parcel boundaries before moving north a half section and crossing Missouri Highway 129. The route continues east for 1.5 miles, crossing Prairie Valley Avenue, and then begins paralleling the north side of the Salisbury – Thomas Hill 161 kV transmission line. The route continues the parallel alignment, with one deviation around several residences along the existing transmission line, for approximately 6 miles. After the route crosses Missouri Highway 3, it crosses the Salisbury – Thomas Hill 161 kV transmission line and turns northeast near County Road 1135. The route crosses a 161 kV and a 115 kV transmission line as it proceeds northeast. Approximately 0.5 mile north of the State Route Z and County Road 1145 intersection, the route turns east crossing a 345 kV transmission line before merging and paralleling south of another Kansas City Power and Light Company 161 kV transmission line. The route continues to parallel the 161 kV transmission line for approximately 7 miles crossing U.S. Highway 63 and then turns south near the intersection of County Roads 1490 and 1495. The route continues south, parallel to a lower voltage transmission line, crossing U.S. Highway 24, for approximately 4.5 miles then turns southeast to parallel north of the Ameren Missouri 69 kV transmission line for 5.5 miles. Approximately 0.75 mile northwest of the County Roads 1018 and 1023 intersection, the route turns due east and follows the same alignment as Alternative Route D to the Mississippi River.

Alternative Route F

Alternative Route F (**Figure 4-11**) follows the same alignment as Alternative Route D to the point just north of Keytesville. Here, Alternative Route F continues east along the same alignment as Alternative Route E to the intersection of County Roads 1490 and 1495, east of Cairo. It turns north-northeast crossing State Route K and continues north along section/parcel boundaries for 1.5 miles. The route crosses State Route FF then turns northeast to parallel the south side of a Kansas City Power and Light Company 161 kV transmission line for approximately 16.5 miles with two diversions around residences and an NRCS Wetland Reserve Program (WRP) easement.

Approximately 3 miles west of Shelbina (in Shelby County) near the intersection of County Roads 425 and 432, the route diverts from the Kansas City Power and Light Company 161 kV transmission line to the southeast. The route diagonally crosses agriculture and pasture land towards the intersection of State Route WW and County Road 439 then turns east crossing Missouri Highway 15. The route continues east mostly along section/parcel boundaries for 3.5 miles, dropping south a half section into Monroe County. After crossing State Route PP, the route continues east along the border of Shelby and Monroe counties for 2 miles before turning southeast. Approximately 0.5 mile south of Hunnewell, the route turns due east continuing along section/parcel boundaries for approximately 2 miles. It turns south-southeast crossing near the intersection of County Roads 375 and 390. The route continues for 2.5 miles, crossing the Hannibal District Railroad then turning east, 2 miles south of Monroe City. Continuing east for 1.0 mile, the route crosses Missouri Highway 24 and parallels north of County Road 594 and Hereford Lane into Ralls County.

Alternative Route F continues east from the county line for approximately 1.5 miles then turns northeast. The route continues in a northeasterly direction for approximately 5 miles turning east near the intersection of Huntington Lane and Hawthorne Road. The route continues east crossing Ameren Missouri's Maywood - Montgomery 345 kV transmission line and State Route H. It continues east for 2 miles crossing a Central Electric Power Cooperative 115 kV transmission line and the Marblehead – Tap 161 kV transmission line just south of Rensselaer and Hannibal. Continuing east, the route crosses State Route M then turns southeast for 2 miles. Near the intersection of Choctaw Trail and U.S. Highway 61, the route turns east again continuing along the north side of the Salt River. Just south of the intersection of State Route O and Flint Hill Road, the route turns east-southeast for approximately 1 mile before heading due east along section/parcel boundaries for 1 mile. It continues to travel east, making three slight deviations to avoid residences before joining with the same alignment as Alternative Routes D and E to the Mississippi River.

Alternative Route G

Alternative Route G (**Figure 4-11**) begins near the intersection of NE 288th Street and Breckenridge Road approximately 1.5 miles southwest of the town of Turney in Clinton County. The route continues east for 5 miles to NE Estep Road. It moves south a half section, crosses Interstate 35 and U.S. Highway 69 continuing east along section/parcel boundaries. Near the Clinton and Caldwell County line, the route moves south a half section and continues east for 3 miles to the intersection of Duroc Drive and Texas Road. The route moves south another half section, crossing State Route D and continues east along section/parcel boundaries for 5 miles to Missouri Highway 13. After crossing Missouri Highway 13, the route moves south a half section continuing east across agriculture and pasture land for about 7 miles. The route moves north a section and parallels south of Ayres and Honeysuckle Drive. Approximately 1.5 miles north of the town of Braymer, the route shifts south a section crossing State Route A and continuing east along section/parcel boundaries into Carroll County.

The route continues east along section boundaries approximately 3 miles into Carroll County. Just after crossing State Route D, the route moves south a half section continuing east, north of County Road 110. The route passes north of Bunch Hollow Conservation Area then turns northeast near the intersection of County Road 110 and State Route Z. The route continues for 1.5 miles, parallels for a short distance a Northwest Missouri Electric Cooperative 69 kV transmission line, and then turns east crossing the 69 kV transmission line. The route continues east for approximately 1.5 miles then turns northeast crossing County Roads 451 and 430. Just west of U.S. Highway 65, the route turns and continues east 7 miles crossing Missouri Highway 139 approximately 1.5 miles north of the town of Hale. The route briefly parallels the south side of a Northwest Missouri Electric Cooperative 69 kV transmission line then crosses the 69 kV transmission line and continues east for 3 miles. After the route crosses the Brookfield Sub Railroad, it turns northeast crossing the Grand River into Chariton County.

The route continues in a northeast direction in Chariton County, avoiding NRCS WRP easements, several residences, and a cemetery then turns east at the intersection of Lakeside Road and State Route Ra. The route continues east passing between the town of Sumner and the Swan Lake National Wildlife Refuge before moving north a half section and continuing east for 5 miles to Missouri Highway 11. After crossing Missouri Highway 11, the route moves south a half section, crosses the Marceline Sub Railroad and continues another 5 miles to Missouri Highway 5. The route continues east and moves north at Cumberland Avenue to avoid several residences. The route moves back south just west of State Road ZZ and continues east for 1.5 miles. It then turns southeast to move south a section and then turns east again until reaching the Thomas Hill 161 kV transmission line. The route parallels the west side of the 161 kV transmission line for 10 miles, crossing Missouri Highway 3, and then turns east-southeast near the intersection of State Route F and County Road 1150. The route crosses four different transmission lines coming out of the Thomas Hill power plant, before turning south-southeast near the intersection of County Roads 1155 and 1160. It crosses and parallels the east side of a Northeast Missouri Electric Power Cooperative 69 kV transmission line for 1.5 miles. Continuing south-southeast, it crosses State Route C and a Kansas City Power and Light Company 161 kV transmission line. The route parallels the 161 kV transmission line on the south side and follows the same alignment as Alterative Route E to the Mississippi River.

Alternative Route H

Alternative Route H (**Figure 4-11**) is a combination of Alternative Routes G and F. Alternative Route H follows the same alignment as Alternative Route G from the starting point to just east of Cairo where Alternative Routes E and G head south and Alternative Routes F and H head northeast. From here, Alternative Route H follows the same alignment as Alternative Route F to the Mississippi River.

Alternative Route I

Alternative Route I (**Figure 4-11**) follows the same alignment as Alternative Routes G and H from the starting point to just below the town of Rothville in Chariton County. After the routes cross the Marceline Sub Railroad, Alternative Route I turns northeast and parallels the railroad for 4.5 miles. North of the Twichell Road and Pioneer Avenue intersection, the route turns east crossing Northwest Missouri Electric Cooperative 161 and 69 kV transmission lines. Approximately 0.5 mile south of Marceline, the route crosses Missouri Highway 5 continuing east mostly along parcel boundaries for 8.5 miles before crossing Missouri Highway 129. After crossing Missouri Highway 129, the route continues east for 2 miles then gradually moves north a section into Macon County. It continues east crossing the Chariton River and the Ameren Missouri 161 kV transmission line before reaching Missouri Highway 3. After crossing Missouri Highway 3, the route diverts north of the Thomas Hill Reservoir then moves south a section continuing east crossing State Route FF and C. The route continues east crossing a Kansas City Power and Light Company 161 kV transmission line, then passes between the U.S. Army National Guard Macon Training Site south of Macon. Near the intersection of Kayak Avenue and Keswick Place, the route turns east crossing U.S. Highway 63 continuing for 3.5 miles before moving north a section close to the intersection of Nature Avenue and Noble Road. The route continues east for approximately 4 miles into Shelby County crossing U.S. Highway 151 just south of Clarence. The route continues east for 7 miles then turns southeast near the intersection of County Roads 417 and 432. It crosses a Kansas City Power and Light Company 161 kV transmission line and then follows the same alignment as Alternative Routes F and H to the Mississippi River crossing.

5. Alternative Route Evaluation

This chapter describes the key resources in the Study Area and a comparative analysis of the potential impacts of each Alternative Route on these resources. The analysis relies on a combination of information collected in the field, GIS data sources, supporting documents, stakeholder input, and the knowledge and experience of the Routing Team. Information presented throughout the chapter is based on an aerial photo-aligned centerline for each Alternative Route. The final location of any route is subject to modification based on final engineering, ground surveys, minimization of impacts on site specific resources, and landowner negotiations.

5.1 Natural Environment Impacts

5.1.1 Water Resources

Water resources of northern Missouri fall within the Missouri River and Upper Mississippi River basins. As a result of the areas' glacial past, the drainage patterns consist of nearly parallel streams that trend south in northwestern Missouri and drain into the Missouri River. Streams in northeastern Missouri flow southeast and into the Mississippi River. The glacial till of northern Missouri has low permeability; therefore, infiltration is low and runoff is rapid (Vandike 1995). This low permeability and a lack of groundwater inflow make for low base flows during dry weather. Northern Missouri is extensively row-cropped, and glacial till is easily eroded, especially on steeper slopes. This combination leads to high suspended sediment loads in many streams and rivers in northern Missouri (Vandike 1995). Water resources in the study area are presented in **Figure 5-1**.

The vast majority of the ponds and lakes in Missouri are privately owned and used for agricultural or recreational purposes. USACE has constructed numerous reservoirs for flood control, including the Mark Twain Lake in Monroe and Ralls counties. Wetlands are typically located in the floodplains along rivers and streams, in swales associated with rivers, or as margins of lakes and impoundments.

In Segment 1, all streams and rivers drain to the Missouri River. The segment begins at the Missouri River and crosses the Independence-Sugar, Platte, and Upper Grand watersheds. Major surface water features include the Missouri River, Platte River, Little Platte River, Grand River, Shoal Creek, and the East Fork Grand River. Groundwater resources are poor with the exception of the Missouri River alluvium, which averages well yields of 1,000 gallons per minute (Miller and Vandike 1997).

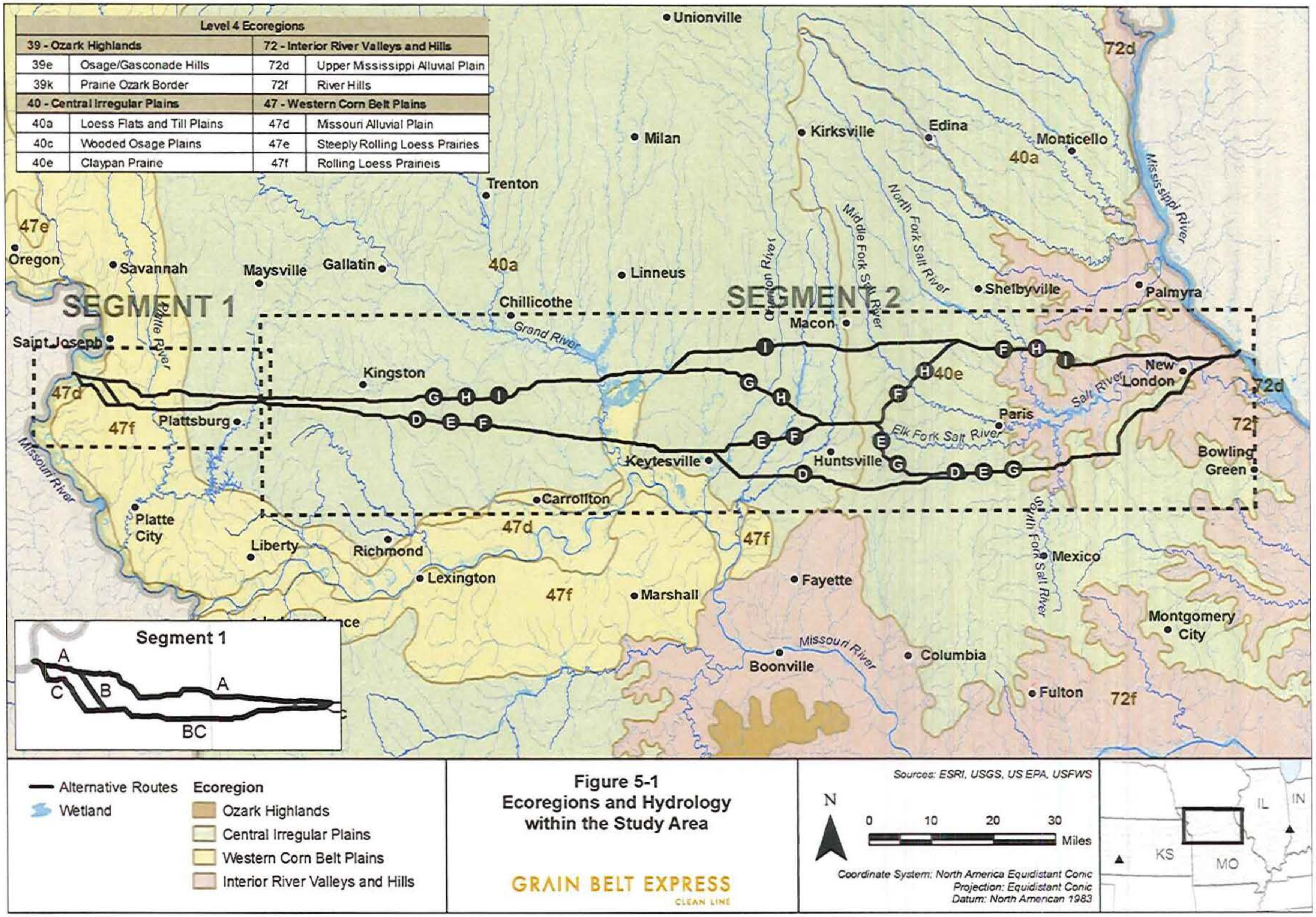


Figure 5-1
Ecoregions and Hydrology within the Study Area

In Segment 2, streams and rivers drain to the Missouri and Mississippi rivers. The segment crosses nine watersheds including the Upper Grand, Lower Grand, Lower Chariton, Little Chariton, Lower Missouri-Crooked, Salt, North Fork Salt, South Fork Salt, and the Sny. Major surface water features include the Chariton River, Mussel Fork, Grand River, North Fork Salt River, South Fork Salt River, Crooked River, Salt River, and the Mississippi River. Segment 2 also has two large reservoirs, Thomas Hill Reservoir and Mark Twain Lake. Groundwater resources are more diverse in the northeastern part of the state and can have areas of moderate yields for irrigation (Miller and Vandike 1997).

Portions of Shoal Creek, Crabapple Creek, Log Creek, and Brush Creek in the Bonanza Conservation Area are designated Outstanding State Resource Waters (State of Missouri 2012). In contrast, several waters in this segment are also listed on the state's 303(d) list that identifies impaired waterbodies that are not currently meeting water quality standards. Other 303(d) listed waters in the area of Segment 2 include Salt Creek in Chariton County, Middle Fork – Salt River in Macon County, a tributary to Coon Creek in Randolph County, and Salt River in Ralls/Pike County, all of which are impaired for low dissolved oxygen levels (MDNR 2013).

Swan Lake National Wildlife Refuge, managed by USFWS, is located in the floodplain of the Grand River near its confluence with the Missouri River. The refuge provides 7,000 acres of wetlands and more than 3,000 acres of open water (USFWS 2013a). In addition, numerous NRCS WRP conservation easements are located along the Grand River.

Mark Twain Lake, impounded by Clarence Cannon Dam, is the only major reservoir in northeastern Missouri in the Mississippi River basin. Clarence Cannon Dam is 1,940 feet long and 138 feet high. At multipurpose pool level (elevation 606 feet), the surface area of Mark Twain Lake is 18,600 acres, and storage is 457,000 acre-feet (Vandike 1995). Mark Twain Lake is used for flood control, recreation, and water supply.

Thomas Hill Reservoir was formed by damming the Middle Fork Little Chariton River in Randolph County. The reservoir, which is privately owned by Associated Electric Cooperative, is used primarily to supply cooling water for the Thomas Hill Power Plant. The lake drains 147 square miles and has a normal surface area of about 4,400 acres. Although it is primarily used for cooling water, it is also a source of water for Thomas Hill Public Water Supply District #1 and is used for recreation (Vandike 1995).

General Impacts and Mitigation Measures

Surface Waters

Direct impacts on hydrologic features are often minimized or avoided by spanning wetlands, rivers, or drainages, when feasible. In the absence of other constraints, engineers typically seek to place structures at high points in topography, inherently resulting in the avoidance of structure placement that impacts water or wetland features in low-lying areas. However, in a few rare instances, such as at crossings of large wetland areas or complexes, a structure may need to be placed within a wetland. In these instances, the area of permanent wetland loss is limited to the area of the footprint of the structure foundation, typically between 0.0005 and 0.0009 acre of permanent impact (average permanent impact acreage for lattice steel and steel monopole structures, respectively).

Regardless of the type of impact, Grain Belt Express will continue to coordinate with USACE concerning potential impacts on jurisdictional wetlands and attempt to minimize permanent impacts when feasible and practicable. Grain Belt Express would implement best management practices during the design, construction, and operational phases to avoid or minimize impacts on wetlands. These practices may include the consideration of designs that limit clearing forests near drainages and in areas of steep topography, requiring the use of wetland mats to minimize impacts of construction traffic, and avoiding construction during seasonally wet periods in certain areas.

At the Mississippi River crossing location, no structures would be placed in the river; however, a structure would be placed on Jim Young Island. Although impacts to the Mississippi River are not anticipated, wetlands may occur on the island and along the riparian margins of the Mississippi River. Grain Belt Express will continue coordination with USACE to identify and mitigate potential impacts that may be associated with wetlands located at the crossing as well as across the project.

Other indirect impacts to surface waters, such as sedimentation and erosion of surrounding soils, can result from ground-disturbing activities. Typically, sedimentation is easily controlled with proper perimeter controls around the transmission line construction area. Best management practices may include implementation of sediment control measures such as silt fences, access road drainage management measures, and timely reseeding of disturbed soil areas. Grain Belt Express will coordinate with MDNR and obtain and comply with the necessary storm water permits for construction of the Project.

Groundwater

Generally, transmission line construction does not impact groundwater. In some instances, dewatering may need to occur in areas with a high water table to place foundations in the ground. Any dewatering activities required by construction would follow best management practices and be covered under the National Pollution Discharge Elimination System Permit or under a separate dewatering permit, as appropriate.

Alternative Route Comparison

For each segment, Alternative Routes were analyzed for the number of stream crossings (including streams, rivers, or drainages that can be perennial, seasonal, intermittent, or ephemeral), number of waterbodies (lakes or ponds) crossed, and acres of wetlands (forested and scrub/shrub). **Figure 5-1** shows the ecoregions and hydrology for both segments.

Segment 1

Excluding the Missouri River itself, all streams and waterbodies in Segment 1 can be easily spanned, and potential wetland acreage within the ROW of each Alternative Route is generally similar (**Table 5-1**). Alternative Route A crosses the fewest streams; however, it also crosses the greatest number of waterbodies and has the greatest total wetland acreage and forested wetland acreage within the ROW. Alternative Routes B and C are comparable with a similar number of stream crossings, waterbody crossings and wetlands within the ROW.

Table 5-1. Segment 1 Alternative Routes Water Resources Information

Water Resources Category	Alternative Routes		
	A	B	C
Stream crossings (count)	53	58	63
Waterbody crossings (count)	9	6	3
Wetlands[1] within the ROW[2] (acres)	41	36	33
Forested wetlands[1] within the ROW[2] (acres)	21	11	12
Scrub-shrub wetlands[1] within the ROW[2] (acres)	--	--	--

[1] National Wetlands Inventory (2013)

[2] ROW is 100 feet on either side of centerline

Segment 2

Excluding the Mississippi River crossing, all waterbodies and streams can be spanned by all of the Alternative Routes. Wetlands will be spanned when feasible. No structures will be placed in the Mississippi River; however, taller structures and longer spans will be required. Alternative Route D has the fewest stream crossings, while Alternative Route F has the most stream crossings, though the number of stream crossings and waterbody crossings is generally similar across all six alternatives (**Table 5-2**).

All of the Alternative Routes intersect one or more reaches of a 303(d) impaired water. However, based on the impairments listed for these streams (*Escherichia coli*, or E. coli, and low dissolved oxygen), the Project is not likely to further impair the streams crossed. Alternative Route D has the fewest stream crossings and the fewest acres of total wetlands within the ROW. Therefore, Alternative Route D would likely have the least overall impact on water resources in Segment 2.

Table 5-2. Segment 2 Alternative Routes Water Resources Information

Water Resources Category	Alternative Routes					
	D	E	F	G	H	I
Stream crossings (count)	228	248	252	245	249	238
Waterbody crossings (count)	24	24	25	24	25	27
Wetlands[1] within the ROW[2] (acres)	118	129	132	137	141	143
Forested wetlands within the ROW[1] (acres)	69	76	77	76	77	77
Scrub-shrub wetlands within the ROW[1] (acres)	1	1	1	<1	<1	<1

[1] National Wetlands Inventory (2013)

[2] ROW is 100 feet on either side of centerline

5.1.2 Wildlife and Habitat

Vegetation and Habitats

Missouri was once a complex mixture of grassland (or prairie), savanna, woodland, and forest occurring on a diversity of landforms that vary in degree of relief, dissection, and geologic parent materials. Grasslands occupied approximately one-third of the state occurring as both upland grasslands and wet grasslands on the wide alluvial plains along rivers.

Today, native grasslands are rare with most converted to pastures composed of planted nonnative pasture species. Existing native vegetation in Missouri has undergone extensive fragmentation into smaller tracts. The general land cover today is a complex mixture of cropland on smoother surfaces and better soils, pasture on irregular surfaces and eroded soils, and woodlands and forests on steeper soils and rougher areas (Nigh and Schroeder 2002).

Along the Missouri River, on the Missouri River alluvial plain, lands that were once wet prairies and marshes with narrow bands and isolated pockets of bottomland forest have been drained and are now devoted mainly for use as highly productive croplands. However, a substantial number of wetlands still remain, and since the flood of 1993, several large areas have been converted to managed wetlands (Nigh and Schroeder 2002).

Just east of the Missouri River alluvial plain, an area of rolling loess prairies occurs that was historically mainly grasslands with oak savannas and woodlands in valleys and on steeper side slopes. This area is now mostly farms with cropland on alluvial plains and less dissected uplands and nonnative pastures occurring on more sloping lands (Nigh and Schroeder 2002).

North central Missouri consists of loess flats and till plains of varied topography due to several larger stream headwaters occurring in this area creating topography from flat to moderately hilly causing a dissected land surface in areas. The area is mostly in cropland on the alluvial plains and flat uplands and nonnative pastureland on more sloping lands with true savannas and open woodlands nearly absent. Small forested patches and fencerows mainly consist of invasive woody species. However, some of the rougher ground contains patches of oak and mixed hardwood woodland and forest (Nigh and Schroeder 2002).

Eastern Missouri, north of the Missouri River and west of the Mississippi River, consists of claypan prairie with topography mostly flat or gently rolling. Most former prairies are now used as cropland with extensive nonnative pasture and hay land on rolling lands with an emphasis on livestock production. Most woodlands are mixed with invasive woody species, and very little natural vegetation remains (Nigh and Schroeder 2002).

In the far eastern portion of Missouri, north of the Missouri River, the Mississippi River hills area includes a broad belt of hills, valleys, and blufflands along the western side of the Mississippi River. Topography ranges from moderately rolling to steep and rugged. Steeper areas remain in woodland and forest. Uplands and broad bottoms have a mixture of nonnative pasture and cropland with former prairie openings in forested areas eliminated. The area nearest the Mississippi River consists of an alluvial plain, most of which are drained for cropland; although, many islands are forested with riverfront species (Nigh and Schroeder 2002).

Wildlife

The mosaic of grassland, savanna, woodland, and forest communities and their associated edge habitat significantly affected the types and numbers of wildlife that occurred historically in Missouri (MDC 2003).

Missouri's natural communities support and provide habitat for a great diversity of wildlife species including more than 150 native breeding bird species (Jacobs and Wilson 1997), 108 native reptile and amphibian species (Johnson 2000), 67 native mammal species (Schwartz 2001), 200 native fish species (Pflieger 1997), 65 native mussel species (Oesch 1995), 32 native crayfish species (Pflieger 1996), and more than 130 native dragonfly and damselfly species (Trial 2005). Missouri ranks 21st in the nation in a ranking of the aggregate native species diversity of vascular plants, mammals, birds, reptiles, amphibians, and freshwater fishes of the 50 states (Stein 2002). Many of these species depend partially or wholly on woodlands and forests (MDC and USDA Forest Service 2010). Game species managed for hunting include big and small game animals, furbearing animals, upland game birds, migratory game birds, and waterfowl.

In addition, Missouri lies within the Mississippi Flyway, one of the four major North American migratory bird corridors. The Mississippi Flyway stretches from the Gulf Coast of Louisiana, Mississippi, and Alabama up through Canada. During early spring and late fall, many bird species migrate between wintering grounds and summer nesting grounds along this Flyway.

Currently, in the area north of the Missouri River very little natural habitat remains with a small percentage of land covered by forests and native grasslands. A large percent is cropland with approximately 20 percent pasture or hay lands. Some species of grassland birds will nest in cropland, grass waterways, pastures, hayfields, and roadsides adjacent to agricultural lands. However, species diversity in these altered habitats typically is very low, and reproductive success appears to fall far below that necessary to maintain stable populations (MDC and USDA Forest Service 2010).

Remaining forest, woodland, and savanna communities provide nesting, cover, and foraging sites for a variety of wildlife from amphibians and reptiles, birds, and small mammals to large mammal species. Riparian forest cover is also important to fishes and other aquatic organisms while ephemeral pools in forest and woodland are important breeding sites for amphibians.

Native prairies are important habitats in Missouri, although few remain. Fewer than 90,000 acres of native prairie still exist in Missouri today and only approximately 25,000 acres are protected by either state or private entities. Prairies are important areas of biodiversity and more than 800 different species of plants can be found on Missouri prairies (Missouri Prairie Foundation 2014). Numerous bird species also use prairies for summer breeding habitat and migration layovers, while fewer use these areas for overwintering. Additionally, up to 3,000 insect species can occur on high quality prairie remnants (Nelson 2005).

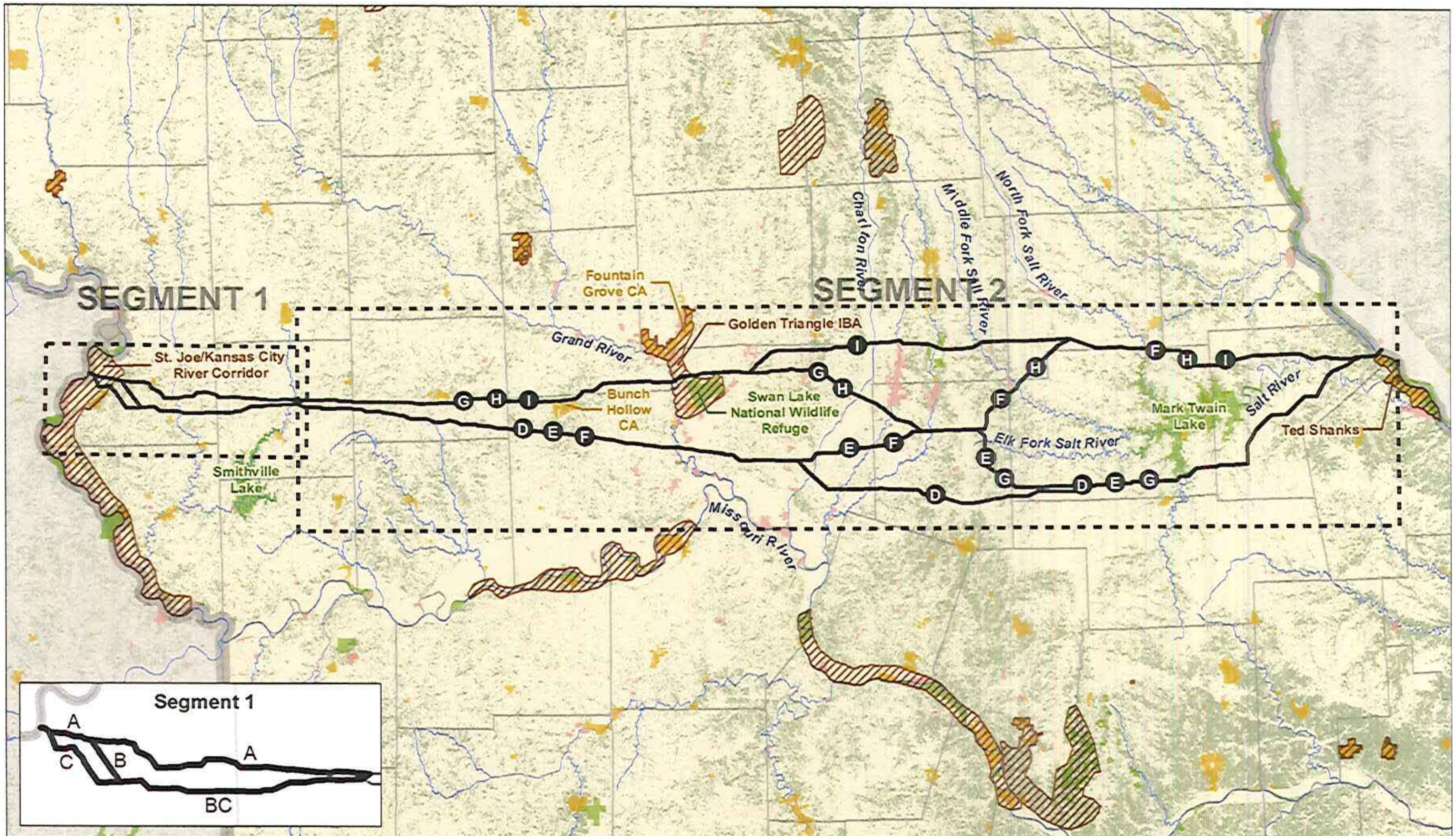
Conservation Lands

Conservation lands in Missouri primarily include lands in the NRCS WRP, lands in the U.S. Department of Agriculture's (USDA) Conservation Reserve Program (CRP), and lands in MDC's conservation areas. The NRCS WRP is a voluntary program that allows landowners to protect wetlands on their property under conservation easements. These easements are federal easements that can either be permanent or implemented in 30 year terms (USDA NRCS 2013). The CRP program is also a voluntary program where areas are planted with native plants to provide soil stability, water conservation, and wildlife habitat. Incentives to landowners include compensation for the acreage enrolled in the CRP program (USDA CRP 2013). MDC administers 995,628 acres of Conservation Area lands located throughout the state, some of which is leased, but the majority is owned in fee.

The Swan Lake National Wildlife Refuge, administered by USFWS, is located in north-central Missouri in Chariton County, in the floodplain of the Grand River near its confluence with the Missouri River. The primary purpose of the refuge is to provide nesting, resting, and feeding areas for waterfowl (including the Eastern Prairie population of Canada geese). The refuge is considered a primary wintering area for Canada geese and is also part of an Audubon Important Bird Area (**Figure 5-2**). The purpose of Swan Lake National Wildlife Refuge is: 1) to act as a refuge and breeding ground for migratory birds and other wildlife; 2) for use as an inviolate sanctuary, or for any other management purpose, for migratory birds; and 3) to carry out the national migratory bird management program (USFWS 2013a). In addition to waterfowl habitat, the refuge provides habitat for resident wildlife, protects endangered and threatened species, and provides wading bird and shorebird habitat. The refuge receives more than 30,000 shorebirds annually and up to 100,000 ducks during the fall migration.

The Nature Conservancy designs conservation plans on an ecoregional basis and maintains portfolios of sites within an ecoregion that would collectively conserve the native species and community types found in that ecoregion. These portfolios are intended to provide a framework for The Nature Conservancy and its partners to make decisions regarding conservation actions on a site by site basis. The Central Tallgrass Prairie ecoregional portfolio includes Swan Lake as one of its conservation areas designated for landscape restoration. The area includes lands in the vicinity of the Grand River and Locust Creek. The area has six significant bodies of water including Swan Lake and Silver Lake (The Nature Conservancy 2000 2008).

The Lower Grand River Conservation Opportunity Area includes Swan Lake National Wildlife Refuge, Pershing State Park, Fountain Grove Conservation Area, and Yellow Creek Conservation Area as core managed areas. Conservation Opportunity Areas are priority sites for implementing conservation actions and comprehensive wildlife conservation by MDC and its partners (MDC 2005). Pershing State Park and Fountain Grove Conservation Area are north of the Swan Lake National Wildlife Refuge, and Yellow Creek is located to the southwest. MDC owns and manages these areas.



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 I

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.

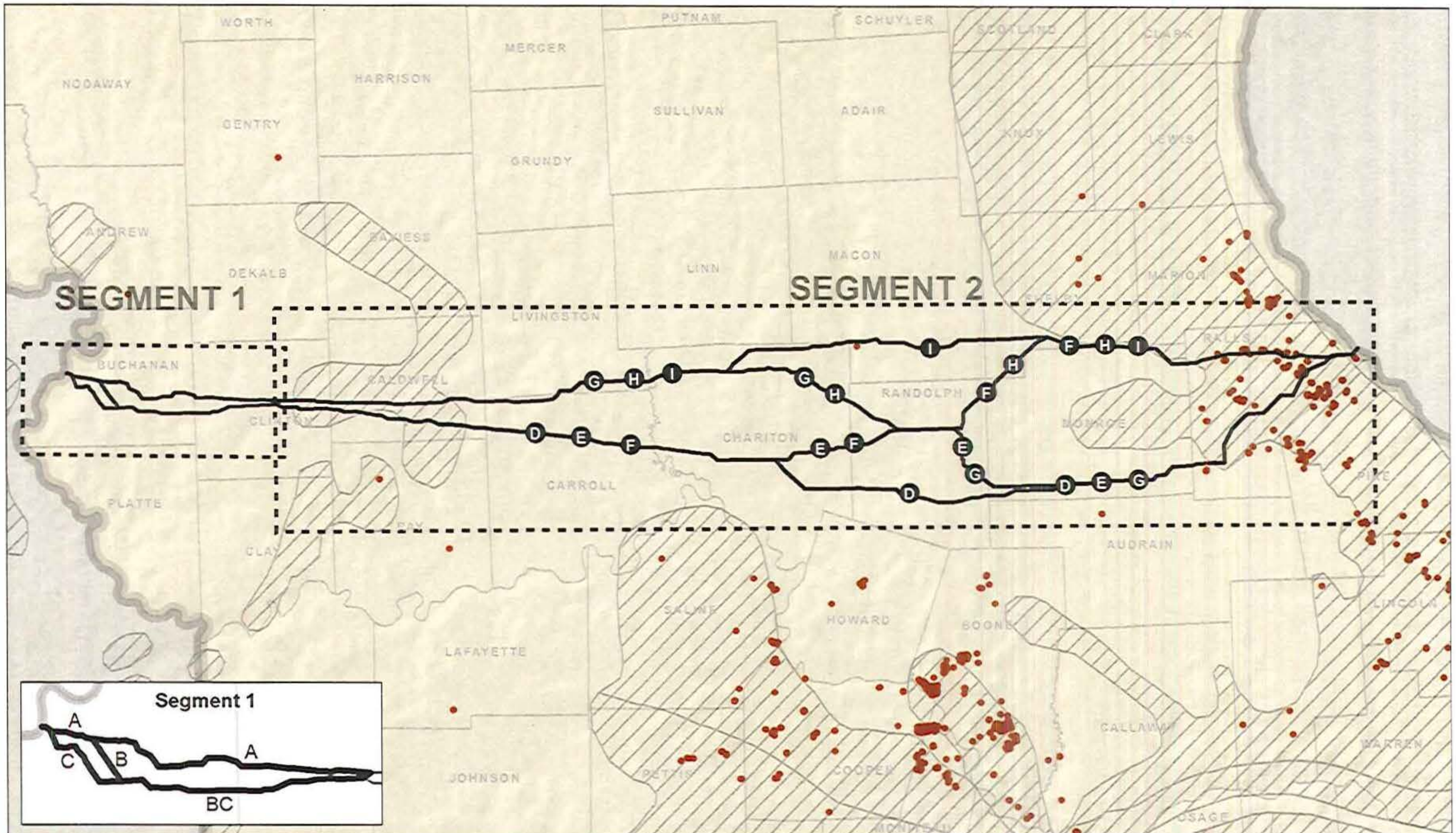
Table 5-7. Potential Habitat of the Indiana and Northern Long-eared Bat with in Segment 2						
Category	Alternative Routes					
	D	E	F	G	H	I
Forested Areas within the ROW (acres)	759	813	937	932	1,056	1,054

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).



- Alternative Routes
- Sinkhole Location
- Karst

Figure 5-3
Karst Topography

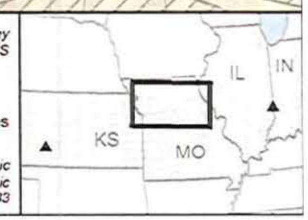
GRAIN BELT EXPRESS
CLEAN LINE

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



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 I

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.

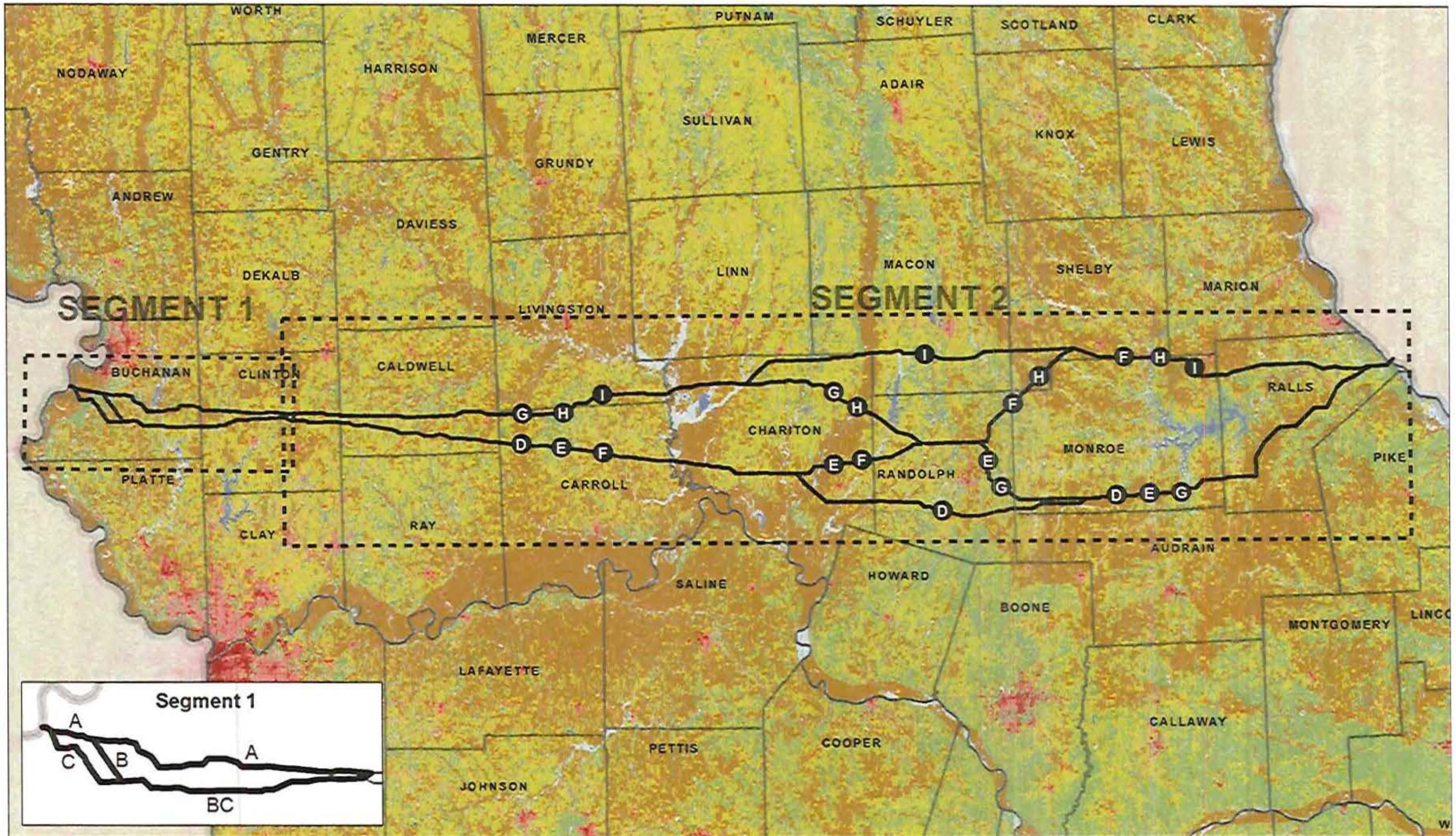
Table 5-10. ROW Parallel in Segment 2

	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.



- 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

IL IN KS MO

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 I 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.

Characteristic View of the Project Area Landscape (Oblique Aerial taken from Helicopter)

Linear infrastructure prevalent in Segments 1 and 2 consists of transmission lines, roadways, oil and gas pipelines, and other utility corridors that contribute visible human-made elements to the predominantly agricultural landscape. These industrial elements can be found throughout the Study Area but do not tend to dominate the landscape.

Typical Landscape in Segment 1: Oil and Gas Pipeline amid Existing Agricultural Land Uses

Typical Landscape in Segment 2: Linear Infrastructure amid Existing Agricultural Land Uses

Although the majority of the Study Area is composed of low intensity development characterized by agricultural land uses, moderate urban development also exists. Several small towns occur along major roadways. These industrial centers are more populated and more frequent at the eastern and westernmost extent of the Study Area.

Viewer/User Groups

Many factors influence the visual impact of any Alternative Route. The viewer is one of these factors. A viewer is defined as not only the person who is viewing the transmission line but also as the person's expectations, activities, and frequency of viewing the line (USDA Forest Service 1995). Three types of viewers were identified in the Study Area:

- Local Residents—Local residents are those people who live in the area of the proposed transmission line. Residents may view the line from their yards or homes, while driving on local roads, farming, or during other activities in their daily lives. The sensitivity of local residents to the visual impact of the line may be mitigated over time by frequent exposure to existing transmission lines and other dissonant features already within the viewshed.
- Commuters and Travelers—Commuters and travelers are people who travel by the transmission line on their way to other destinations. Typically, drivers have limited views of the transmission line where vegetation or buildings provide screening and where the line crosses high above the road surface. Under these conditions, the visual perception of the line for commuters and travelers is anticipated to be relatively low because they are typically moving and have a relatively short duration of visual exposure

to the line. When new visual features persist in the immediate vicinity or directly parallel to the road over long distances, longer visual exposure can be expected.

- Recreational Users—Recreational users include primarily local residents involved in recreational activities, such as wildlife viewing and hunting at Swan Lake National Wildlife Refuge and in Mark Twain National Forest, sightseeing along the Great River Road Scenic Byway, fishing and boating on USACE reservoirs, and engaging in other recreational uses at state conservation areas. These areas are described in greater detail in **Table 5-17**. For some recreational users, scenery may be an important part of their experience because their activities may include attentiveness to views of the landscape for long periods. Such viewers also may have a high appreciation for visual quality and high sensitivity to visual change.

Scenic Integrity and Visual Absorption

Scenic integrity is the degree by which the landscape character deviates from a natural or naturally appearing landscape in line, form, color, and texture of the landscape. In general, natural and naturally appearing landscapes have the greatest scenic integrity. As human-made incongruities are added to the landscape, scenic integrity diminishes.

Additionally, some landscapes have a greater ability to absorb alterations with limited reduction in scenic integrity. Character and complexity, as well as environmental factors, influence the ability of a landscape to absorb changes. A new transmission line sited next to an existing transmission line provides less contrast and, therefore, can be absorbed into that landscape more readily than a transmission line introduced as a new feature into a previously undeveloped area. Scenic integrity refers to the degree of intactness and wholeness of the landscape character. New transmission and substation facilities are more likely to "blend-in" with surroundings near pre-existing facilities and would be an additive feature to the landscape, instead of a new feature.

Visually Sensitive Features and Recreational Resources within the Segments

Recreational areas are found throughout the Project area and vary from conservation areas to state parks and reservoirs. Table **5-17** details the recreational areas that are located in the vicinity and potentially visible from the Alternative Routes. Recreational areas are organized and described from west to east.

Table 5-17. Visually Sensitive Features and Recreational Resources			
Recreational Resource	**Size**	**Major Recreational Activities**	**Proximity to Alternative Routes**
Segment 1			
Jentell Brees Boat Ramp	42.8 acres	Boat access to the Missouri River	650 feet from Alternative Routes A, B, and C.
Bluffwoods Conservation Area	2,097 acres	Wildlife viewing, camping, and hunting	0.75 mile from Alternative Route C
Pidgeon Hill Conservation Area	396 acres	Wildlife viewing, hiking, and hunting	Adjacent to Alternative Route A
Belcher Branch Lake Conservation Area	372 acres	Boating, fishing, wildlife viewing, and hunting	0.7 mile from Alternative Routes B and C
Agency Conservation Area	94 acres	Fishing, camping, and wildlife viewing	350 feet from Alternative Route A
Hartwell Conservation Area	112 acres	Fishing, camping, and wildlife viewing	0.4 mile from Alternative Routes B and C.
Smithville Reservoir	18,391 acres	Boating, fishing, camping, hiking, birding, swimming, water skiing, biking, horseback riding, golfing, accessing the beach, and hunting	3.5 miles from Alternative Routes B and C
Segment 2			
Bonanza Conservation Area	1,503 acres	Bicycling, bird watching, camping, fishing, boating, horseback riding, and hunting	0.5 mile from Alternative Routes G, H, and I
Bunch Hollow Conservation Area	3,060 acres	Wildlife viewing, camping, hunting, fishing, and boating	0.5 mile from Alternative Routes G, H, and I

Table 5-17. Visually Sensitive Features and Recreational Resources			
Recreational Resource	**Size**	**Major Recreational Activities**	**Proximity to Alternative Routes**
Swan Lake National Wildlife Refuge	10,397 acres	Environmental education, fishing, hunting, interpretation, photography, wildlife viewing	0.5 mile from Alternative Routes G, H, and I
Salisbury Municipal Golf Course	190 acres	Golf	Approximately 100 feet from Alternative Route D
Mussel Fork Conservation Area	2,277 acres	Wildlife viewing, camping, hiking, hunting, fishing, and boating	1.7 miles from Alternative Route I
Thomas Hill Reservoir	9,119 acres	Wildlife viewing, camping, hunting, fishing, and boating	0.6 mile from Alternative Routes G and H; 0.2 mile from Alternative Route I
Helen K. Wiese Conservation Area	100 acres	Canoeing, fishing, and wildlife viewing	1.5 miles from Alternative Routes D, E, and F
Mark Twain Lake and State Park	50,192 acres (reservoir) 1,180 (state park)	32 recreation areas offering: camping; boating; fishing; swimming; hiking; and wildlife viewing	0.7 to 8.5 miles from Alternative Routes F and H; 0.1 to 4.4 miles from Alternative Routes D, E, and G

General Impacts

As described in Section 1.4, *Project Description*, a combination of lattice and monopole structures may be used for the Project. Visually, lattice structures blend into the background, especially from the middle and bac -ground distances. The lattice design allows the natural colors of the surrounding backdrop to be seen, dissipating the visual intrusion of the transmission line. Monopole structures tend to stand out more on the landscape, compared with lattice structures, and there are typically more monopole structures per mile than lattice structures. In areas where long vistas are possible, the use of monopole structures could lead to greater visible impacts, particularly in areas where a transmission line parallels a roadway.

Generally, short-term effects of transmission line construction could potentially impact public and private facilities. Construction could potentially negatively affect access to recreational areas by temporarily: 1) blocking access roads, trails, or other facility entrances; 2) closing roads during specific construction activities; 3) disrupting traffic; and 4) creating detours, possibly making access more difficult. Construction could also temporarily impact the rural setting and the scenic integrity of the area due to increased construction-related traffic, noise, dust, brightly colored signage, and the number of people coming to the area. Large cranes and/or helicopters are typically used during the construction of transmission lines, creating an increased temporary disturbance in the visual, aesthetic, and peaceful nature of some areas.

Alternative Route Comparison

Impacts to recreation and visual resources would occur from the visual contrast created by line placement within previously undisturbed landscapes near publicly accessible recreational areas with high scenic integrity. Overall, areas with greater visual impacts include places where the Alternative Routes do not parallel existing transmission lines or roadways in developed areas. Whenever practical, parcel boundaries were selected for siting the line in areas where existing transmission lines were not available or where parcel boundaries were deemed more favorable. The Routing Team sought to align the routes along half section lines, shifting farther from roadways and other areas of high visibility.

Segment I

The entire length of Segment I is located within 25 miles of the urbanized area of St. Joseph. The main recreational resources in the vicinity of Segment I include Bluffwoods Conservation Area, Pigeon Hill Conservation Area, Belcher Branch Lake Conservation Area, and Smithville Reservoir (**Figure 5-5**). None of the Alternative Routes cross these resources; however, Alternative Route A is in close proximity to both Pidgeon Hill and Agency State Conservation Areas.

Beginning within the Missouri River floodplain, the Alternative Routes pass through a primarily agricultural landscape characterized by scattered development, including roadways and residential areas. The towns of Agency, Faucet, and Gower are the nearest communities to the Alternative Routes. Stands of forest occur throughout the landscape beyond the floodplain, which is also transected by various roads, utility pipelines, and transmission lines. The presence of infrastructure and associated urbanization throughout the area results in relatively low scenic integrity. Alternative Routes A and B generally parallel the path of Rockies Express/Keystone Pipelines for approximately 5 miles before diverging at Contrary Creek.

Where Alternative Routes A, B, and C cross Highway 371 and Interstate 29, the line will be visible to local residents traveling these roadways. Views would not be available in instances where Alternative Routes are shielded by the presence of vegetation and topography. Alternative Routes in Segment I are not anticipated to be highly visible from Smithville Reservoir because of the distance from all Alternative Routes (more than 3 miles). Alternative Route C may potentially be visible to the north of the Bluffwoods Conservation Area, and

Alternative Route A may be visible south of the Pigeon Hill Conservation Area and from the Agency Conservation Area. However, the presence of rolling topography and linear infrastructure, such as roadways and existing transmission lines, would minimize the impacts to these areas created by the Alternative Routes in Segment I. Distant views of Alternative Routes B and C, which would be located 2 miles north of Belcher Branch Lake Conservation Area, may be available.

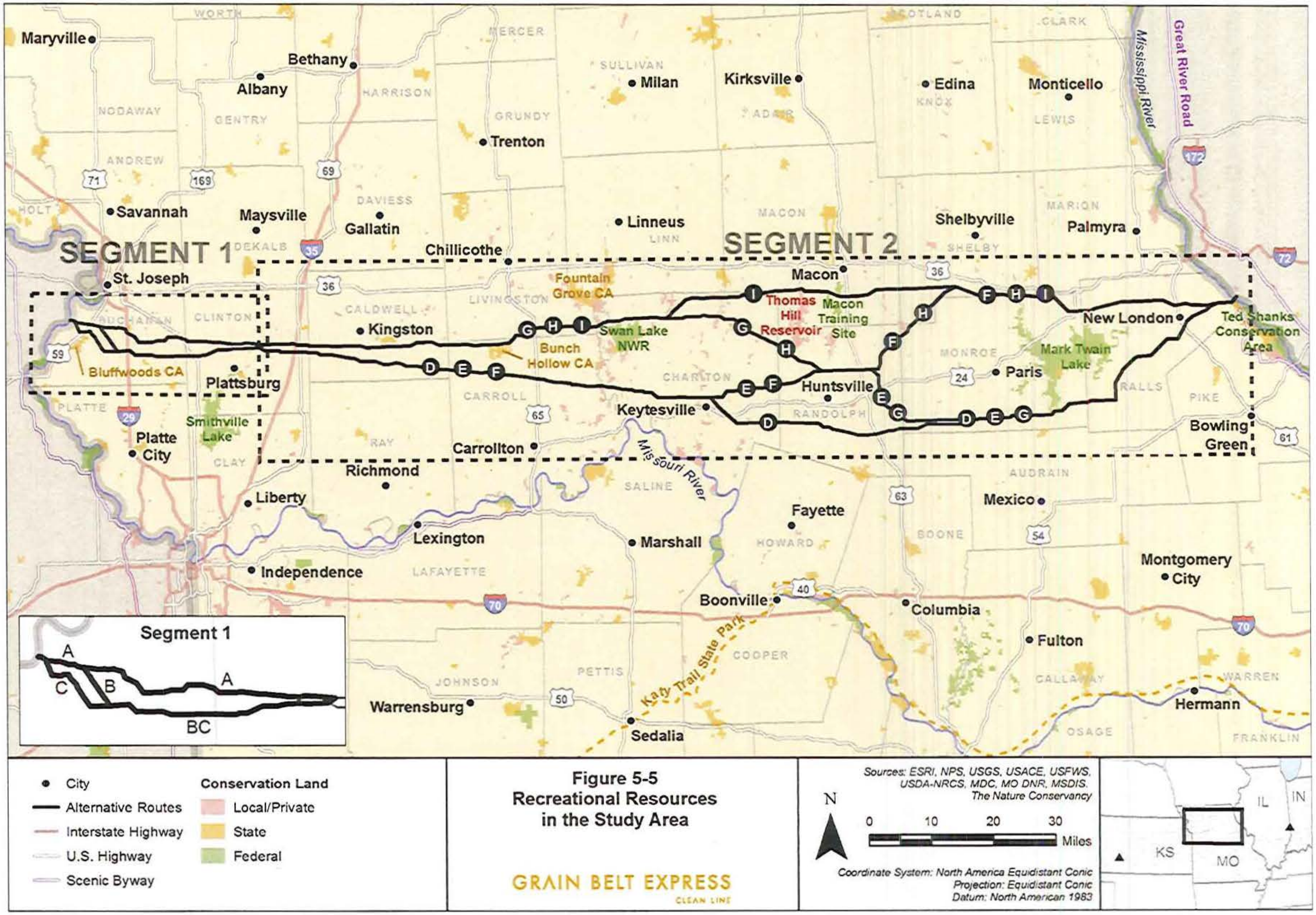


Figure 5-5
Recreational Resources in the Study Area

Segment 2

The main recreational resources within Segment 2 include Bonanza and Bunch Hollow Conservation Areas, Swan Lake National Wildlife Refuge, Mussel Fork Conservation Area, Mark Twain Reservoirs, and Mark Twain State Park (**Figure 5-5**).

Alternative Routes D, E, and F begin southeast of the town of Turney and cross Interstate 35 where they generally parallel the Rockies Express/Keystone Pipelines for approximately 78 miles before they diverge just north of Keytesville near State Route 5. The majority of this portion of Segment 2 is composed of agricultural land with scattered residences in a gently rolling landscape. Alternative Routes D, E, or F would not represent a substantial change from the character of the existing landscape, which has already been modified by the presence of existing linear infrastructure in the form of roads, overhead utility lines, and pipelines.

Generally, Alternative Routes G, H, and I are closer to major recreational facilities in the area, increasing the potential visibility to viewers. Beginning southeast of Turney, the routes cross Interstate 35 and several existing transmission lines as they continue eastward toward State Highway 65. Paralleling existing transmission lines typically reduces visual impacts due to the previous visual disturbance. Along this portion of Segment 2, the line may be visible to some recreational visitors at Bonanza and Bunch Hollow Conservation Areas, which are 0.5 and 0.2 mile north and south of the line, respectively. Visitors at Swan Lake National Wildlife Refuge will also likely have views of Alternative Routes G, H, and I to the north of the refuge.

Near Rothville, Alternative Route I departs from G and H and continues northeast to parallel an existing transmission line for approximately 10 miles as it passes roughly 1.7 miles south of the Mussel Fork Conservation Area. Alternative Route I then continues east and passes within 0.2 mile of the northernmost extent of Thomas Hill Reservoir. Alternative Routes G and H pass within 0.6 mile of the southernmost extent of the reservoir, paralleling the path of an existing transmission line. The landscape in this area of Segment 2 is characterized by mature forest and gently rolling topography. Although portions of the line may be visible to visitors within Mussel Fork Conservation Area and Thomas Hill Reservoir, impacts to recreational resources are not anticipated. Views of the line would be intermittent and not detract from the scenic integrity of the area. Moreover, the addition of transmission lines within areas already characterized by infrastructure would not represent a substantial departure from the existing visual character of the area.

Segment 2 passes to the north and south of Mark Twain Lake, the southern portion of which is located as close as 0.1 mile from Alternative Routes D, E, and G. Mark Twain State Park is located within the area designated for the lake and is more than 4.5 miles from any of the Alternative Routes. The distance on either end of the lake, as well as existing topography and vegetation immediately adjacent to the lake, would likely limit views of any Alternative Routes at this location; therefore, impacts to the recreational resources are not anticipated. Agricultural lands typifying the area surrounding the lake are characterized by open fields and patches of forest with interspersed residential and agricultural land uses. Topography surrounding the lake can be characterized as flat to gently undulating, allowing for some distant views across the landscape.

Typical Agricultural Landscape Southeast of Mark Twain Lake

South of Mark Twain Lake, visible features of the transmission line associated with Alternative Routes D, E, and G would be introduced into an agricultural and forested area and may create new visual disturbances in the area. Steel structures and lines will be visible to residents and motorists travelling along local roadways, however, forest cover throughout much of the area would provide some degree of natural shielding from public vantage points. Recreational uses at the reservoir would be unaffected because of existing forest cover and topography, which would limit views from the reservoir. As a result, impacts associated with recreational uses of the reservior are not anticipated.

5.2.5 Cultural Resources

Archaeological Resources

The Routing Team reviewed the Missouri Cultural Resource Inventory, maintained by the Missouri SHPO, for archaeological sites, architectural resources, and historic properties listed on the National Register. Prehistoric development within Missouri was heavily influenced by the variation in the natural environments across the state and by the presence of the Mississippi and the Missouri rivers and their associated valleys. Archaeologists have divided the history of human occupation of Missouri into five major periods: Paleoindian Period (circa 12,000 to 8,000 years Before Christ (B.C.); Dalton Period (circa 8,000 to 7,000 years B.C.); Archaic Period (circa 7,000 to 600 B.C.); Woodland Period (circa 600 B.C. to 900 Anno Domini [A.D.]); and Mississippian Period (circa 900 A.D. to post-1700 A.D.)

Evidence of the Paleoindian occupation of Missouri has been confined to isolated fluted projectile point finds generally along major watercourses and interfluvial divides. The Dalton Period coincides with a climactic shift to warmer, drier weather. Coincident with the weather changes, the prehistoric inhabitants of Missouri developed a greater diversity of stone tools suggesting adaptation to a more diverse environment with a variety of natural resources. The Archaic Period is marked by continued technological developments reflecting an increasing reliance on a range of faunal and floral resources. By the latter part of the Archaic Period, the percentage of ground stone tools used within sites had increased, and prehistoric ceramics began to appear.

The Woodland Period within Missouri is marked by an increasing reliance on domesticated plants as a resource, the increasing use and production of ceramic vessels, and the introduction of a complex burial process including the creation of corporate burial grounds and earthen mounds. Trade became increasingly important during the Woodland Period with trade goods featuring prominently in the elaborate burials associated with the Middle Woodland period. These burials are typically referred to as Hopewellian after the Hopewell site in Ohio. The Late Woodland Period experienced a retraction in interregional trade, a diminishment of the elaborate mortuary rituals, and a simplification of ceramic design and motifs.

The Mississippian Period constitutes the most complex period of cultural development within the prehistory of the midwestern United States. This period witnessed the development of ranked societies, an increasing reliance on maize agriculture, the construction of platform and burial mounds, and a revival in long-distance trade. Fortified town and temple complexes dating to this period have been identified in the Mississippi and Missouri River valleys. Initial European contact with the indigenous inhabitants of the Midwest occurs during the Mississippian Period. The Proto-historic tribal affiliations of these groups include the Oneota, Kansa, Missouri, Osage, Sac, and Fox tribes.

By the early nineteenth century, the native population within Missouri had significantly declined. Coincident with the declining indigenous population, a large influx of Euro-American settlers began moving west, following major waterways and intent on cultivating the newly acquired Missouri territory. Eventually these settlers spread across the state, and by the mid-nineteenth century the economy of the state was characterized by farming and industrial centers of commerce and trade. These communities flourished, creating many of the successful urban centers of industry that continue to shape and define Missouri. Archaeological excavations in many of these city centers and surrounding rural landscapes document the history of urban and rural immigrant communities and the development of an industrial society.

Two archaeological sites have been previously identified within the ROW of the Alternative Routes in Segment 1 of the Project. These sites consist of a Middle Woodland Period habitation site and a Woodland Period habitation site. Approximately 10 previously identified archaeological sites have been identified within 1,000 feet of Segment 1. These sites are predominantly prehistoric habitation or lithic scatter sites. Two previously identified prehistoric sites within Segment 1 also consist of mound/cairn sites. Such sites are generally associated with the Early to Middle Woodland periods. The previously identified prehistoric sites suggest that Segment 1 may be particularly sensitive for Woodland Period archaeological sites, including burial mounds. Historic archaeological sites that have been identified within the vicinity of Segment 1 consist of Antebellum Period commercial/industrial sites and Early Industrial Period habitation sites.

A total of 12 archaeological sites have been previously identified within the ROW of the Alternative Routes in Segment 2 of the Project. These sites consist predominantly of historic period sites, undateable habitations sites, or habitations sites dating to the Early Industrial or Antebellum periods. One Paleo-Indian site has been identified within Segment 2. Approximately 72 archaeological sites have been identified within 1,000 feet of Segment 2. These sites consist of a nearly equivalent number of prehistoric, historic, and unknown archaeological sites. The prehistoric sites consist of habitation sites, lithic scatters, two cemeteries, and two cairn/mound sites. The majority of the prehistoric sites could not be identified with a period of occupation. The proximity of the Missouri River to portions of Segment 2 suggests the potential for Paleo-Indian deposits. Paleo-Indian sites have been associated with major river valleys in Missouri, including the Missouri and Mississippi rivers. In addition, Early to Middle Woodland Period sites, including burial mound sites, have been identified in the Salt and Chariton drainage basins. The portions of Segment 2 that extend through these drainage basins, particularly within Chariton, Randolph, and Monroe counties, are considered particularly sensitive for prehistoric deposits associated with the Early to Middle Woodland periods. The historic archaeological sites identified within the vicinity of Segment 2 consist of Early Industrial and Antebellum Period habitation and commercial/industrial sites.

Architectural Resources

Segment 1 of the Project running through Buchanan County and the west half of Clinton County has few known architectural resources (**Figure 5-6**). Scattered rural farmsteads are the primary architectural resources identified. The farmsteads generally appear to have frame barns and residences or other workshops that have been altered with modern materials.

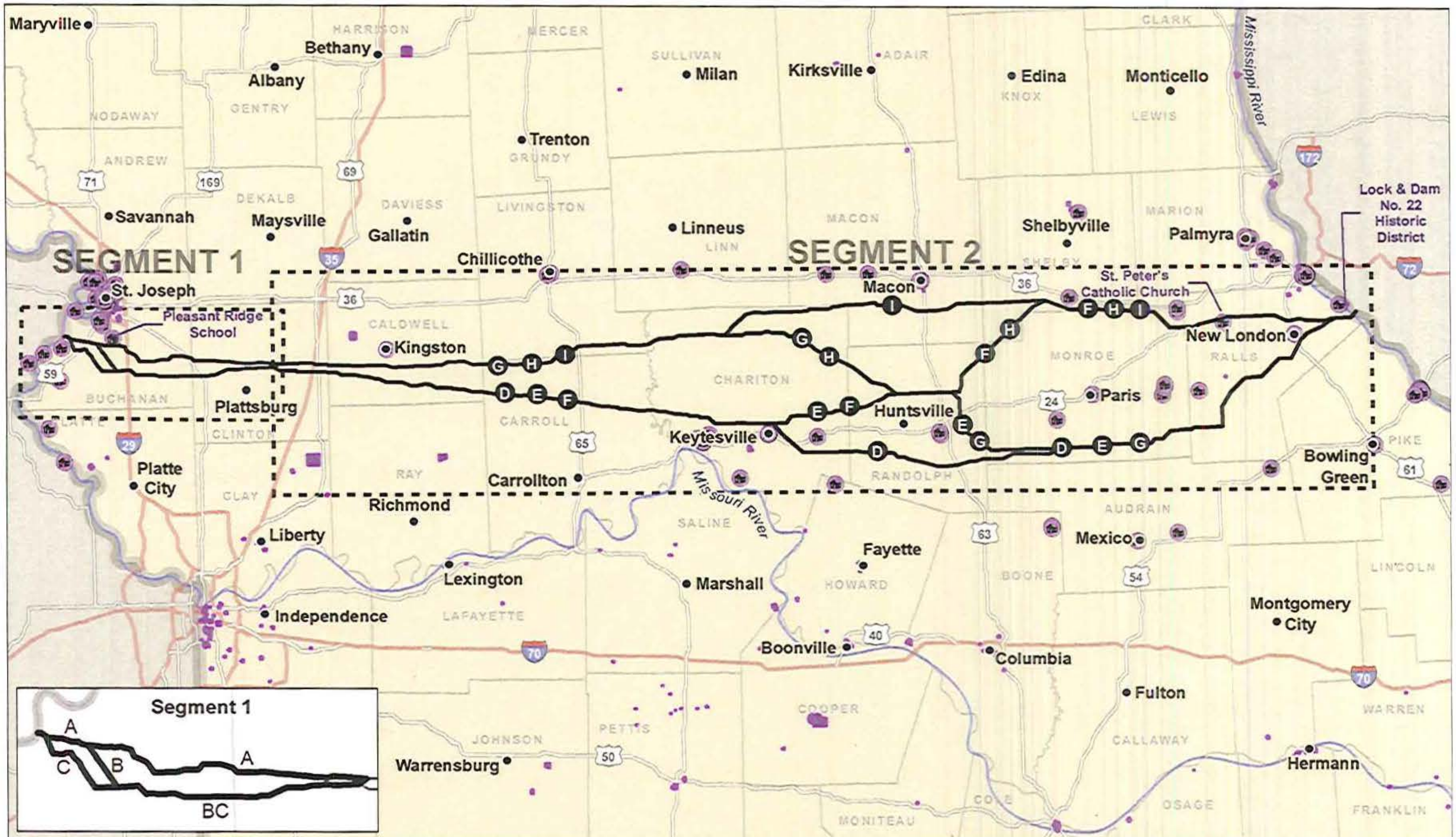
Towns located within or near Segment 1 include St. Joseph, Plattsburg, Agency, Faucett, Turney, and Gower.

Segment 2 consists of the east half of Clinton, Caldwell, Carroll, Livingston, Chariton, Macon, Randolph, Shelby, Monroe, and Ralls counties (**Figure 5-6**). These counties are likely to include rural farmsteads, residences, commercial buildings, cemeteries, churches, bridges, and schools. All of the counties are part of a 13 to 17 county area known as Little Dixie. Settlers in this area came from the upper south states of Kentucky, Virginia, and Tennessee in addition to immigrants from Germany. There is a strong antebellum influence in the folk architecture of these counties. The principal architectural types that dominate the recorded architectural resources in Chariton County are frame single-pen, double-pen hall-and parlor, central-hall, and I-houses. Schools and churches in some areas are constructed of brick and are generally two stories high. A couple of significant concrete form block houses are located within Chariton County. These structures in the Study Area tend to be in various states of disrepair or ruin. The farmsteads within the Study Area also follow folk types and styles. Numerous Civil War skirmish sites are documented throughout central Missouri. No known sites are located in the Study Area, but there could be undocumented sites and/or cemeteries. The towns located near or within Segment 2 are discussed in **Table 5-15**. The hamlet of Wein, in Chariton County, could be eligible as a rural historic district.

General Impacts and Mitigation

Transmission lines tend not to have significant indirect impacts on archaeological resources, which are usually located entirely below the ground surface. However, some sites have surface expression, such as burial mounds, effigies and intaglios, stone circles or alignments, foundations and walls, and cemeteries. The new transmission structures might detract from the setting or feeling of a site, particularly if the significance of the site relates in part to a sense of wildness, openness, primitiveness, or sacredness. Whenever possible, adverse impacts on identified sites would be avoided by strategically locating access roads, staging areas, and structures.

Impacts on archaeological properties may be physical and/or visual, depending on the type of site. Visual impacts, such as those described for architectural historic properties, can occur where the physical setting, location, or feeling contributes to the significance of the resource. Frontier military posts or homesteads, battlefields, historic trails, cemeteries, burial mounds, or landforms that are identified as sacred places are some examples. Adverse physical impacts can include ground disturbance by excavation to construct transmission line support structures and



City	National Register of Historic Places Site
Alternative Routes	National Register of Historic Places District
Interstate Highway	
U.S. Highway	

Figure 5-6
Architectural Historic Properties in the Study Area

GRAIN BELT EXPRESS
CLEAN LINE

Sources: ESRI, NPS, MO DNR, MO SHPO, MSDIS.

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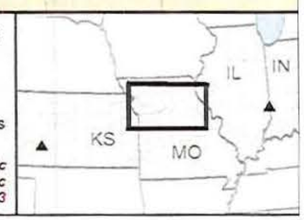
0 10 20 30 Miles

Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983



substations, compression and/or rutting by heavy machinery, grading/constructing access roads, pulling stumps, material storage, or surface collection of artifacts by construction crew persons.

Impacts on architectural historic properties would be primarily visual, created by the construction of new structures where none exist, the addition of a second transmission line next to an existing transmission line corridor (generally a lesser impact), and clearing of forested land. Impacts would vary based on local relief, height of existing vegetation, and any intervening recent development. Any physical impacts on architectural historic properties would be avoided, where possible, by strategically locating access roads, staging areas, and structures.

Alternative Route Comparison

A review of archaeological resources from the Missouri SHPO identified several recorded archaeological sites along the Project ROW, including all of the Alternative Routes (MSHPO 2013). Generally, archaeological resources are only a concern when located within the ROW and can usually be spanned or avoided, eliminating any impacts.

A review of the National Register from the Missouri National Register files was completed for each segment. Spatial information was collected on all previously identified architectural and archaeological resources within 0.25, 0.5, and 1 mile of each Alternative Route. A review of the National Register shapefiles from the Missouri SHPO identified three National Register-listed properties within 0.5 to 1 mile of the Alternative Routes.

Segment I

Alternative Routes A and B each have one archaeological resource within the ROW and several resources within 1,000 feet (see **Table 5-18**). Alternative Route C has the fewest resources within the ROW and within 1,000 feet. It should be noted that the Rockies Express/Keystone pipelines had an extensive archaeological survey completed as part of the environmental permitting required for those projects. Therefore, more resources may be associated with the pipeline parallel because the adjacent area was previously surveyed for cultural resources. Other areas of the state lack previous surveys, therefore, resources may still be present but have not been located. Alternative Route C does not parallel existing infrastructure and most likely lacks the same survey intensity that has been conducted along the pipeline.

Table 5-18. Archaeological Resources for Alternative Routes in Segment 1			
	A	B	C
Resources within the ROW[1]	1	1	-
Resources within 1,000 feet[2]	6	5	1

[1]The ROW is 100 feet on either side of centerline.

[2]Resources are measured from the centerline of the Alternative Routes.

The National Register-listed Pleasant Ridge School was identified approximately 1 mile from Alternative Route A. Alternative Routes B and C do not have any National Register-listed resources within 1 mile of the centerline.

Segment 2

A total of 12 archaeological resources are located within the ROW for Alternative Routes in Segment 2 (**Table 5-19**). Alternative Routes D and E have the greatest number of previously identified archaeological resources, with 12 and 11 archaeological resources, respectively. As noted for Segment 1, the Rockies Express/Keystone pipelines underwent extensive archaeological survey prior to their construction. Therefore, although it may appear that more resources are located along these Alternative Routes, it is likely a reflection of the extensive surveys completed for those projects.

Table 5-19. Archaeological Resources for Alternative Routes in Segment 2						
	D	E	F	G	H	I
Resources within the ROW[1]	12	11	8	4	1	2
Resources within 1,000 feet[2]	44	48	43	23	18	18

[1]The ROW is 100 feet on either side of centerline.

[2]Resources are measured from the centerline of the Alternative Routes.

Two National Register-listed sites are located within 1 mile of the Alternative Routes in Segment 2. The National Register-listed St. Peter's Catholic Church is approximately 3,000 feet from Alternative Routes F, H, and I. The Lock and Dam No. 22 Historic District is approximately 1.4 miles from all Alternative Routes and is also listed on the National Register.

5.3 Engineering

Converter Station

As discussed in Section 1.4.3, three converter stations would ultimately be constructed for the Project. The first converter station would take the power generated from the wind farms in southwest Kansas and convert it to DC electricity. The intermediate converter station would be located in Ralls County, Missouri, and would convert DC electricity back to AC for distribution in the electric grid. The final converter station would be located near the Sullivan Substation in Indiana and would also convert DC electricity back to AC for distribution in the electric grid.

The location of the intermediate converter station, which depends on the final alignment of the Proposed Route, would be near Ameren's Maywood-Montgomery 345 kV Line transmission line. This transmission line would connect the converter station to the surrounding grid. Grain Belt Express would work with landowners near the Proposed Route to determine a suitable location for the converter station. Several potential converter station locations were considered near the Alternative Routes in the vicinity of the Ameren transmission line. Ideal converter station locations include areas outside of floodplains and wetlands with relatively flat topography, close to major roads or highways and railroads, and sufficient enough space to accommodate the 40- to 60-acre site. The construction and maintenance of the converter station requires paved roads and railroads to move transformers and other heavy pieces of equipment.

Alternative Routes D, E, and G intersect the Maywood-Montgomery 345 kV transmission line at the same location. This area is flat and consists of agricultural fields. The town of Center is located approximately 1 mile east of the Maywood-Montgomery 345 kV transmission line. Despite the proximity to the town, few residences are located west of Center near the area of the existing transmission line, and parcel sizes in this area are generally large. State Highway 19 is parallel to the Alternative Routes and provides a suitable road for hauling heavy equipment. In addition, a railroad is located approximately 20 miles south of the intersection of the Alternative Routes and the existing transmission line, near the town of Bowling Green.

Alternative Routes F, H, and I all intersect the Maywood-Montgomery 345 kV transmission line at the same location. This area is generally characterized as moderately sloped with flat agricultural fields. Residential density in this area is low, but several residences are scattered throughout the area. There are also several large tracts of forest that are associated with drainages. Most roads in this area are gravel roads. State Highway H is the major paved road in the area and is located approximately 1mile east. A railroad is located approximately 2 miles north of the Alternative Routes, although the closest rail station may still be several miles further away in Monroe City, which is the closest town to the converter station area.

Both areas have suitable locations for the converter station. However, more potential sites are located near the Alternative Routes D, E, and G. The flat topography and nearby highway are both benefits to siting the converter station in this location, in addition to the larger parcel sizes, which are ideal for the 40- to 60-acre site.

5.3.1 Transportation

Local and county roads are the dominant mode of transportation throughout the Study Area; however, two interstates (Interstate 29 and Interstate 35) cross north-to-south through the Study Area. There are also numerous private and public airfields used for municipal, agricultural, and recreational activities. The Routing Team avoided crossing directly over all public and private airfields; however, all Alternative Routes do fall within an estimated obstruction zone. The estimated obstruction zones were calculated using the same requirements as the Federal Aviation Administration (FAA) approximated notification zone requirements (Code of Federal Regulations, Title 14, Part 77 Subpart B). Many of the larger towns and cities in the Study Area are connected by railroads, several of which are crossed by Alternative Routes in both segments.

General Impacts and Mitigation

Numerous U.S. highways, state highways, and county and local roads transect the Study Area. Highways and roadways can be spanned with the transmission line and impacts are generally minimal. During construction, it may be necessary to close portions of roads to allow the stringing of the conductor over the road. Coordination with the Missouri Department of Transportation would occur for all highway crossings associated with the Project. Similarly, the crossing of rail lines results in minimal impacts, although coordination with railway operators would be necessary during construction of the railway crossings.

Generalized notification zones for public and military airports and heliports are determined per FAA regulations (Code of Federal Regulations, Title 14, Part 77, Subpart B). The generalized zones are designed to identify potential flight obstructions and are based on the projected height of structures and the airport runway length. Impacts from structures located within a notification zone can be mitigated by lighting or marking the structure or by situating the new structure adjacent to an existing obstruction (such as an existing transmission line or tree line). Similar generalized notification zone buffers were considered around verified private airfields to avoid negatively impacting their operations, even though these regulations do not apply to private airfields.

Alternative Route Comparison

Segment 1

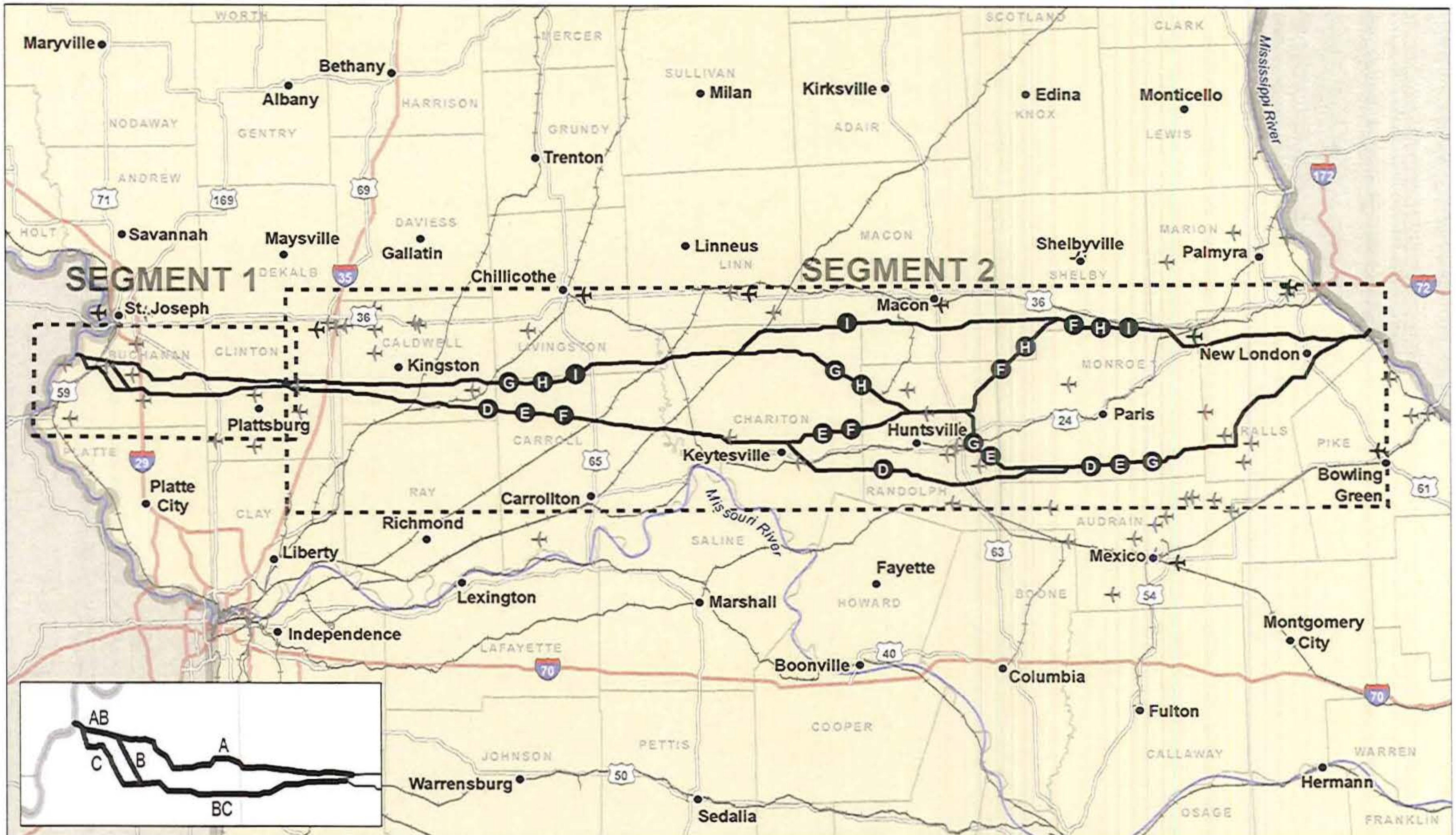
All of the Alternative Routes in Segment 1 cross Interstate 29, two U.S. highways, and two state highways (**Table 5-20**). U.S. highways crossed by all three of the Alternative Routes include Highways 169 and 59. State highways crossed by all three Alternative Routes include State Highways 33 and 371. All Alternative Routes cross the same number of railroads and U.S. and state highways. No impacts to transportation are expected from any of the Alternative Routes.

Table 5-20. Transportation Infrastructure Crossed by Alternative Routes in Segment I			
	A	**B**	**C**
Public airfields (miles of FAA Notification Zones crossed)	-	-	-
Private airfields (miles of estimated obstruction zone crossed)	3.5	5.9	4.8
Railroad crossings	1	1	1
Interstate crossings	1	1	1
U.S. highway crossings	2	2	2
State highway crossings	2	2	2

No public airfields are located in close proximity to any of the Alternative Routes in Segment I (**Figure 5-7**). All three Alternative Routes are within the estimated notification zone for private airfields, based on the notification zone as calculated by the runway length and the average height of structures (**Table 5-21**).

All three Alternative Routes are within the 15,000-foot estimated obstruction zone for the private Booze Island Airport. The Alternative Routes' crossing of the Missouri River is approximately 12,800 feet from the end of the unimproved runway surface. Any impacts from the Alternative Routes on the operation of Booze Island Airport would be assessed as part of the FAA Part 77 notification.

All three Alternative Routes are within the estimated 7,500-foot obstruction zone for a private landing strip. Alternative Routes A and B are approximately 3,100 feet from the northern end of the landing strip. After the aircraft are above the tree cover, which is approximately 100 feet from the northern end of the landing strip, impacts to the operation of the airfield from Alternative Routes A and B would not be anticipated. Alternative Route C is approximately 5,400 feet from the southern-most end of the landing strip, and at this distance, impacts to the operation of the airfield are not anticipated.



City	Public Airport		
Alternative Routes	Private Airport		
Interstate Highway	Railroad		
U.S. Highway	Major River		

Figure 5-7
Transportation Infrastructure in the Study Area

GRAIN BELT EXPRESS
CLEAN LINE

Sources: ESRI, NPS, USGS, USACE, USFWS, USDA-NRCS, MDC, MO DNR, MSDIS. The Nature Conservancy

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0 10 20 30 Miles

Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983

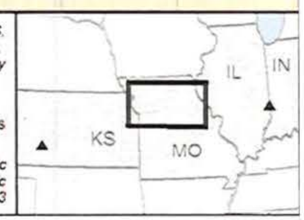

Table 5-21. Public and Private Airstrips in Segment I							
Alternative Route	**Airfield Name**	**Ownership**	**Runway Type**	**Runway Length (feet)**	**Distance from Alternative Route**	**Orientation of Runway**	**Orientation of Alternative Route from Runway**
A, B, C	Booze Island Airport	Private	Grass	3,260	12,840 feet from the northern end of the runway to Alternative Routes A, B, and C	NE–SW	Perpendicular
A, B, C	Unnamed	Private	Grass	1,470*	3,120 feet from the northern end of the runway to Alternative Routes A and B; 5,390 feet from the southern end of the runway to Alternative Route C	N–S	Perpendicular (A, B), Perpendicular (C)
B, C	Farris	Private	Paved	2,100	8,450 feet from the northern end of the runway to Alternative Routes B and C	N–S	Perpendicular (8,450 feet) Parallel (6,970 feet)

B, C	Plattsburg Airpark	Private	Paved (deteriorated)	2,100	4,730 feet from the northern end of the runway to Alternative Routes B and C	N–S	Perpendicular
A	Unnamed (Clinton County)	Private	Grass	1,650*	4,700 feet from the northwestern-most end of the runway to Alternative Route A	NW–SE	Perpendicular

*Runway information was not available from FAA and was measured using aerial imagery.

Alternative Routes B and C are within the estimated 7,500 foot obstruction zone for the private Farris Strip. While these routes are approximately 6,900 feet from the vicinity of the airfield (within the FAA notification zone), they are approximately 8,400 feet from the northern end of the runway. Due to the distance of the Alternative Routes to the end of the runway, impacts to the operation of the airfield are not anticipated. Interstate 29 and several residences are located between the runway and the Alternative Routes.

Alternative Routes B and C are within the estimated 7,500 foot obstruction zone for the private Plattsburg Airpark. The Alternative Routes are approximately 4,700 feet from the northern end of the unimproved landing strip. Any impacts from the Alternative Routes on the operation of Plattsburg Airpark would be assessed as part of the FAA Part 77 notification.

Alternative Route A crosses the estimated 7,500 foot obstruction zone for a private, unnamed landing strip on the far eastern edge of Segment 1. This unimproved landing strip is approximately 4,700 feet from the termination of Alternative Route A. This landing strip is not listed on the FAA's list of certified and non-certified private-use facilities.

Segment 2

All of the Alternative Routes in Segment 2 cross Interstate 35. **Table 5-22** lists the number of times U.S. highways and state highways are crossed by each Alternative Route.

Table 5-22. Transportation Infrastructure Crossed by Alternative Routes in Segment 2

	D	E	F	G	H	I
Public airfields (miles of FAA Notification Zones crossed)	-	4.3	6.9	4.3	6.9	6.2
Private airfields (miles of estimated obstruction zone crossed)	10.4	8.4	5.9	4.6	2.1	2.1
Railroad crossings	8	7	7	8	8	10
Interstate crossings	1	1	1	1	1	1
U.S. highway crossings	6	5	5	5	5	5
State highway crossings	12	11	10	10	9	9

Alternative Route D crosses the most U.S. and state highways (6 and 14 crossings, respectively), while Alternative Routes E, F, G, H, and I all cross five different U.S. highways. These remaining Alternative Routes do not cross any U.S. highway more than once. Alternative Routes H and I cross the fewest number of state highways.

There are few public airfields in proximity to any of the Alternative Routes (**Figure 5-7**). Alternative Route D is the only Alternative Route that does not cross the estimated FAA

Notification Zone of a public airfield (**Table 5-23**). Alternative Routes E, F, G, and H are within the estimated 15,000 foot FAA notification zone for Omar N. Bradley Airport in Moberly, MO. The Alternative Routes are approximately 18,150 feet and 12,400 feet from the northern and southern ends of the main runway, respectively, and approximately 13,400 feet from the eastern end of the second runway. Additionally, as these Alternative Routes traverse the notification zone, existing transmission lines are paralleled in an effort to minimize the impact to the airport's flight paths.

Alternative Routes E, F, G, H, and I are within the general 15,000 foot FAA notification zone for Captain Ben Smith Airfield (Monroe City Regional Airport). The Alternative Routes are approximately 13,500 feet from the westernmost end of the runway. Due to the distance of the Alternative Routes to the end of the runway, impacts to the operation of the airfield are not anticipated.

All Alternative Routes cross the estimated 7,500 foot estimated obstruction zone for a private, unnamed landing strip on the far western edge of Segment 2. This unimproved landing strip is approximately 3,200 feet from Alternative Routes G, H, and I. Alternative Routes D, E, and F are approximately 1,500 feet from the southernmost end of the landing strip. This landing strip is not listed on the FAA's list of certified and non-certified private-use facilities.

Alternative Routes D, E, and F cross the estimated 7,500 foot obstruction zone for the private landing strip, Shiloh Airpark. The far southernmost end of the landing strip is approximately 3,300 feet from the Alternative Routes. Because of the distance of the Alternative Routes from the runway and the preexisting tree cover on the runway approach, impacts to the operation of the airfield are not anticipated. This landing strip is not listed on the FAA's list of certified and non-certified private-use facilities.

Alternative Route D crosses the estimated 7,500 foot obstruction zone for an additional private, unnamed landing strip on the southern edge of the Study Area. The eastern edge of the landing strip is approximately 6,300 feet from Alternative Route D. Following the same trajectory towards Alternative Route D, aircraft operators would first encounter an existing 161 kV transmission line approximately 1,000 feet from the eastern edge of the landing strip. Because of the distance of the Alternative Route to the end of the runway and the proximity of the existing transmission line to the airfield, impacts to the operation of the airfield are not anticipated.

Alternative Routes D, E, and G cross the estimated 7,500 foot obstruction zone for a private, unnamed grass airfield in Monroe County. The Alternative Routes are approximately 3,100 feet from the southwestern end of the runway. This landing strip is not listed on the FAA's list of certified and non-certified private-use facilities.

Table 5-23. Public and Private Airports in Segment 2							
Alternative Route Affected	**Airfield Name**	**Ownership**	**Runway Type**	**Runway Length (feet)**	**Distance from Alternative Route**	**Orientation of Runway**	**Orientation of Alternative Route from Runway**
D, E, F, G, H, I	Unnamed (Clinton County)	Private	Grass	1,650*	3,220 feet from the northwestern end of the runway to Alternative Routes G, H, and I; 1,450 feet from the southern end of the runway to Alternative Routes D, E, and F	NW - SE	Perpendicular (GHI) Perpendicular (DEF)
D, E, F	Shiloh Airpark	Private	Grass	1,300*	3,290 feet from the southern end of the runway to Alternative Routes D, E, and F	N -S	Perpendicular (3,290 feet) Parallel (2,800 feet)
D	Unnamed (Salisbury, MO)	Private	Grass	2,050*	6,300 feet from the eastern end of the runway to Alternative Route D	E - W	Perpendicular
E, F, G, H	Omar N Bradley Airport	Public	(A) Paved (B) Paved	(A) 5,000 (B) 3,350	18,150 feet from the northwestern end of runway A to Alternative Routes E, F, G, and H; 12,470 feet from the southeastern end of	(A): NW - SE (B): NE - SW	Perpendicular (A) Perpendicular (B)

Table 5-23. Public and Private Airports in Segment 2							
Alternative Route Affected	**Airfield Name**	**Ownership**	**Runway Type**	**Runway Length (feet)**	**Distance from Alternative Route**	**Orientation of Runway**	**Orientation of Alternative Route from Runway**
					runway A to Alternative Routes E and G; 13,460 feet from the northeastern end of runway B to Alternative Routes E and G		
D, E, G	Unnamed (Monroe County)	Private	Grass	1,380*	3,150 feet from the southwestern end of the runway to Alternative Routes D, E, and G.	SW-NE	Perpendicular
F, H, I	Captain Ben Smith Airfield (Monroe City)	Public	Paved	3,515	13,460 feet from the western end of the runway to Alternative Routes F, H, and I; 7,430 feet from runway to parallel of Alternative Routes F, H, and I	E - W	Perpendicular (13,460 feet) Parallel (7,430 feet)

*Runway information was not available from the FAA and was measured using aerial imagery.

5.3.2 Other Existing Infrastructure

Cellular and Radio Towers

Cellular and radio towers exist throughout the Study Area. Although these structures have a relatively small base, many have guy wires that extend 150 feet or more from the base of the structure. To avoid interference with the maintenance and operation of these features, transmission lines typically avoid crossing over or under guy wires.

Alternatives Comparison

Segment 1

One cellular tower is located within 500 feet of Alternative Routes B and C. No impacts to the operations or maintenance of the cellular/radio tower are expected because the base of the guy wires is more than 200 feet from the centerline of the Alternative Routes.

Segment 2

See **Table 5-24** for the number of cellular/radio towers within 500 feet of the Alternative Routes in Segment II. As discussed in Segment 1, no impacts are expected to cellular towers from any of the Alternative Routes.

Table 5-24. Cellular/Radio Towers in Segment 2

	D	E	F	G	H	I
Cell/radio towers (within 500 feet)	3	3	2	2	1	-

5.3.3 Existing Utility Corridors

Efforts were made to have Alternative Routes parallel existing transmission lines or pipeline corridors where feasible. Paralleling existing infrastructure is generally considered an acceptable practice for siting new transmission lines. However, there are a few construction and engineering considerations to consider when paralleling existing infrastructure. Existing infrastructure paralleled throughout the Study Area includes:

- Nashua–Lake Road 161 kV transmission line
- Gower–Plattsburg 115 kV transmission line
- Northwest Missouri Electric Coop 69 kV transmission line
- Chillicothe–Thomas Hill 161 kV transmission line
- Kansas City Power & Light Co 161 kV transmission line

- Salisbury–Thomas Hill 161 kV transmission line
- Central Electric Power Coop 115 kV transmission line
- Ameren Missouri 69 kV transmission line
- Keystone Gas Pipeline
- Kinder Morgan Interstate Gas Transmission Pipeline
- Rockies Express Pipeline
- Platte Pipeline
- Transource Sibley- Nebraska City 345 kV transmission line (In-Service date 2017)

General Mitigation Measures

During construction, outages may be required when working near other transmission lines. Outages are often difficult to schedule due to peak use seasons (summer and winter) when utilities are unable to take lines out of service and could result in a longer construction time. In addition, there are areas where existing transmission lines would be crossed. The proposed line would be constructed over the top of existing transmission lines and require taller structures to provide for adequate clearance between the conductors.

Existing pipelines are similar to existing transmission lines in terms of ROWs. The utilities can abut ROWs but not overlap them. Subsurface surveying may be required to determine the exact location of the pipelines prior to construction. Steel plating or matting may also be required when crossing over the top of pipelines to protect them from large construction vehicles.

Alternative Comparison

Segment 1

The number of transmission and pipeline crossings for the Alternative Routes in Segment 1 is shown below in **Table 5-25**. All Alternative Routes cross the same number of <115 kV, 161 kV, and 345 kV transmission lines and cross pipeline corridors. Alternative Route C crosses the least number of pipelines and pipeline ROWs. The pipeline corridors would likely be able to be crossed by a single span at the crossing locations.

Table 5-25. Transmission and Pipeline Crossings for Alternative Routes in Segment 1			
Transmission Lines Crossed	**A**	**B**	**C**
<115 kV	3	3	3
161 kV	1	1	1
345 kV	2	2	2
Pipeline ROW crossings (approximate)	4	6	3
Pipelines crossed (approximate)	10	12	3
Total Crossings	10	12	9

Segment 2

Transmission and pipeline crossings for the Alternative Routes in Segment 2 are shown in **Table 5-26**. Alternative Route G has the most total transmission line crossings, 20 of which are of 69 kV and 115 kV transmission lines. Although engineering challenges still exist when crossing any transmission line, crossing lower voltage lines is typically less of a challenge. Alternative Route I has the fewest transmission line crossings overall, and it also crosses the fewest higher voltage transmission lines (345 kV). Overall, engineering challenges associated with any Alternative Routes would be comparable, given the tradeoffs in crossing lower and higher voltage transmission lines.

Table 5-26. Transmission and Pipeline Crossings for Alternative Routes in Segment 2						
Transmission Lines Crossed	**D**	**E**	**F**	**G**	**H**	**I**
<115 kV	11	16	11	20	15	10
161 kV	7	7	8	8	9	7
345 kV	3	3	3	3	3	2
Pipeline ROW crossings (approximate)	21	19	17	14	12	16
Pipelines crossed (approximate)	42	36	34	17	15	19
Total Crossings	42	45	39	45	39	35

6. Identification of the Proposed Route

6.1 Rationale for the Selection of the Proposed Route

As stated in the introductory chapters, the goal in selecting a suitable route for the Project is to minimize impacts on the natural, cultural, and human environment while avoiding circuitous routes, extreme costs, and non-standard design requirements. However, in practice, it is not usually possible to optimally minimize all potential impacts at all times. There are often inherent tradeoffs in potential impacts to every routing decision. For example, in heavily forested study areas, a route that avoids the most developed areas would likely require the greatest amount of forest clearing, while the route that has the least impact on vegetation and wildlife habitats often impacts more residences or farm lands. Thus, an underlying goal inherent to a routing study is to reach a reasonable balance between minimizing potential impacts on one resource versus increasing the potential impacts on another. The following section presents the rationale for selection of the Proposed Route and, thus, the route that the Routing Team considered to best minimize the impacts of the Project overall. The rationale is derived from the accumulation of the routing decisions made throughout the process, the knowledge and experience of the Routing Team, comments from the public and regulatory agencies, and comparative analysis of potential impacts presented in Chapter 5.

6.2 Summary of Alternative Route Comparison

6.2.1 Segment 1

Alternative Route A

Advantages

- Requires the fewest number of total stream crossings (53)
- Crosses through the shortest length of the estimated obstruction zones for private airfields (3.5 miles)
- Parallels the most miles of existing pipelines (6.3 miles)
- Crosses the fewest number of pipeline ROWs (4)

Disadvantages

- Requires the greatest number of waterbody crossings (9)
- Crosses the most developed acreage (11 acres)
- Contains the most acres of total wetlands within the ROW (41 acres)
- Contains the most acres of forested wetlands within the ROW (21 acres)
- Crosses the largest number of total parcels (127)
- Greatest number of houses within 250 feet (3) and 500 feet (27)

Alternative Route B

Advantages

- Contains the fewest acres of forested wetlands within the ROW (11 acres)
- Contains the fewest acres of potential Indiana and northern long-eared bat habitat within the ROW (124 acres)
- Parallels the most miles of existing transmission line (4.4 miles or 13%)
- Crosses the fewest number of parcels <10 acres in size (5, tied with C)
- Crosses the fewest number of total parcels (115)
- No residences within 250 feet of the ROW (same as C)
- Most cell towers within 500 feet (1, same as C)

Disadvantages

- Crosses the greatest number of pipeline ROWs (6)
- Contains the greatest acres of agricultural land within the ROW (501 acres)
- Contains the fewest acres of grassland/pasture within 200 feet of the ROW (163 acres)
- Crosses through the greatest length of the estimated obstruction zones for private airfields (5.9 miles)

Alternative Route C

Advantages

- Requires the fewest number of waterbody crossings (3)
- Contains the fewest acres of total wetlands within the ROW (33 acres)
- Crosses the fewest number of parcels <10 acres in size (5, tied with B)
- No residences within 250 feet of the ROW (same as B) and the fewest residences within 500 feet (7)
- Crosses fewest number of total parcels (111)
- Parallels the most miles of parcel boundaries (7.5 miles)

Disadvantages

- Requires the greatest number of stream crossings (63)
- Contains the most acres of potential long-eared and Indiana bat forested habitat within the ROW (168 acres)
- Parallels no existing transmission or pipeline ROWs
- Contains the most cell towers within 500 feet (1, same as B)

6.2.2 Segment 2

Alternative Route D

Advantages

- Requires the fewest number of stream crossings (228)
- Requires the fewest number of waterbody crossings (24, same as E and G)
- Contains the fewest acres of total wetlands within the ROW (118 acres)
- Contains the fewest acres of forested and grassland habitat within the ROW (759 and 1,154 acres, respectively)
- Contains the fewest acres of potential Indiana and long-eared bat forested habitat within the ROW (759 acres)
- Crosses the second fewest number of small parcels (<10 acres in size) (13)
- Fewest number of residences within 250 feet (5)
- Fewest number of residences within 500 feet (50)
- Crosses through no FAA Notification Zones for public airfields
- Parallels the most miles of existing pipeline corridors (44.6 miles)
- No NR-listed architectural sites within 1 mile (same as E and G)

Disadvantages

- Crosses through the greatest length of the estimated obstruction zone for private airfields (10.4 miles)
- Highest number of U.S. highway crossings (6) and state highway crossings (12)
- Crosses the greatest number of pipeline ROWs (21)
- Crosses the second greatest length of agricultural lands (90.7 miles)
- Contains the most cell/radio towers within 500 feet (3, same as E)

Alternative Route E

Advantages

- Parallels the most miles of existing linear infrastructure (transmission lines and pipelines) (70.3 miles)
- Parallels the second most miles of existing pipelines (39.3 miles, same as F)
- Contains the second fewest acres of potential Indiana and long-eared bat forested habitat within the ROW (813 acres)
- Requires the fewest number of waterbody crossings (24, same as D and G)
- No NR-listed architectural sites within 1 mile (same as D and G)
- Requires the fewest railroad crossings (7, same as F)

Disadvantages

- Contains the greatest number of acres of NWI forested and scrub/shrub wetland acres within the ROW (70 acres)
- Crosses the most developed acreage (44 acres)
- Crosses the most miles of agricultural land (90.9 miles)
- Greatest number of residences within 250 feet (11, same as F and I)
- Greatest number of transmission line and pipeline ROWs (45)
- Crosses the most city and/or county public land (2614 feet, same as G)
- Second longest route (176.5 miles)
- Most cell/radio towers within 500 feet (3, same as D)

Alternative Route F

Advantages

- Crosses the fewest miles of Karst topography (46.1 miles)
- Crosses the greatest number of large (>80 acres) parcels (306)
- Fewest cemeteries within 500 feet (1, same as H)
- Contains the fewest railroad crossings (7, same as E)

Disadvantages

- Crosses the most streams (252)
- Crosses the most parcels (557)
- Greatest number of residences within 250 feet (11, same as E and I)
- Crosses through the most FAA Notification Zones for public airfields (6.9 miles, same as H)
- Is located in proximity to National Register-listed St. Peter's Catholic Church (3,000 feet, same as H and I)

Alternative Route G

Advantages

- Parallels the most miles of existing transmission line (39.0 miles or 22%)
- No NR-listed architectural sites within 1 mile (same as D and E)
- Requires the fewest number of waterbody crossings (24, same as D and E)

Disadvantages

- Is the longest Alternative Route (177.5 miles)
- Crosses the Lower Grand MDC-designated Heritage Hot Spot (4.5 miles, same as H and I)
- Crosses the most city and/or county public land (2614 feet, same as E)

- Crosses the most miles of karst topography (51.0 miles)
- Is located within 1 mile of Swan Lake National Wildlife Refuge (same as H and I)

Alternative Route H

Advantages

- Crosses through the fewest miles of the estimated obstruction zone for private airfields (2.1 miles, same as I)
- Crosses the fewest number of state highways (9, same as I)
- Parallels the greatest length of 161kV transmission lines (30.9 miles)
- Fewest cemeteries within 500 feet (1, same as F)

Disadvantages

- Contains the most acres of potential Indiana and long-eared bat forested habitat within the ROW (1,056 acres)
- Crosses the most small parcels (<10 acres in size) (22)
- Crosses the Lower Grand MDC-designated Heritage Hot Spot (4.5 miles, same as G and I)
- Crosses through the most FAA Notification Zones for public airfields (6.9 miles, same as F)
- Is located within 1 mile of Swan Lake National Wildlife Refuge (same as G and I)
- Is located in proximity to National Register-listed St. Peter's Catholic Church (3000 feet, same as F and I)

Alternative Route I

Advantages

- Is the shortest Alternative Route (163.2 miles)
- Crosses the fewest number of parcels (493)
- Crosses the fewest number of transmission line and pipeline ROWs (35)
- Crosses the fewest miles of agricultural land (67.3 miles)

Disadvantages

- Contains the greatest acreage of total wetlands within the ROW (acres)
- Greatest number of residences within 250 feet (11, same as E and F)
- Requires the greatest number of waterbody crossings (27)
- Contains the second most acres of potential Indiana and long-eared bat forested habitat within the ROW (1,054 acres)
- Crosses the Lower Grand MDC-designated Heritage Hot Spot (4.5 miles, same as G and H)
- Parallels the fewest miles of existing transmission line (4.3 miles)

- Parallels the fewest miles of existing linear infrastructure (transmission lines and pipelines) (4.3 miles)
- Is located within 1 mile of Swan Lake National Wildlife Refuge (same as H and G)
- Is located in proximity to National Register-listed St. Peter's Catholic Church (3000 feet, same as F and H)

6.2.3 Combined Proposed Route

The Routing Team recommends a combination of Alternative Routes B and D as the Proposed Route for the Project (**Figure 6-1**). This combination of routes meets the overall goal of minimizing impacts on the natural, human, and historic resources, while making best use of existing linear infrastructure ROWs and avoiding non-standard design requirements. The Proposed Route has a total length of 206 miles and parallels existing linear infrastructure ROWs for 28 percent of its total length.

Alternative Route B was selected in Segment 1. Alternative Route B parallels a combination of pipelines, an existing transmission line, and parcel boundaries. Initial alignments cross the eastern floodplain of the Missouri River and into the rolling hills along the pipeline. Approximately 3 miles beyond the eastern bluffs, the route turns southeast adjacent to an existing transmission line to avoid residential development along the pipeline and the town of Agency. The route continues along the existing transmission line for 4.5 miles and then turns due east, eventually joining the pipeline corridor. Alternative Route B has a range of benefits over other Alternatives. It has no residences located within 250 feet of the route centerline, avoids the residential congestion located farther east along the pipeline corridor, and avoids crossing through the town of Agency. Alternative Route B has the least impact on forested areas and parallels existing linear infrastructure, thereby reducing fragmentation of potential habitat for the Indiana bat and northern long-eared bat. Alternative Route B also reduces the fragmentation of area land use, by locating the line adjacent to existing utility infrastructure.

Alternative Route D was selected in Segment 2. It follows the Rockies Express/Keystone pipelines, existing transmission lines, and parcel boundaries for approximately 57 percent of its total length. Alternative Route D has the least number of residences within 250 and 500 feet. Alternative Route D is also located approximately 5 miles south of the Swan Lake National Wildlife Refuge, which is an important area for migratory birds. In addition, the area around Swan Lake National Wildlife Refuge has large complexes of wetlands, some of which are protected under the Natural Resource Conservation Service's Wetland Reserve Program. Considering Alternative Route D parallels existing linear infrastructure for a significant portion of the total length, new fragmentation in forested areas would be minimized. Furthermore, Alternative Route D also has the fewest acres of forested habitat within the right-of-way, which results in the least potential impact to the Indiana bat and northern long-eared bat habitat.

The combination of Alternative Routes B and D comprise a Proposed Route for the Project that is reasonable and sound because: 1) the selection of the Proposed Route integrated input from government agencies, local officials, and the general public into the route development, analysis, and selection process; and 2) the Proposed Route best minimizes the overall effect of the Grain Belt Express transmission line on the natural and human environment while avoiding unreasonable and circuitous routes, unreasonable costs, and special design requirements.

- City
- Intermediate Converter Station
- Missouri Proposed Route
- Kansas Approved Route
- Interstate Highway
- U.S. Highway

Conservation Land

- Local/Private
- State
- Federal
- Gas Pipeline

Figure 6-1
Proposed Route

GRAIN BELT EXPRESS
CLEAN LINE

Sources: ESRI, NPS, USGS, USACE, USFWS, USDA-NRCS, MDC, MO DNR, MSDIS. The Nature Conservancy

N

0 10 20 30 Miles

IL IN KS MO

Coordinate System: North America Equidistant Conic
Projection: Equidistant Conic
Datum: North American 1983

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