List of Figures

Figure

Appendix A
Figures

GRAIN BELT EXPRESS
CLEAN LINE

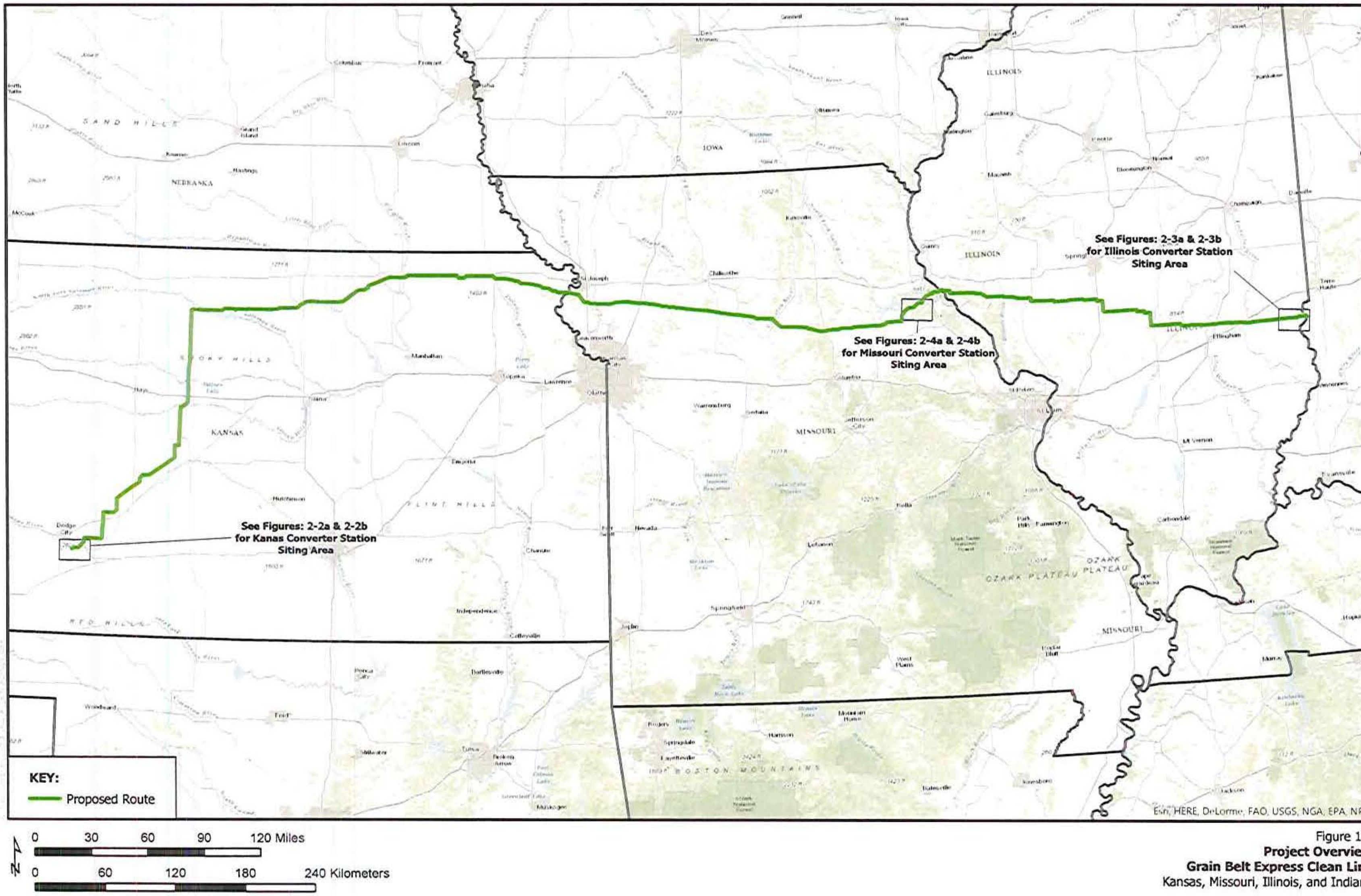


Figure 1-1
Project Overview
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

Schedule TFS-4

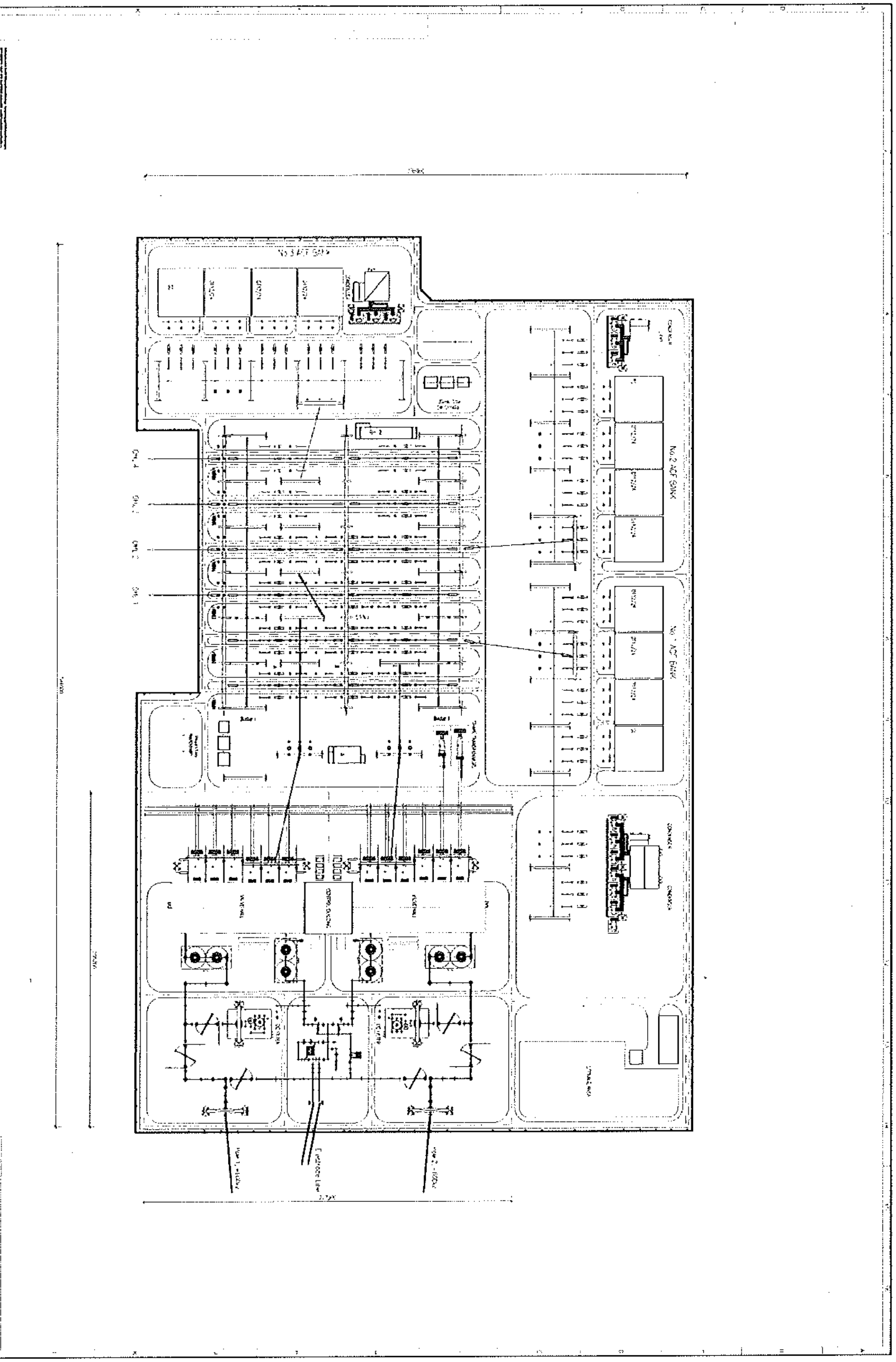


Figure 2-1
Clean Line Converter Station General Layout

GRAIN BELT EXPRESS
CLEAN LINE

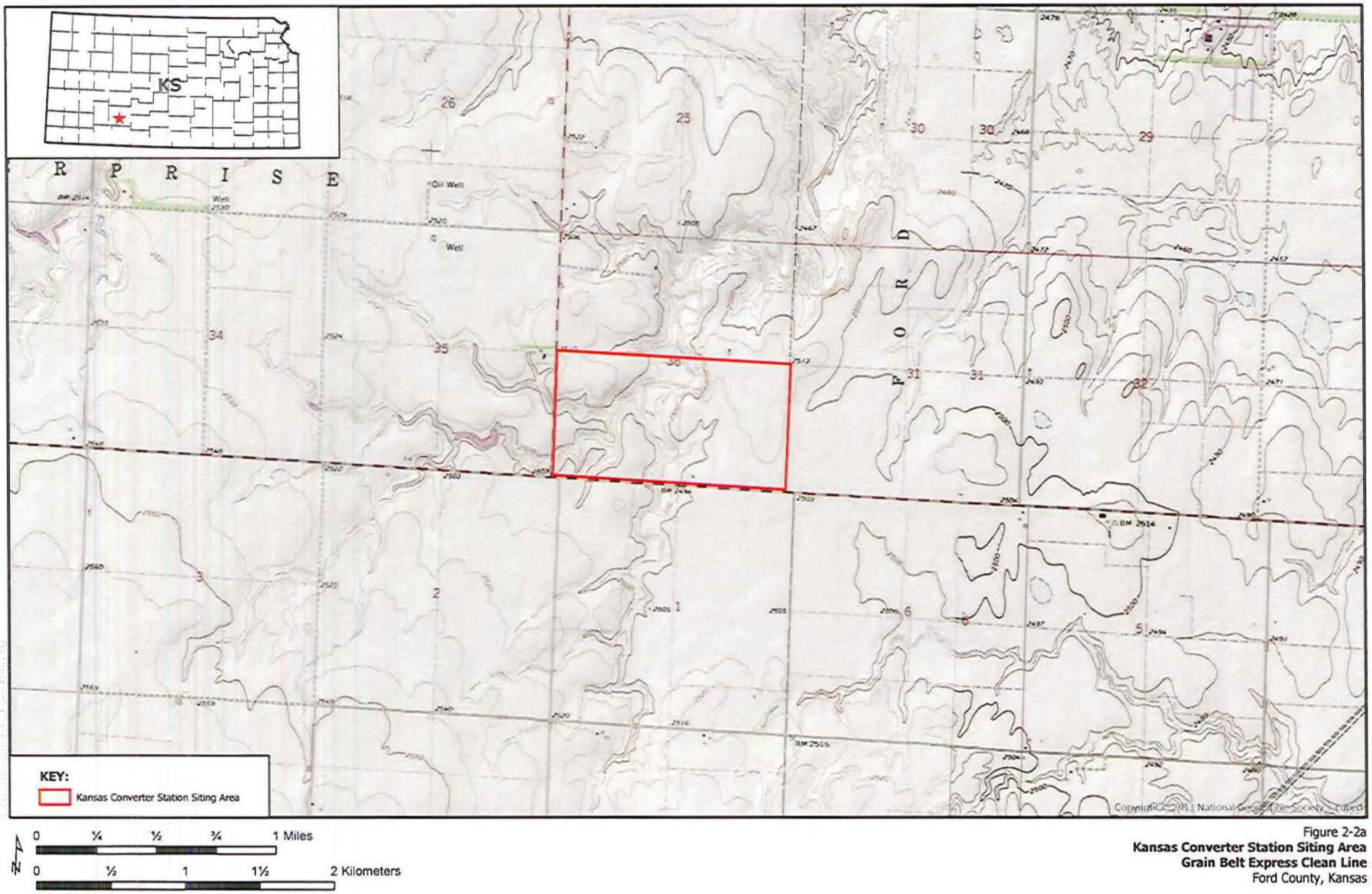
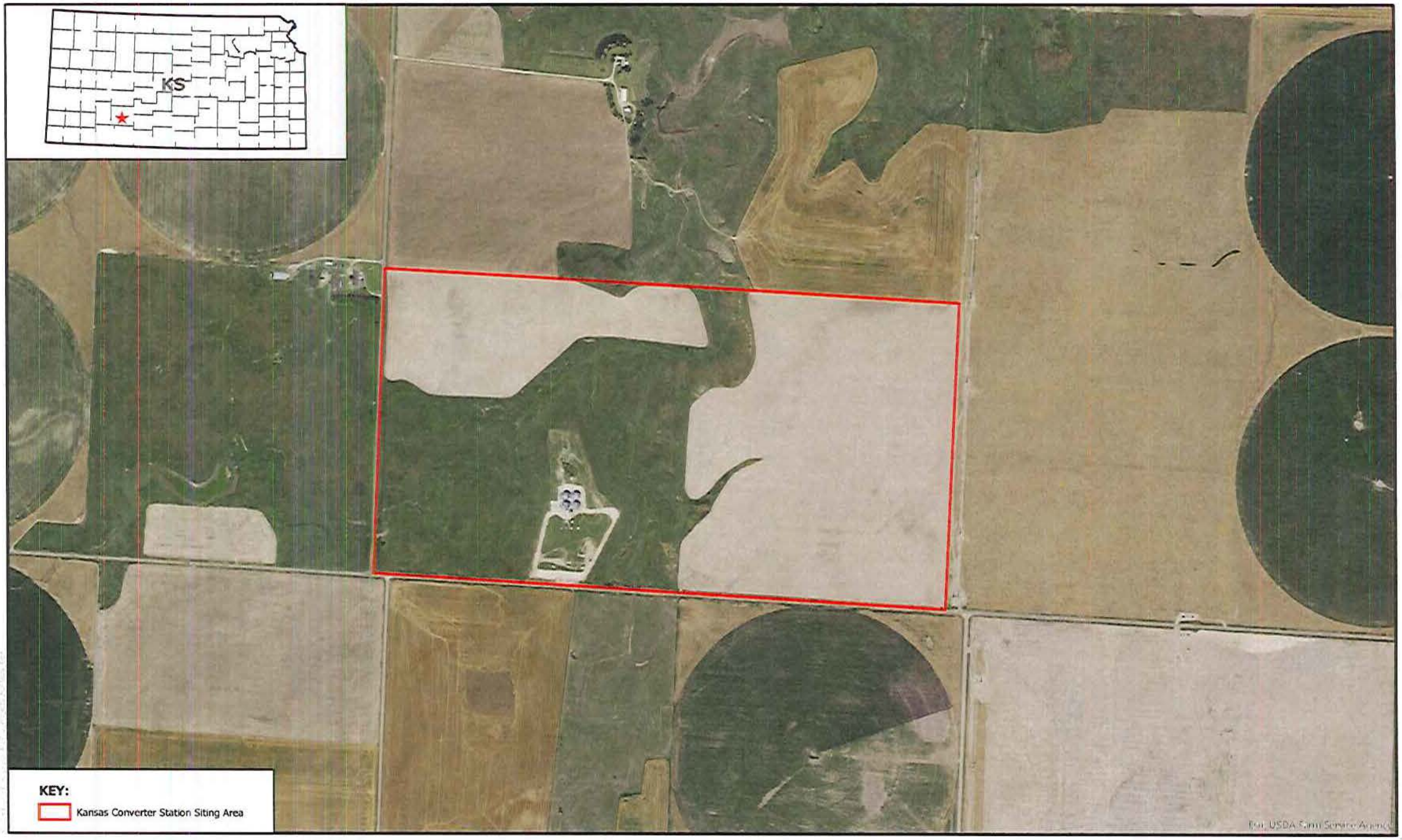


Figure 2-2a
Kansas Converter Station Siting Area
Grain Belt Express Clean Line
Ford County, Kansas

GRAIN BELT EXPRESS
CLEAN LINE



0 0.1 0.2 0.3 0.4 Miles

0 0.2 0.4 0.6 0.8 Kilometers

N

Figure 2-2b
Kansas Converter Station Siting Area
Grain Belt Express Clean Line
Ford County, Kansas

Schedule TFS-4

Schedule TFS-4

GRAIN BELT EXPRESS
CLEAN LINE

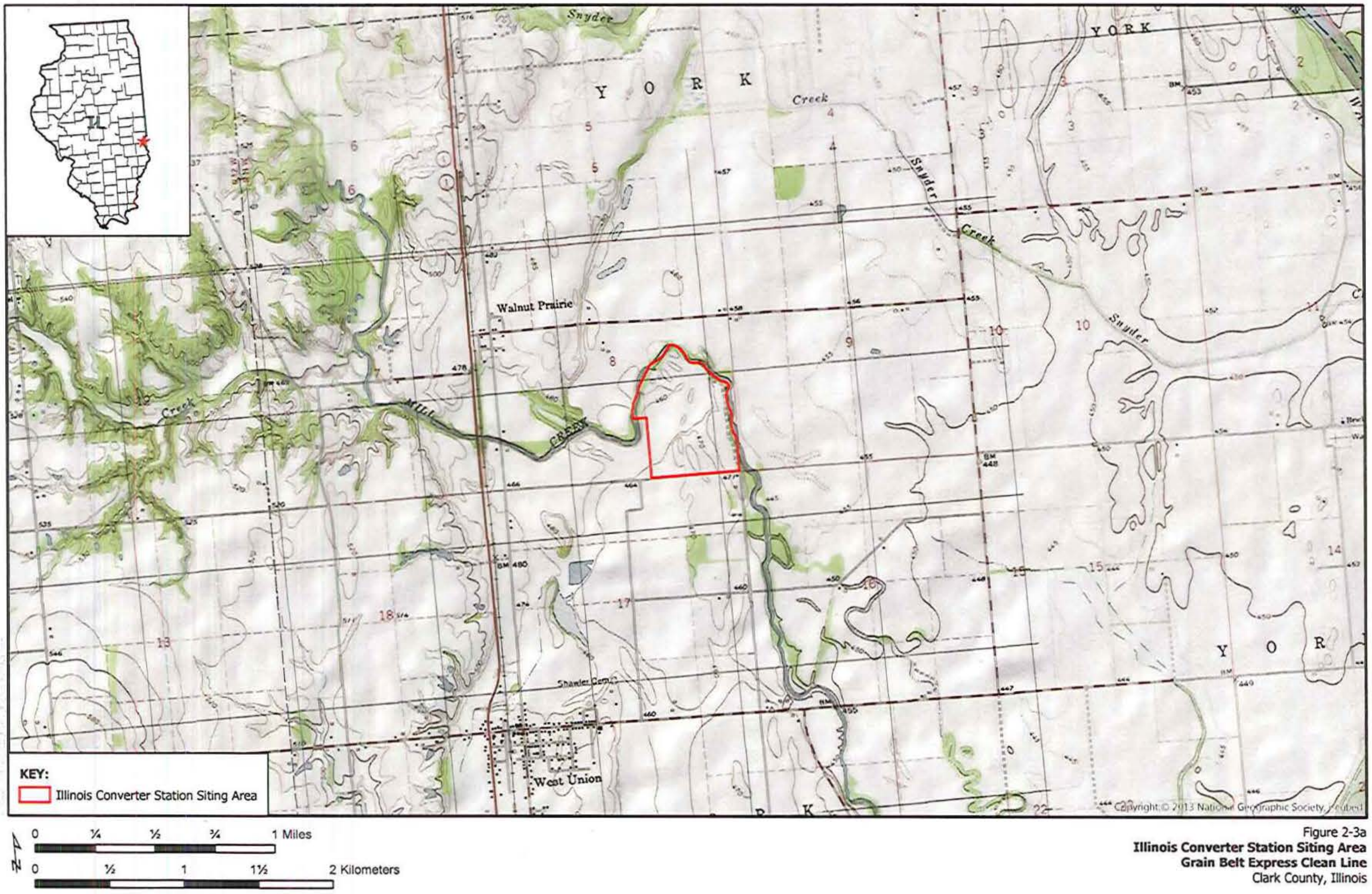
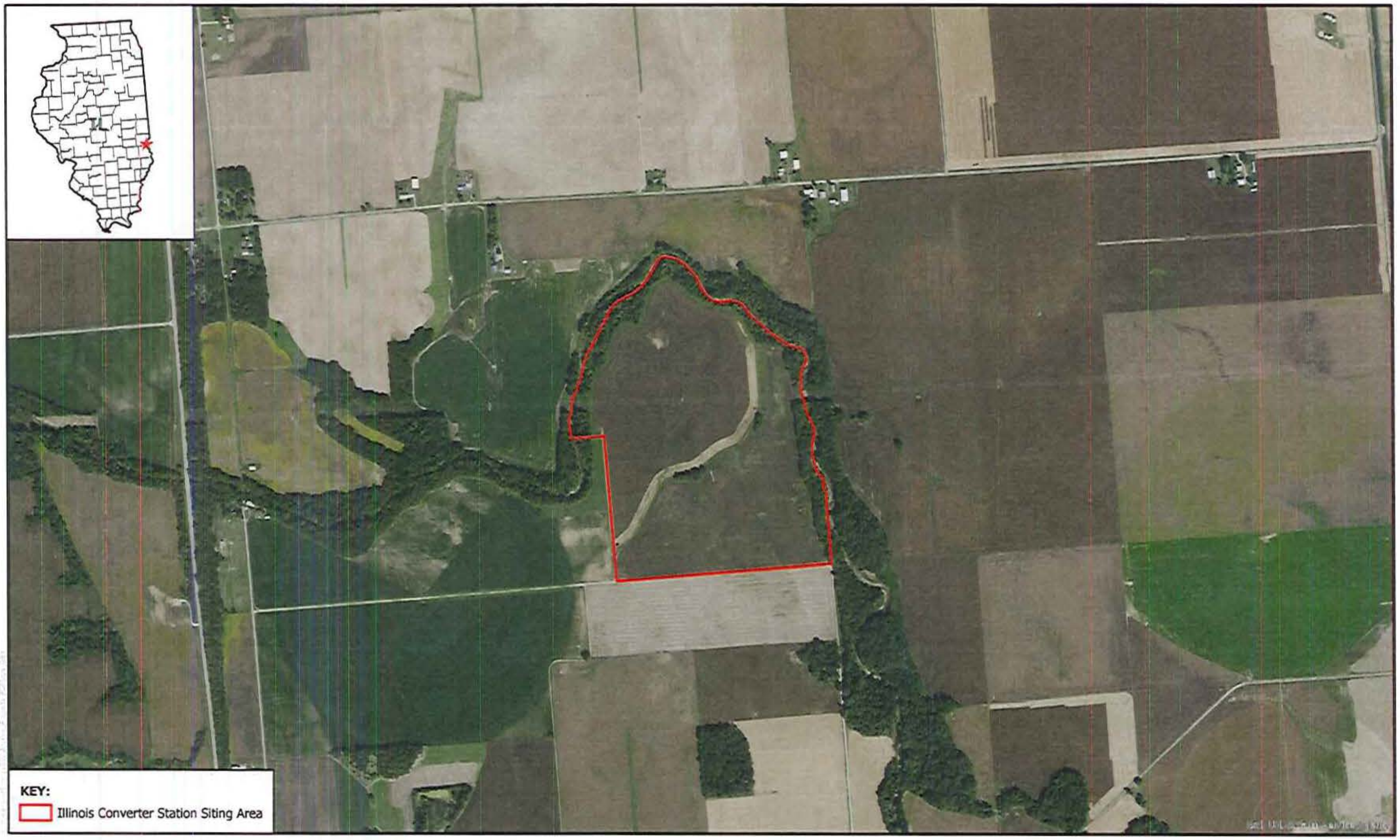


Figure 2-3a
Illinois Converter Station Siting Area
Grain Belt Express Clean Line
Clark County, Illinois

GRAIN BELT EXPRESS
CLEAN LINE



0 0.1 0.2 0.3 0.4 Miles
0 0.2 0.4 0.6 0.8 Kilometers

Figure 2-3b
Illinois Converter Station Siting Area
Grain Belt Express Clean Line
Clark County, Illinois

GRAIN BELT EXPRESS
CLEAN LINE

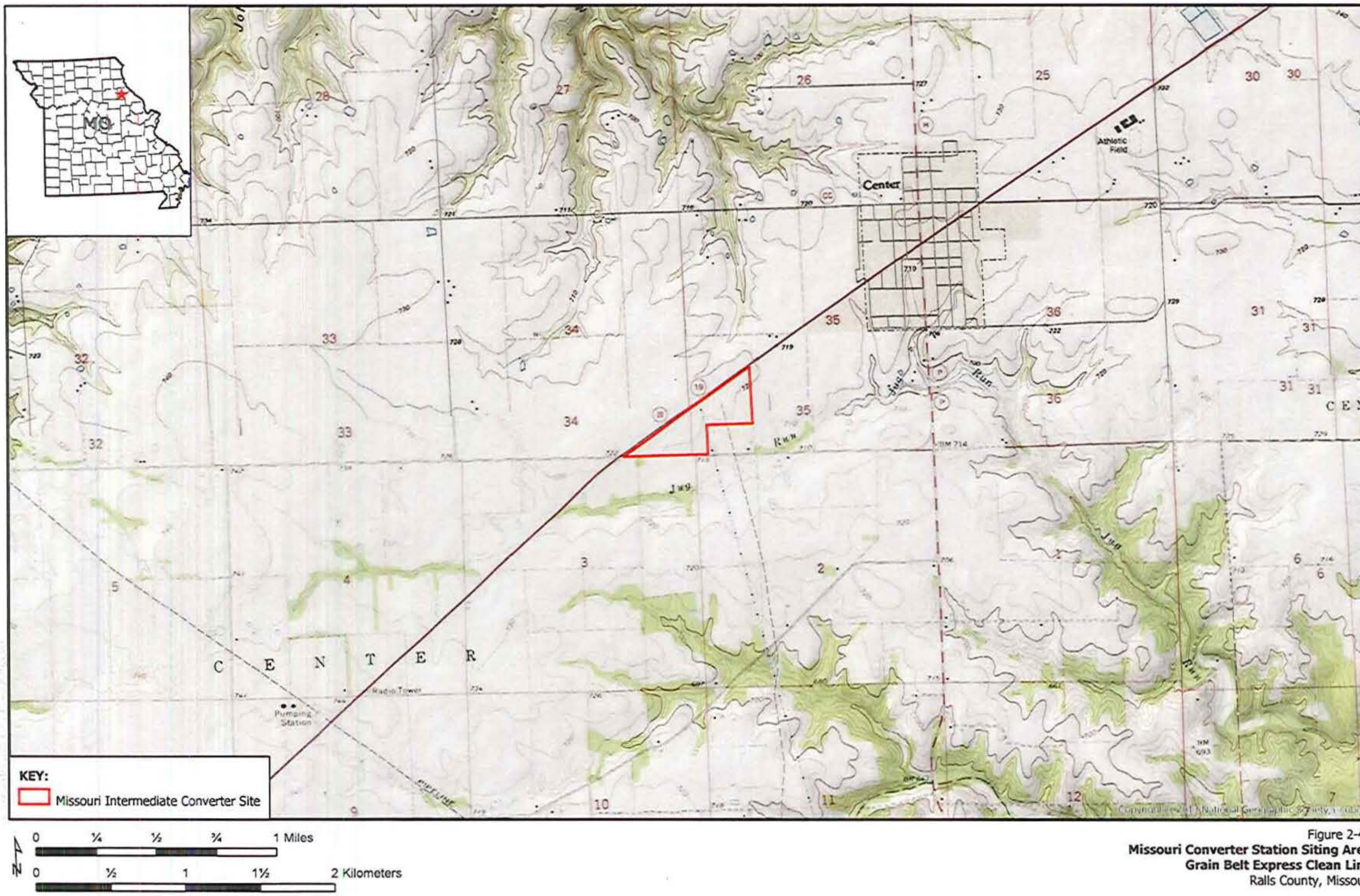


Figure 2-4a
Missouri Converter Station Siting Area
Grain Belt Express Clean Line
Ralls County, Missouri

GRAIN BELT EXPRESS
CLEAN LINE

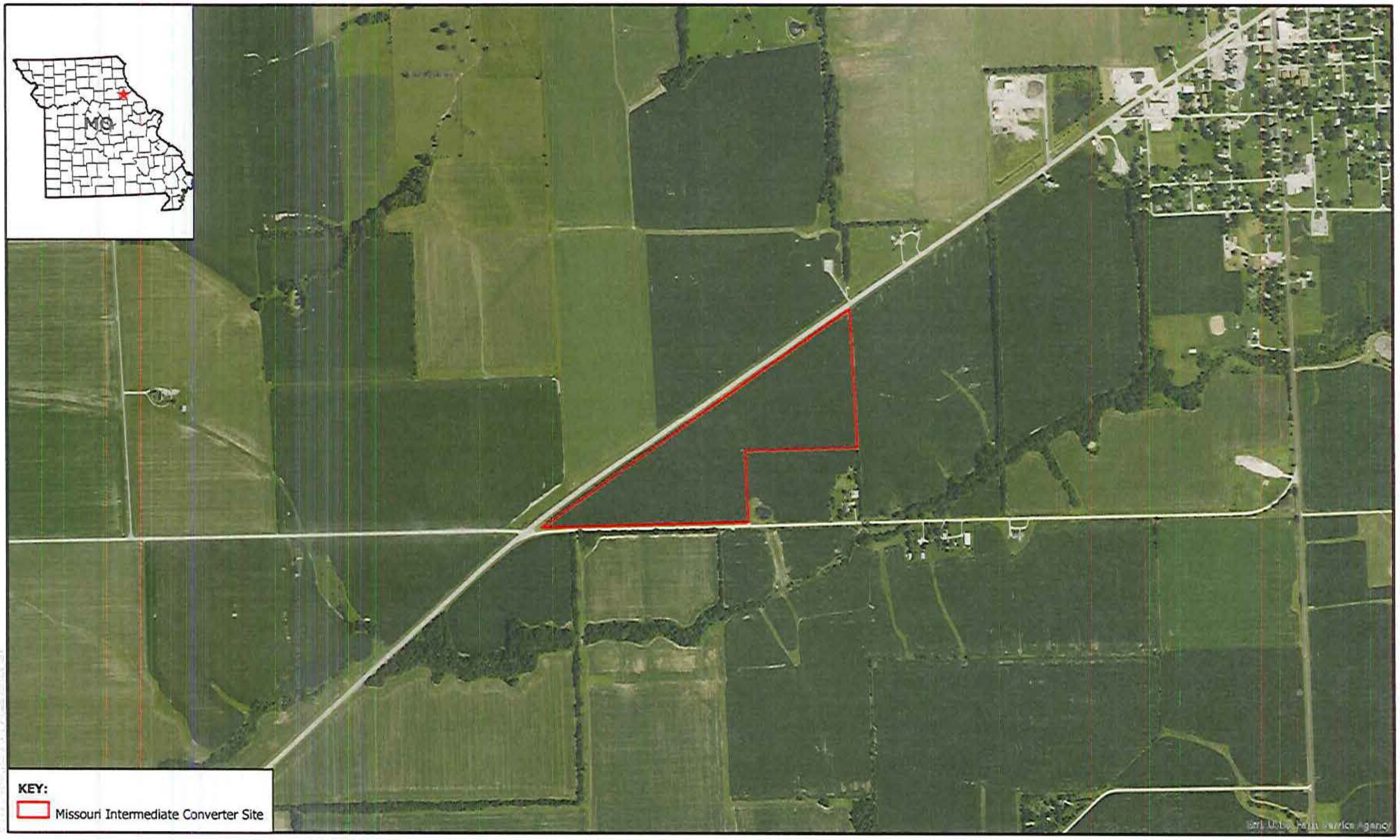


Figure 2-4b
Missouri Converter Station Siting Area
Grain Belt Express Clean Line
Ralls County, Missouri

GRAIN BELT EXPRESS
CLEAN LINE

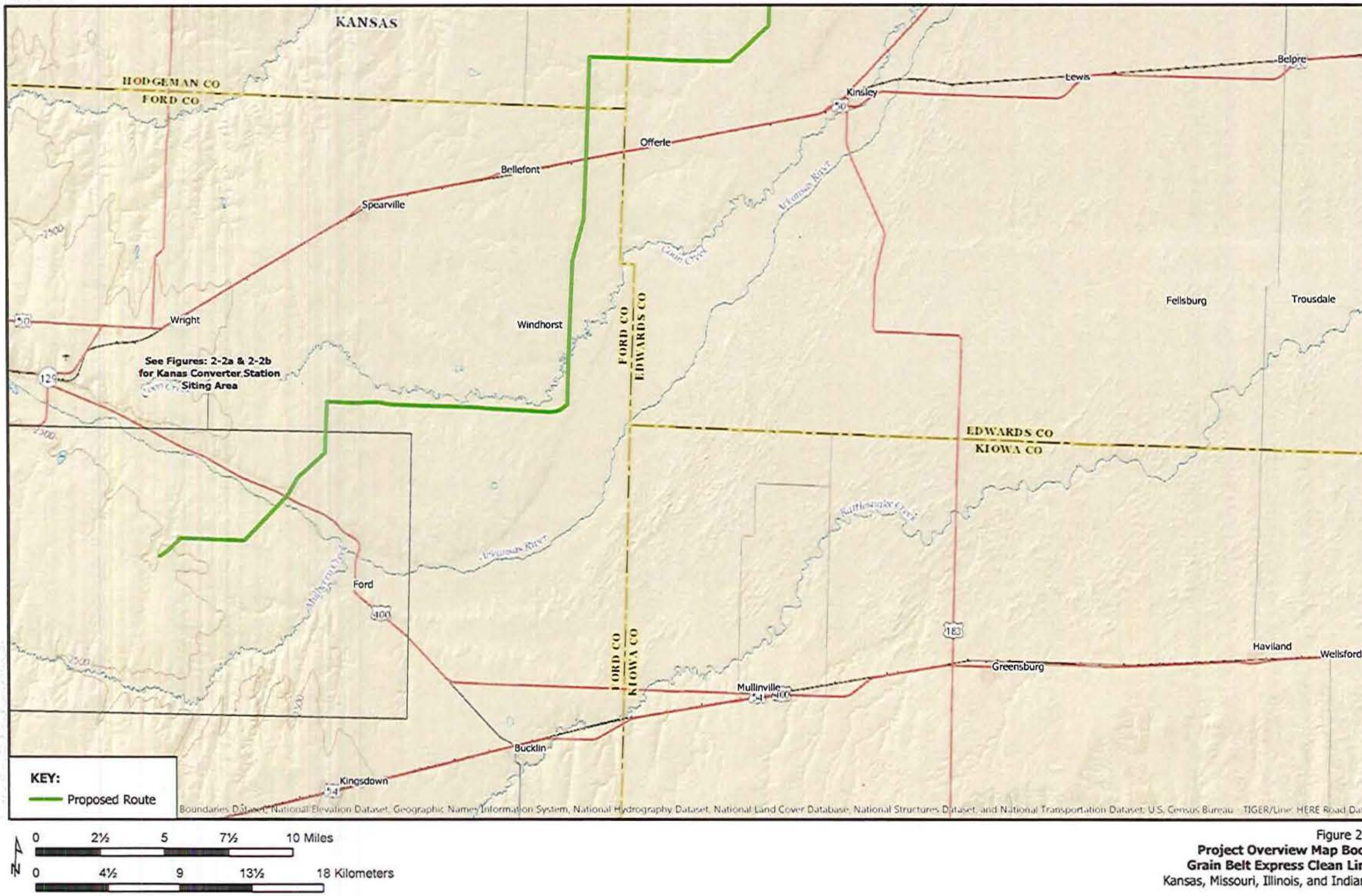
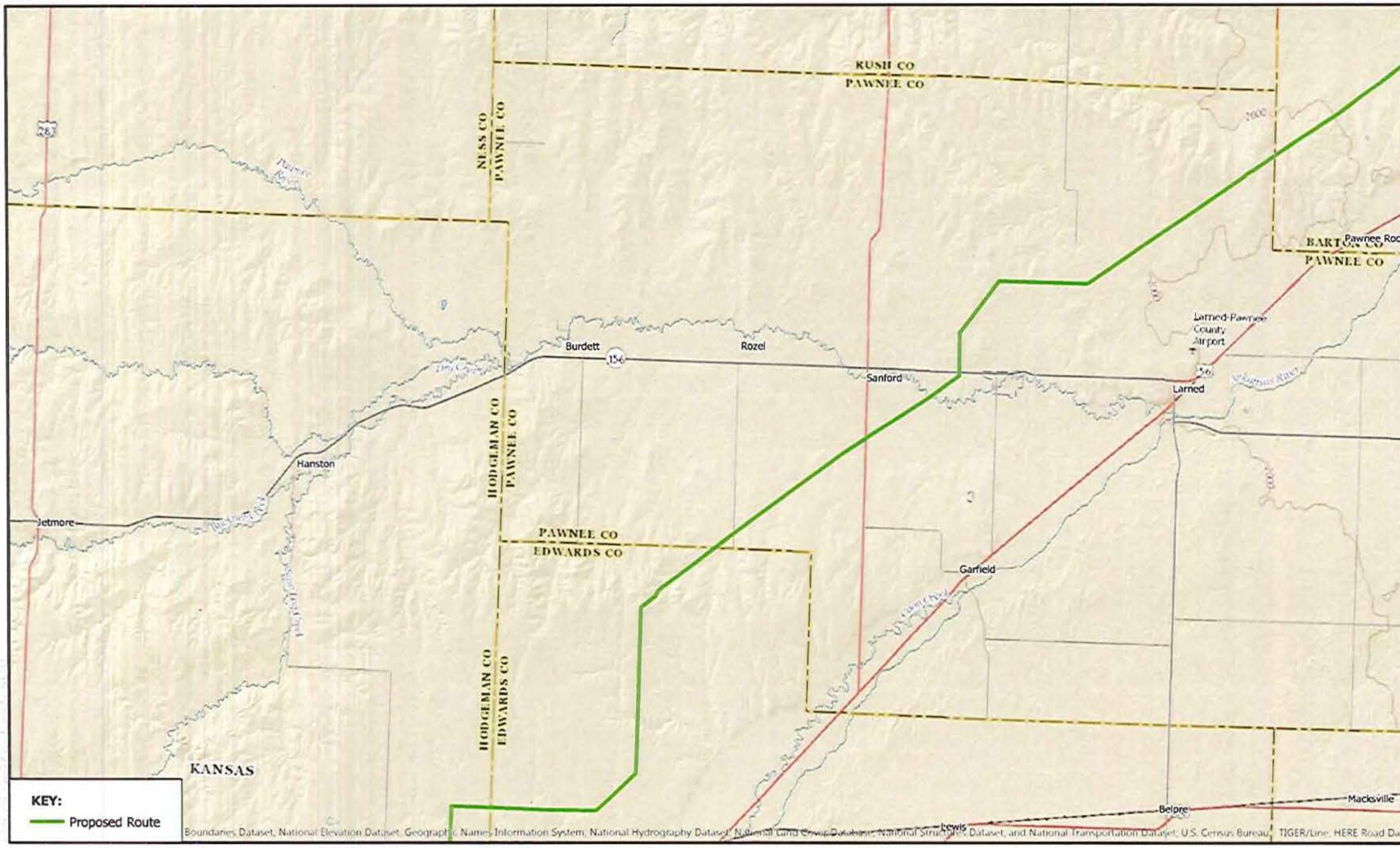


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

GRAIN BELT EXPRESS
CLEAN LINE



N
0 2½ 5 7½ 10 Miles
0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

Schedule TFS-4

GRAIN BELT EXPRESS
CLEAN LINE

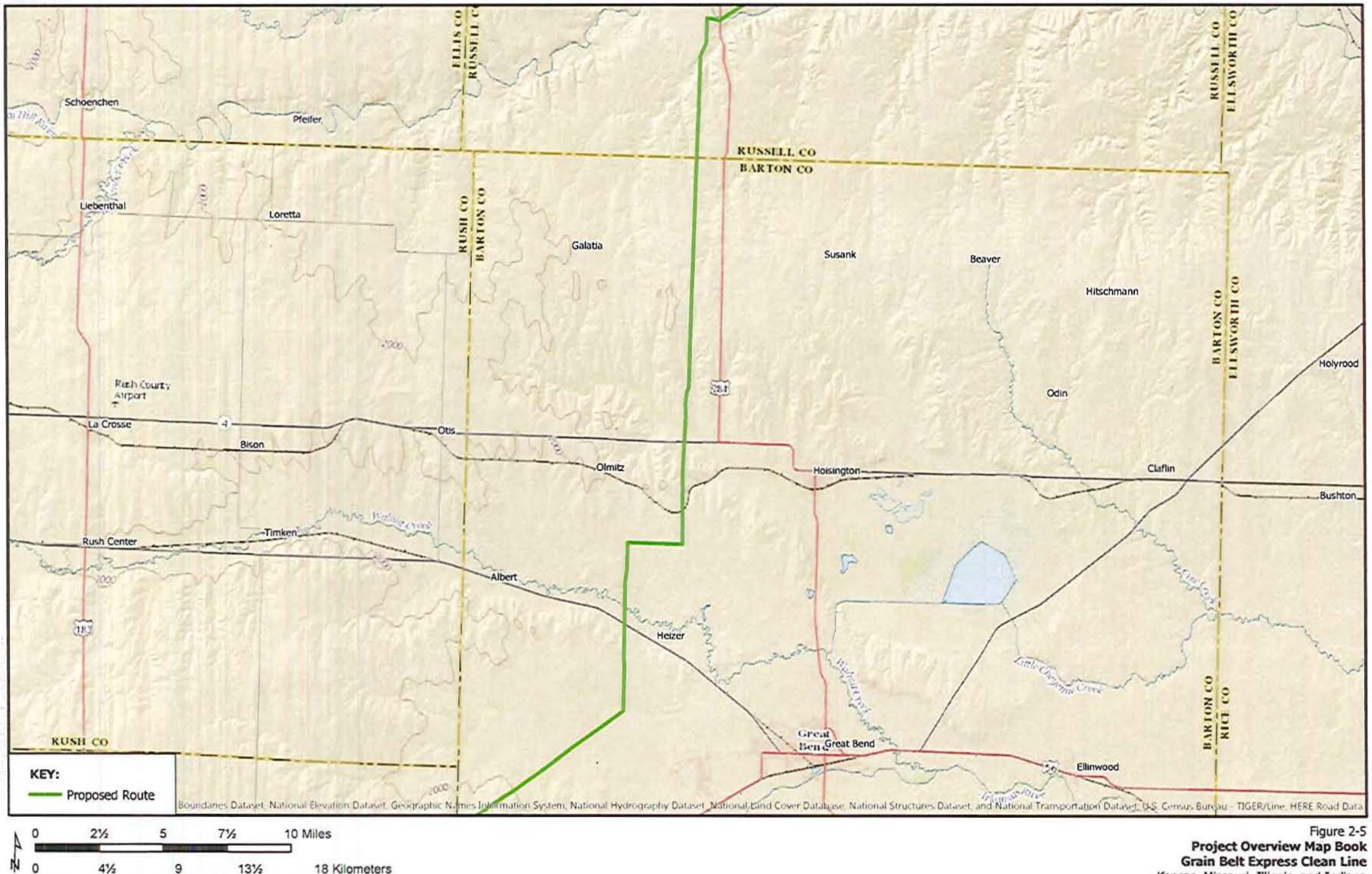
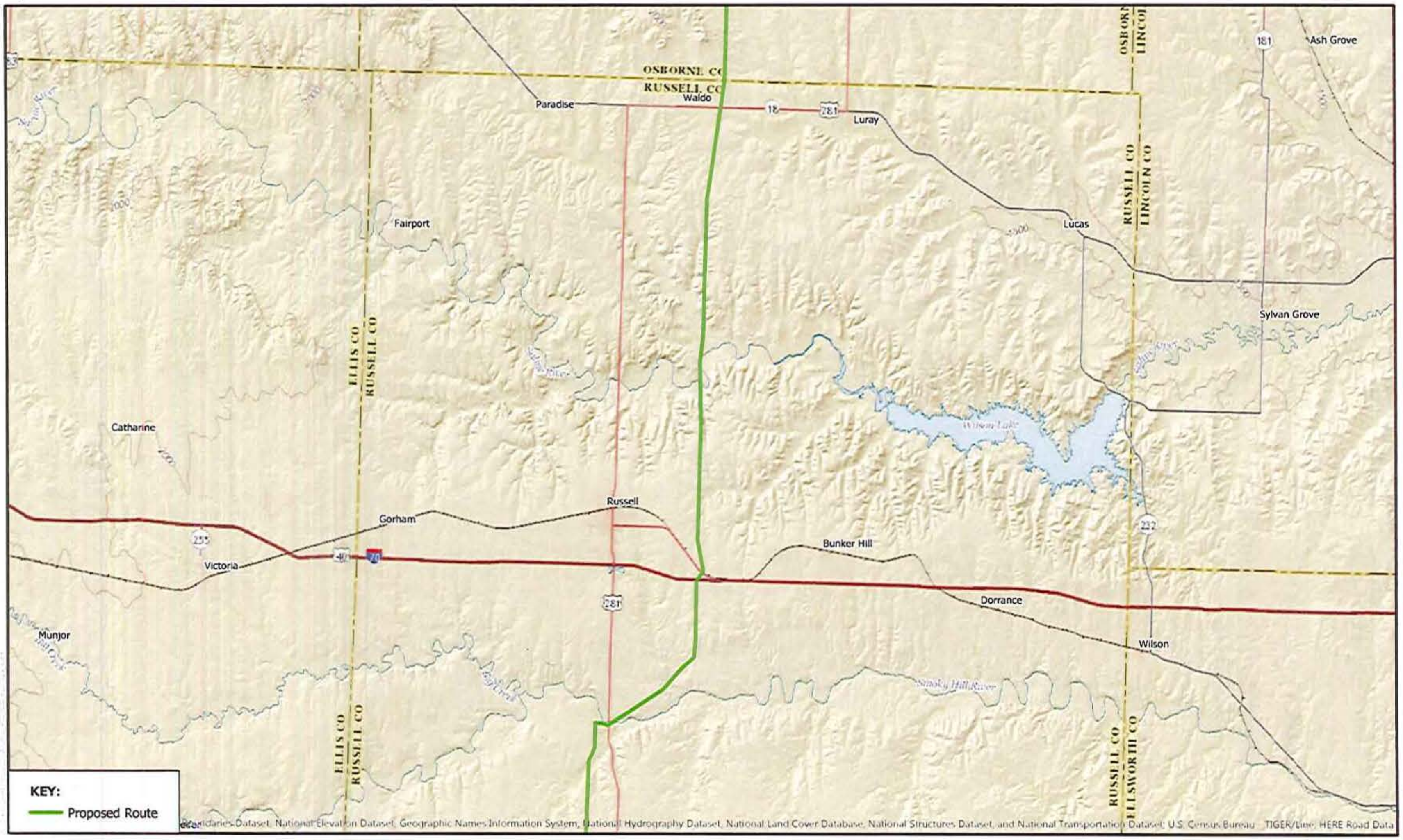


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

GRAIN BELT EXPRESS
CLEAN LINE



0 2½ 5 7½ 10 Miles

0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

GRAIN BELT EXPRESS
CLEAN LINE

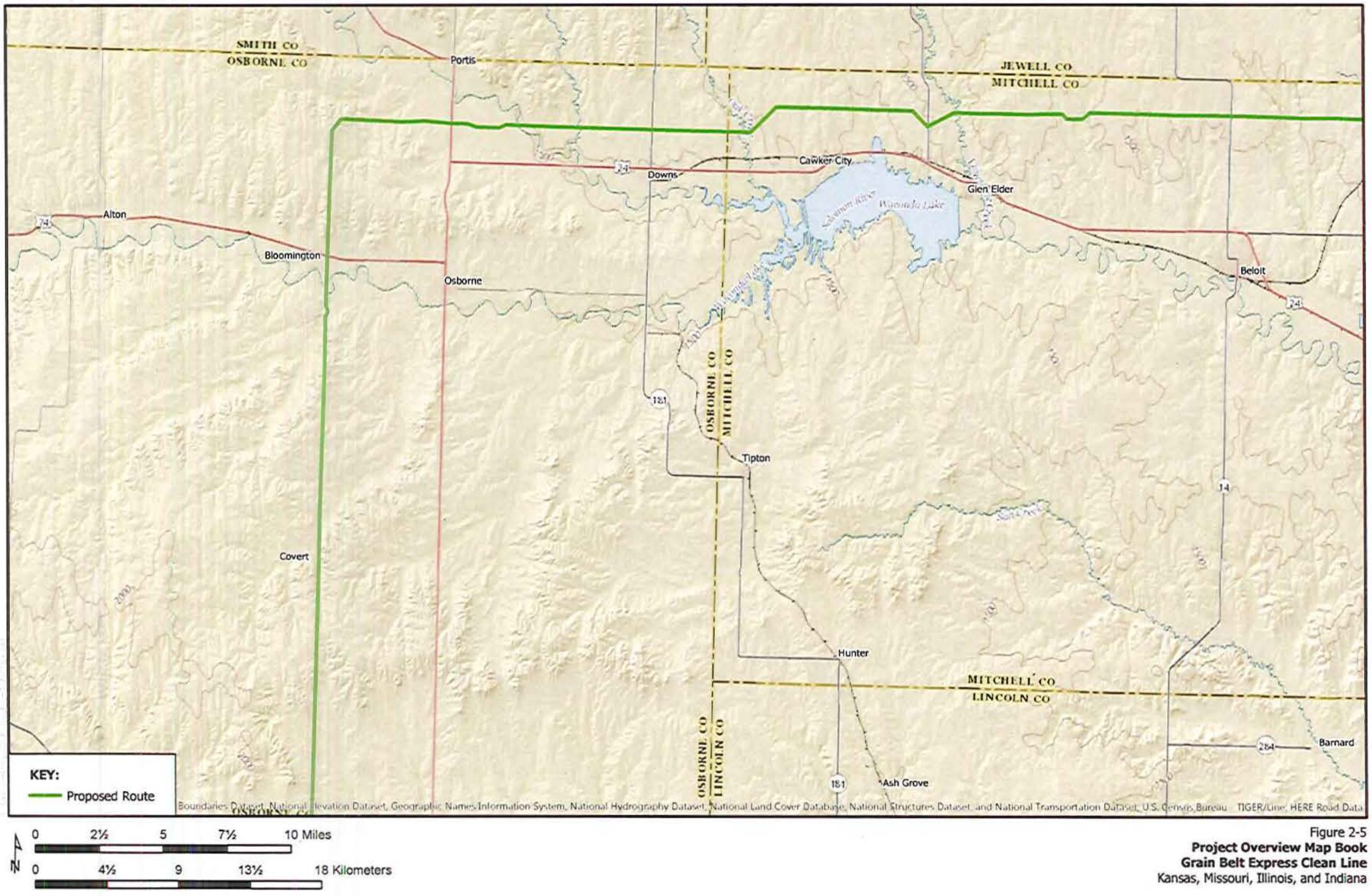
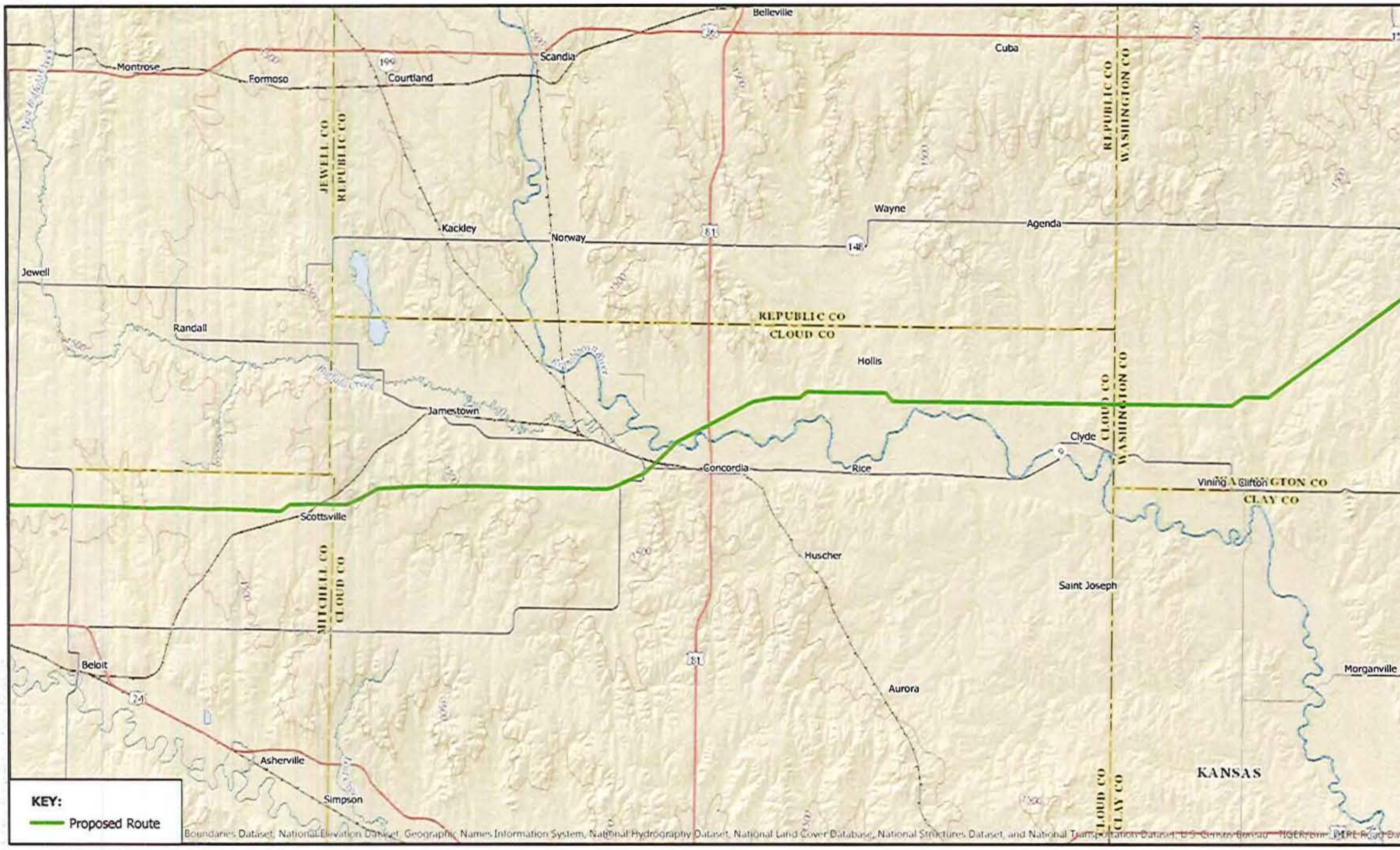


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana



0 2½ 5 7½ 10 Miles

0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

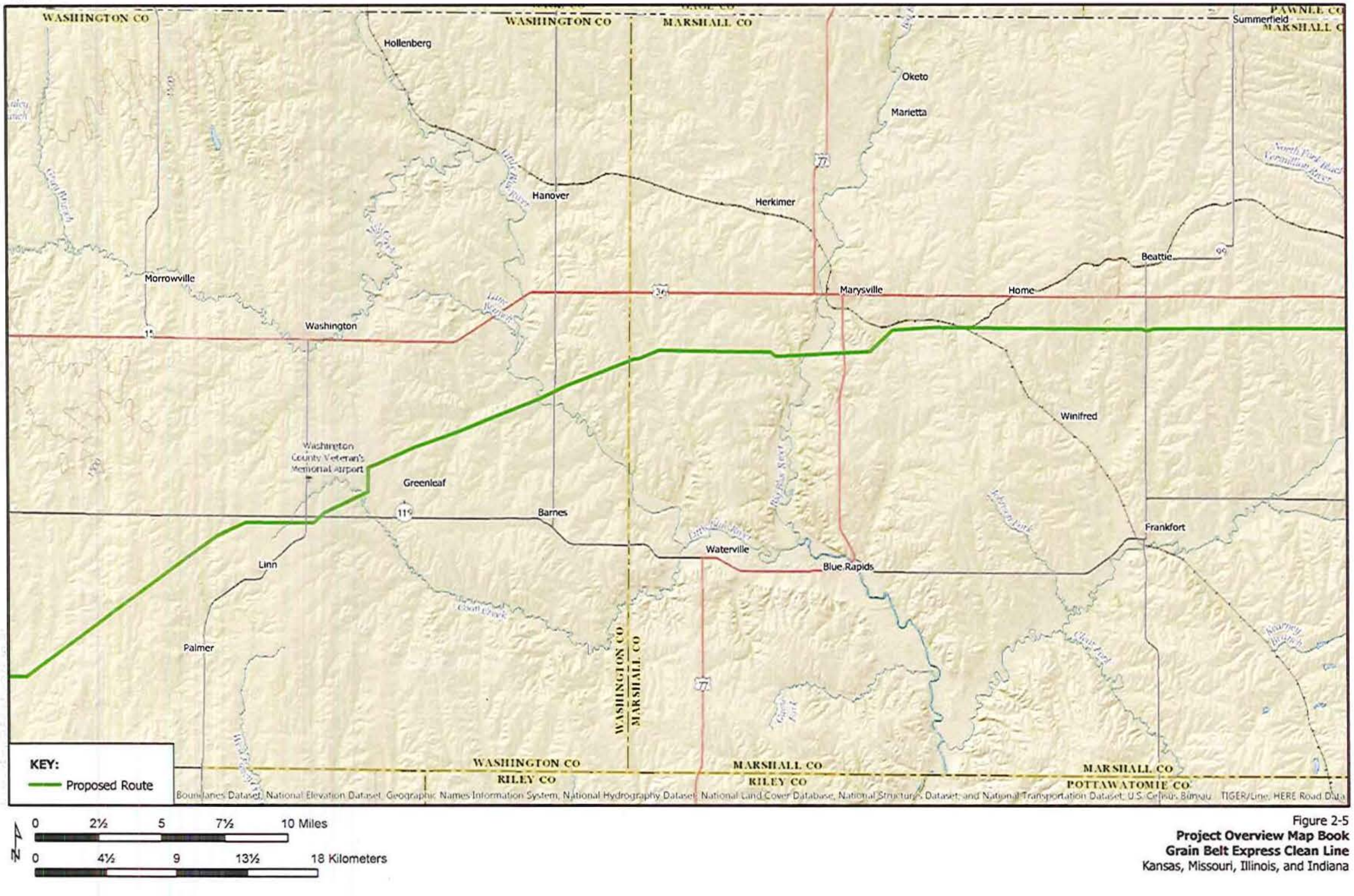


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

GRAIN BELT EXPRESS
CLEAN LINE

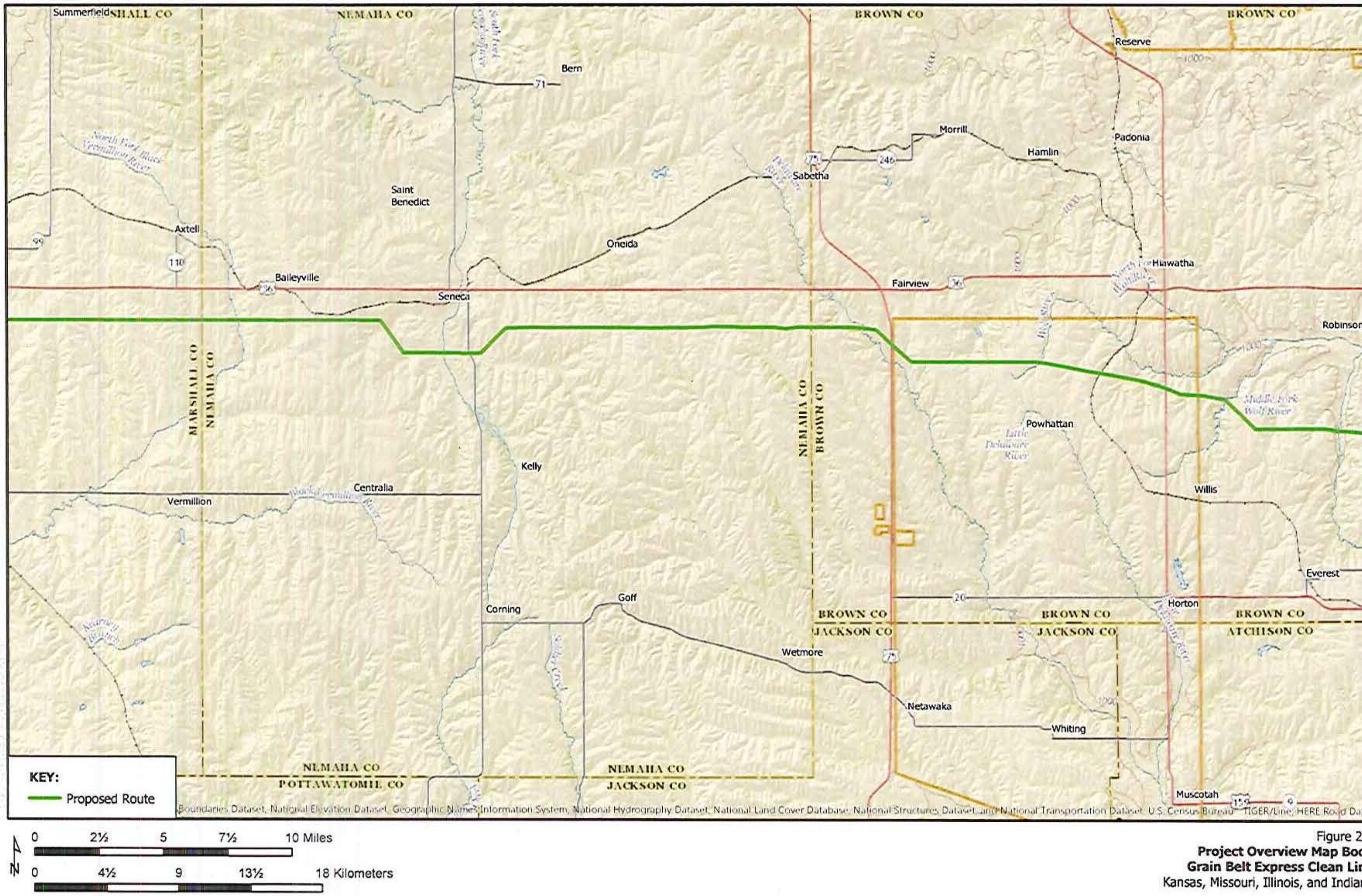


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

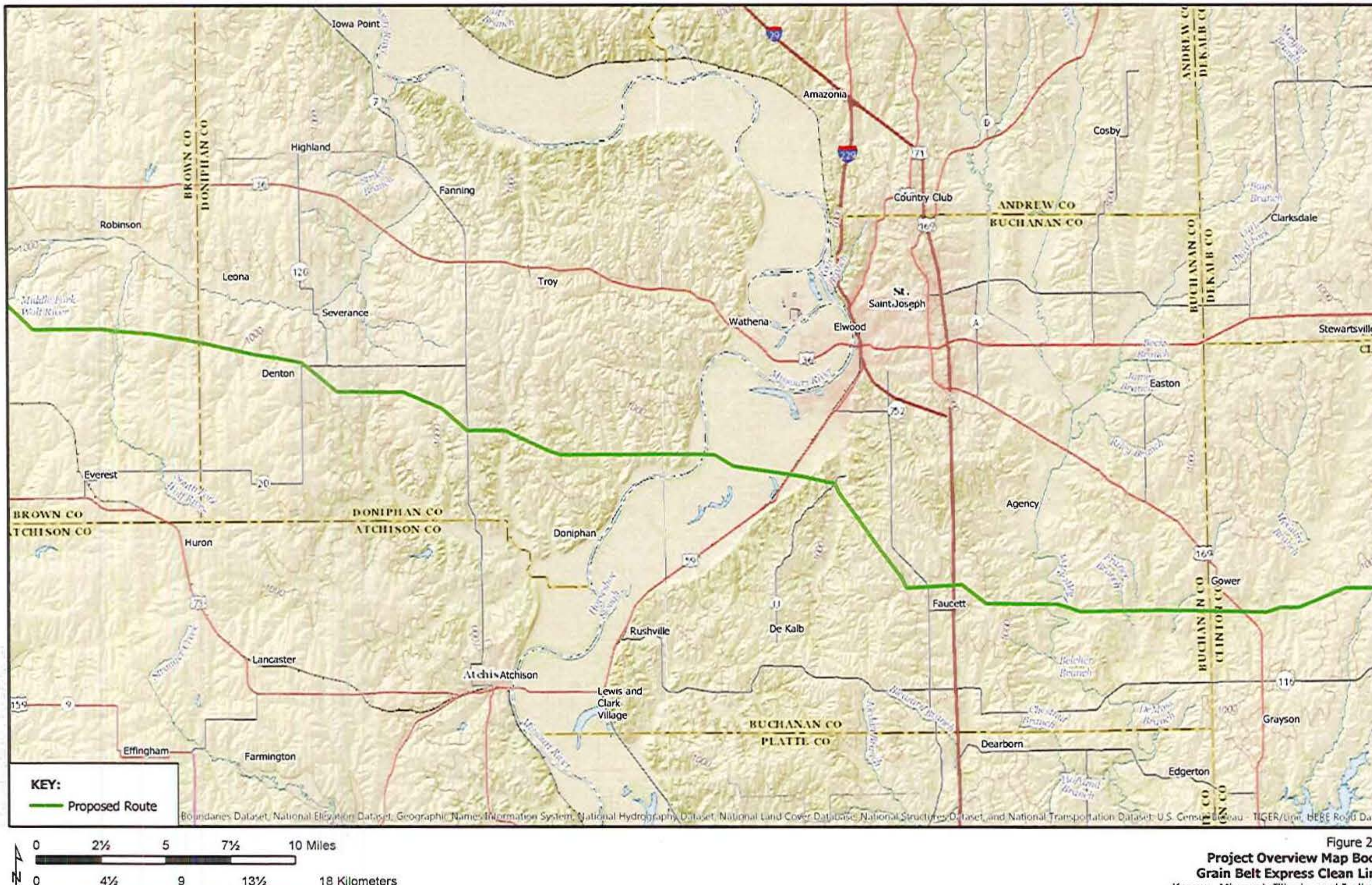
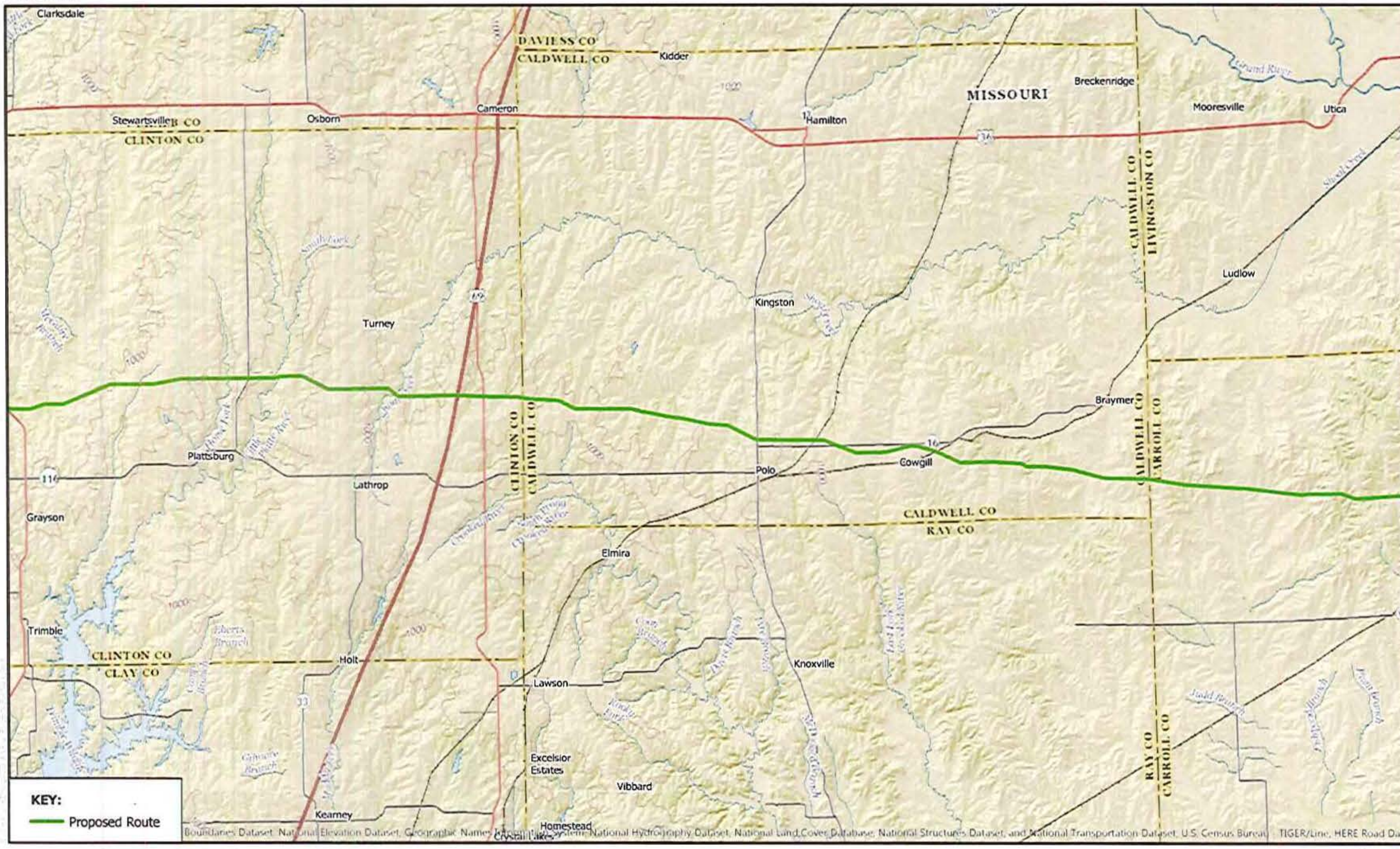


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

Schedule TFS-4

GRAIN BELT EXPRESS
CLEAN LINE



0 2½ 5 7½ 10 Miles

0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

Schedule TFS-4

GRAIN BELT EXPRESS
CLEAN LINE

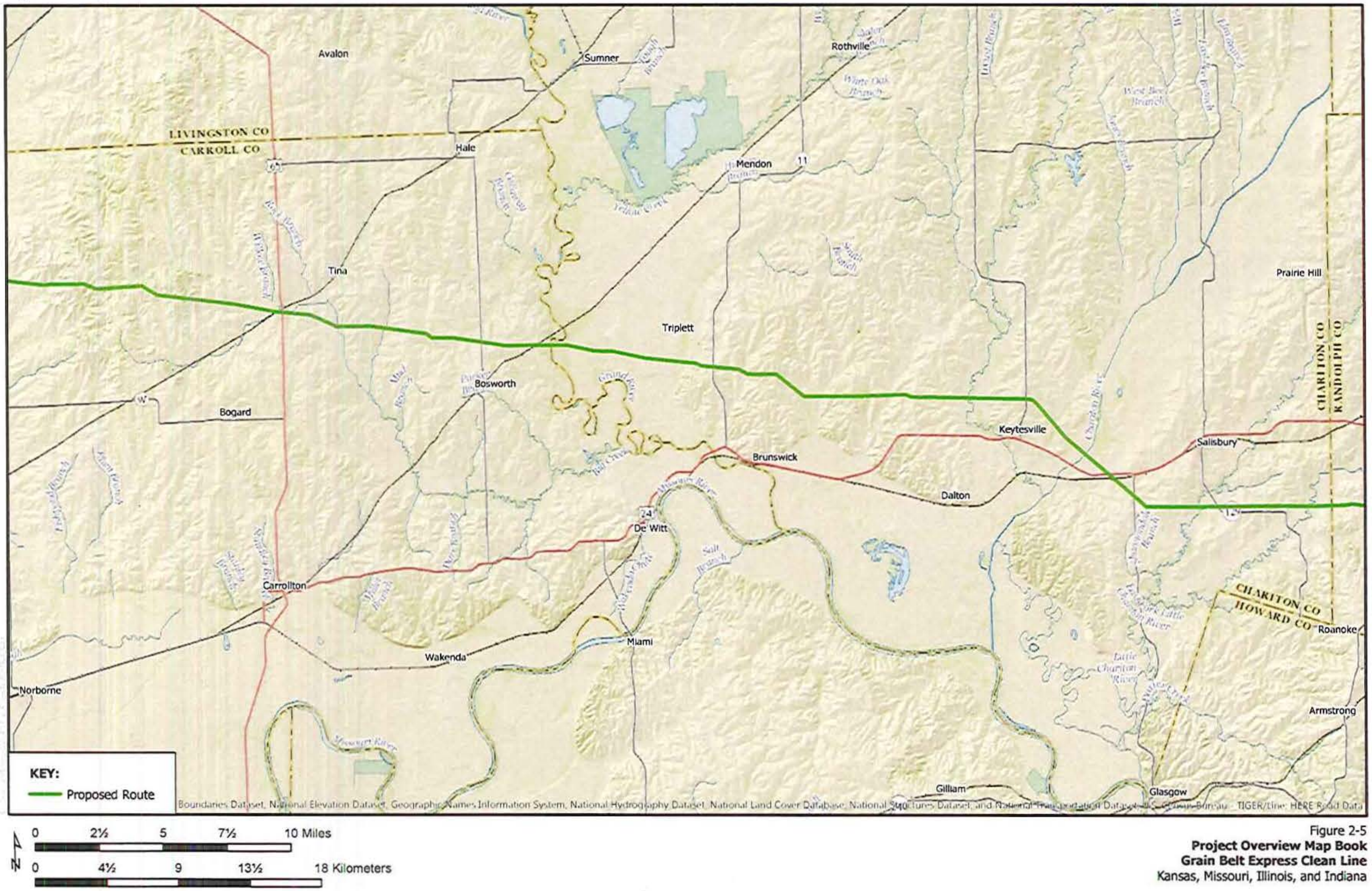
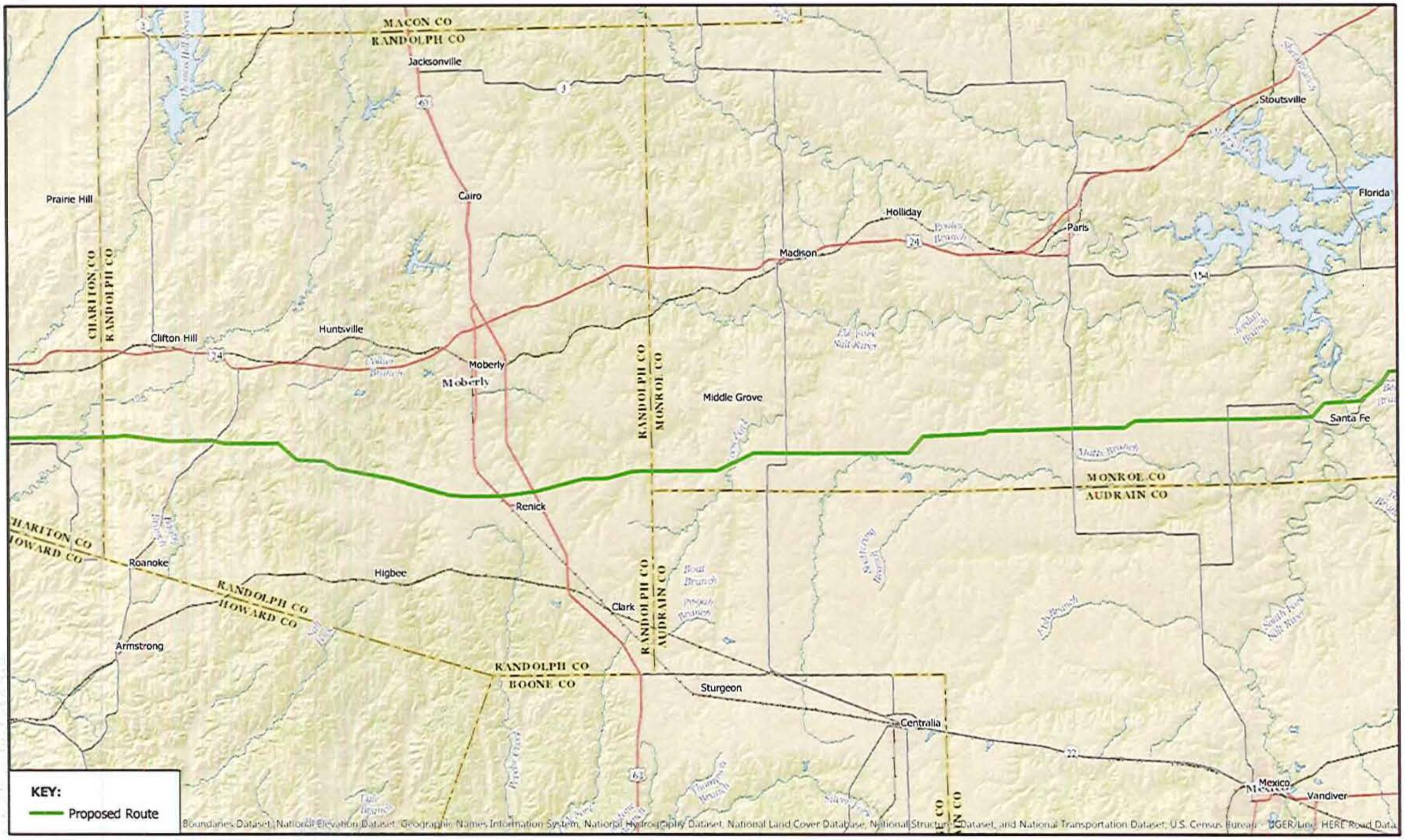


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

Schedule TFS-4

GRAIN BELT EXPRESS
CLEAN LINE



0 2½ 5 7½ 10 Miles

0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

GRAIN BELT EXPRESS
CLEAN LINE

Schedule TFS-4

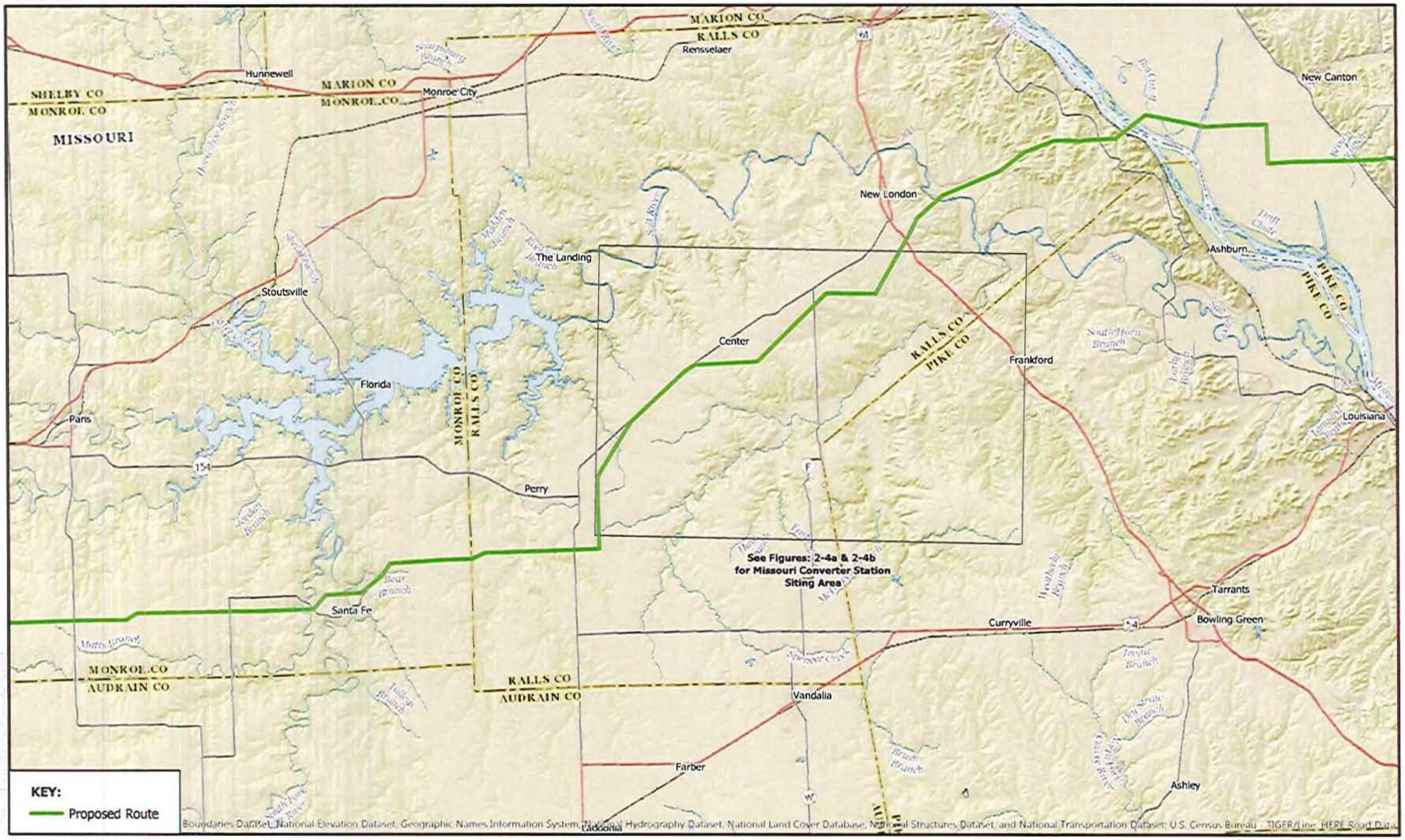


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

GRAIN BELT EXPRESS
CLEAN LINE

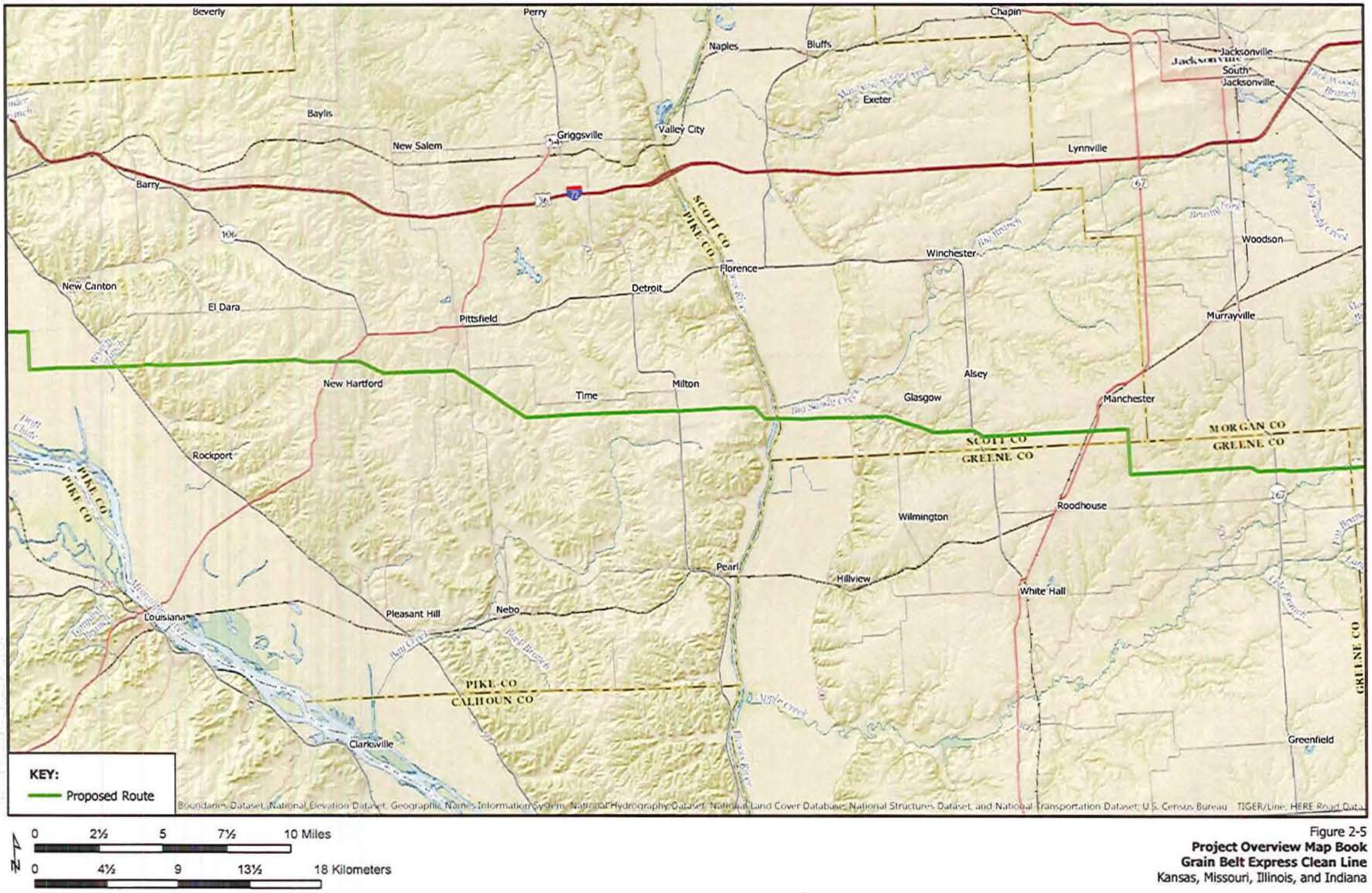
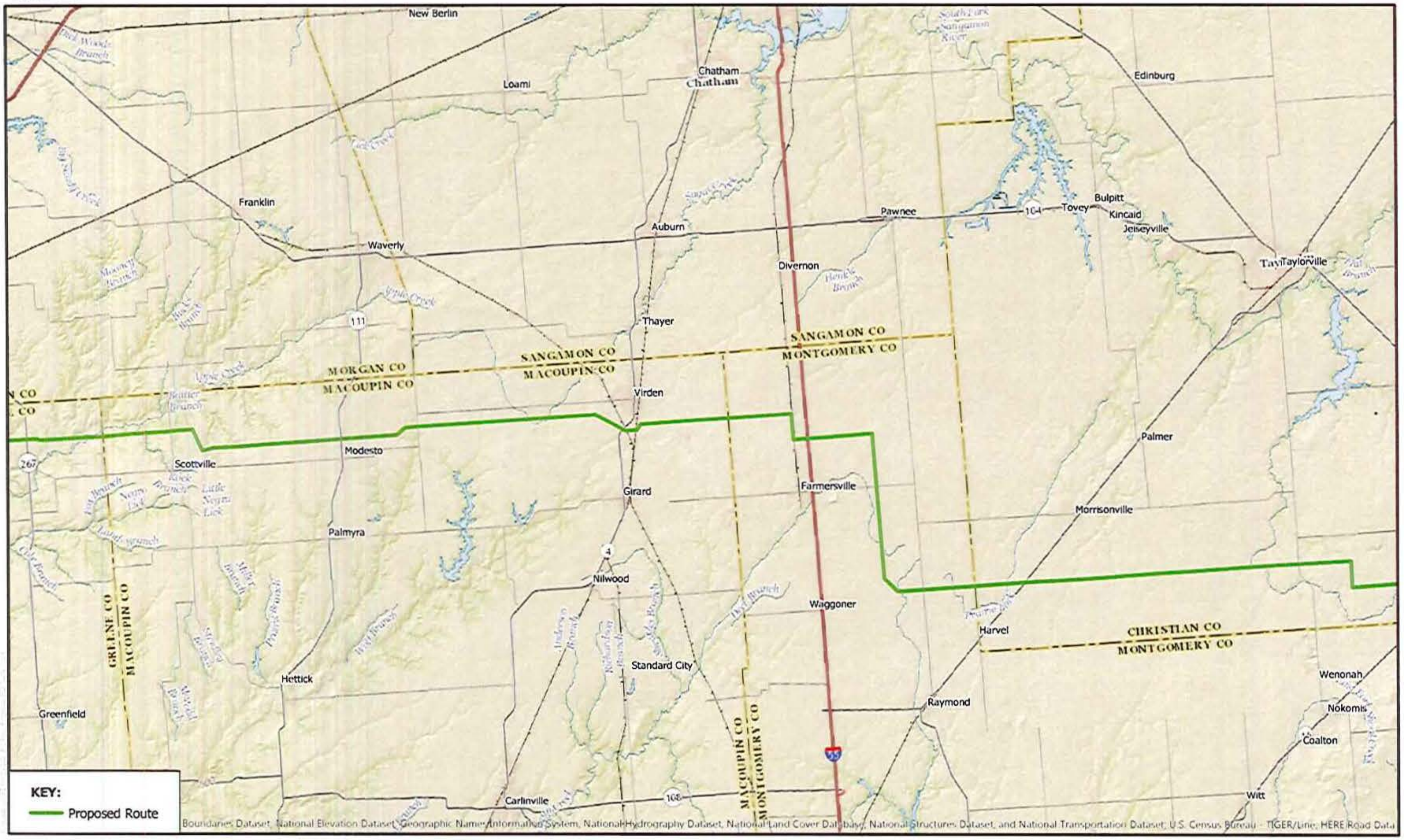


Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

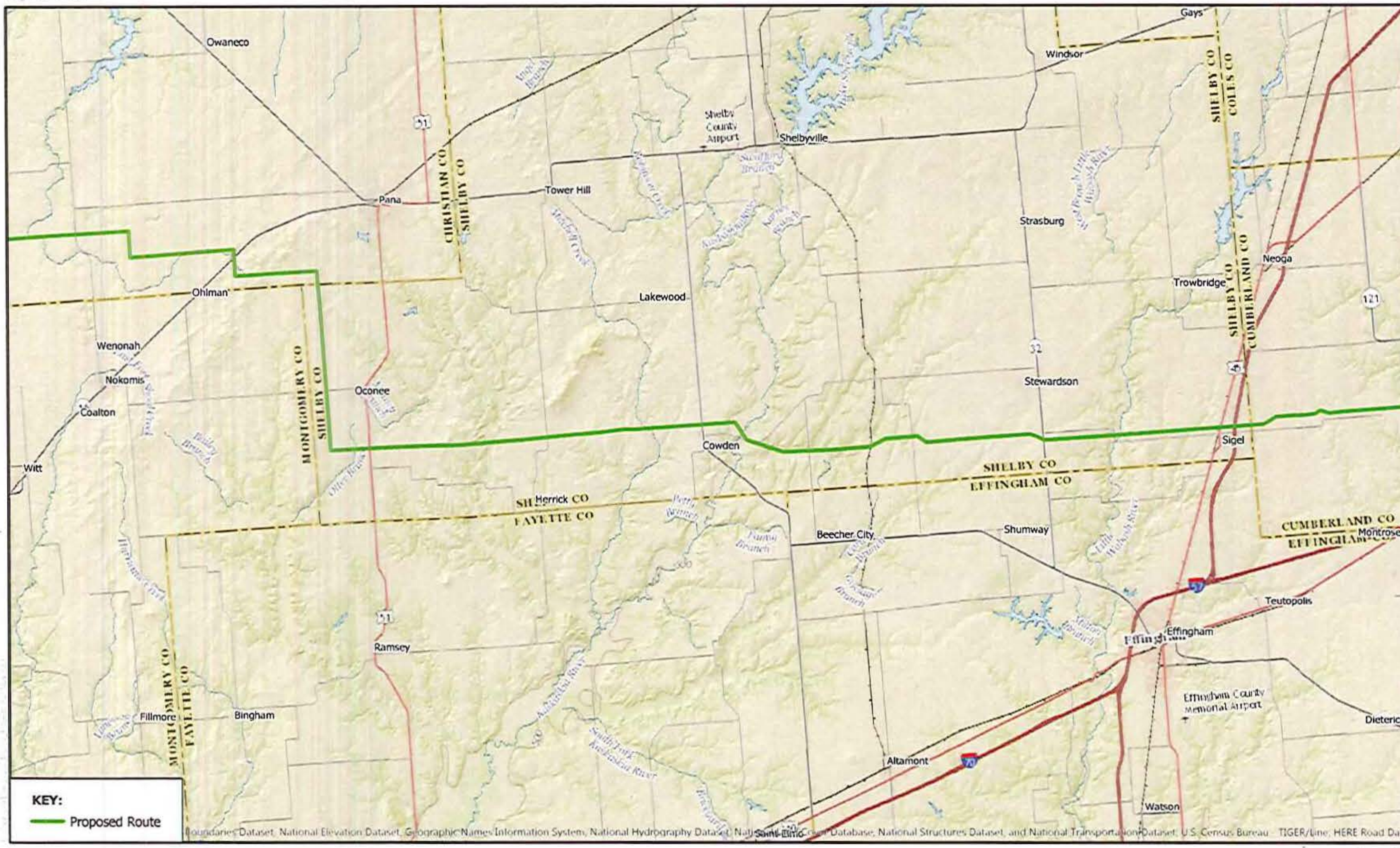
GRAIN BELT EXPRESS
CLEAN LINE



0 2½ 5 7½ 10 Miles

0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

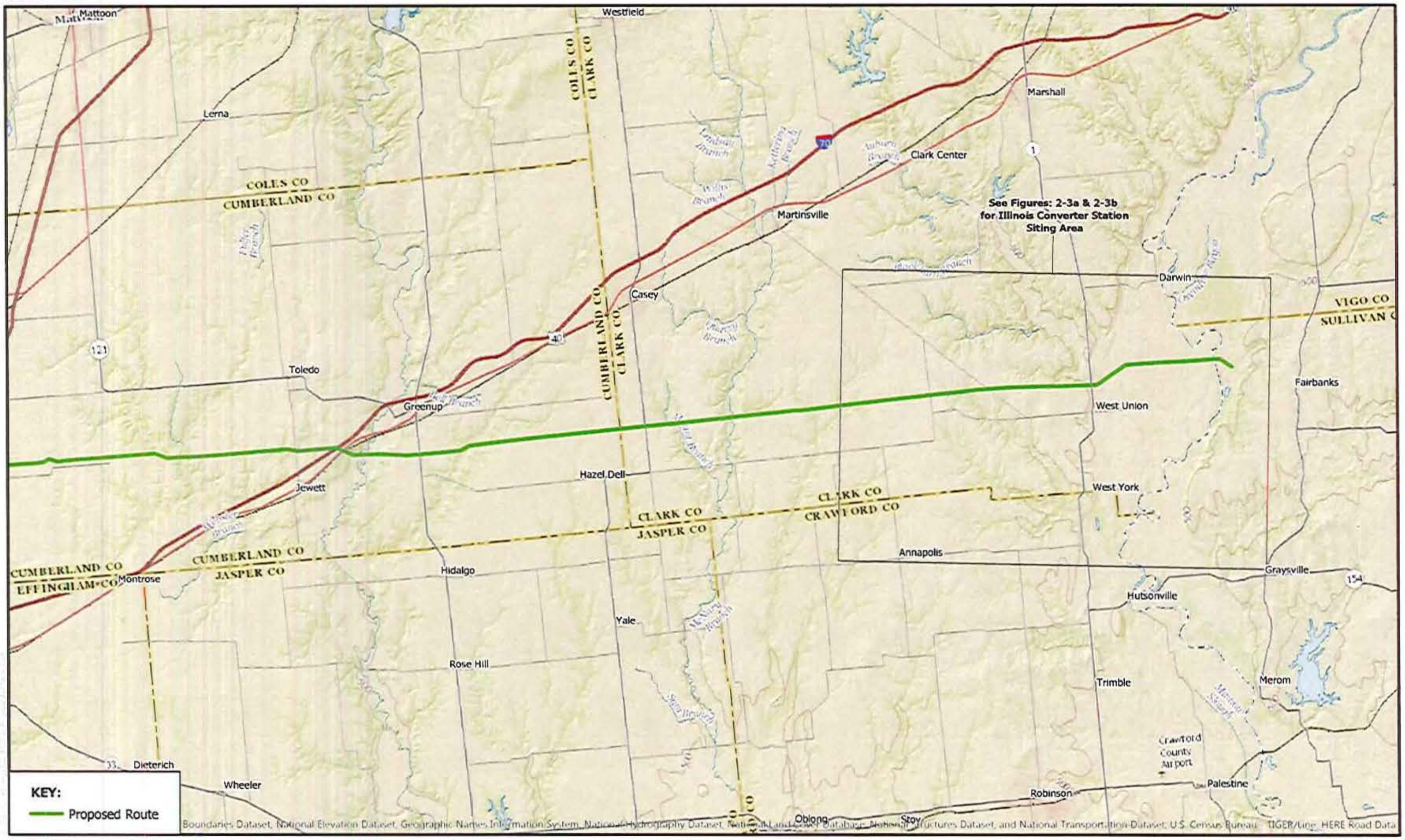


0 2½ 5 7½ 10 Miles

0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

GRAIN BELT EXPRESS
CLEAN LINE



0 2½ 5 7½ 10 Miles

0 4½ 9 13½ 18 Kilometers

Figure 2-5
Project Overview Map Book
Grain Belt Express Clean Line
Kansas, Missouri, Illinois, and Indiana

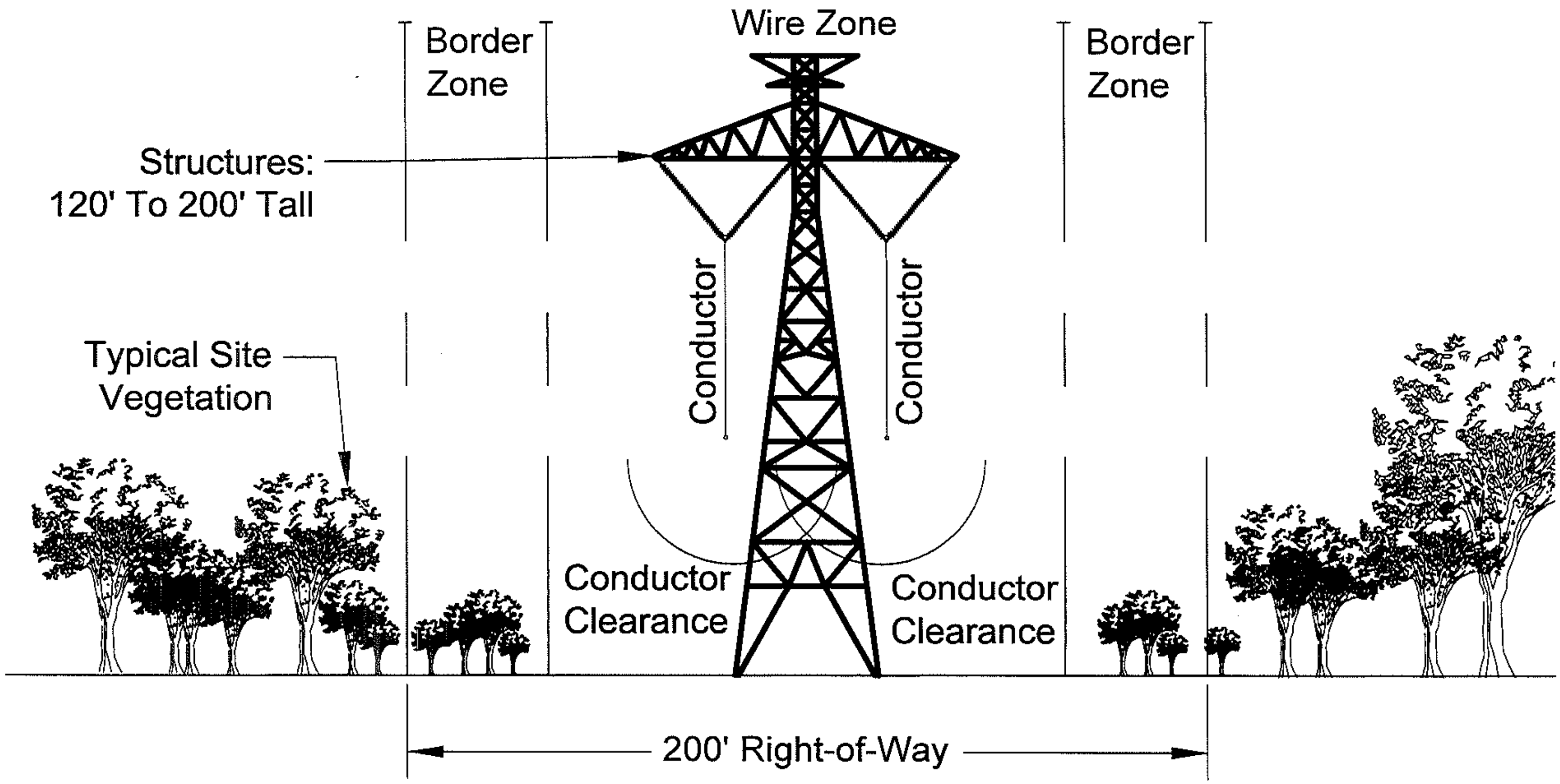


Figure 2-6

DC R.O.W. Limits

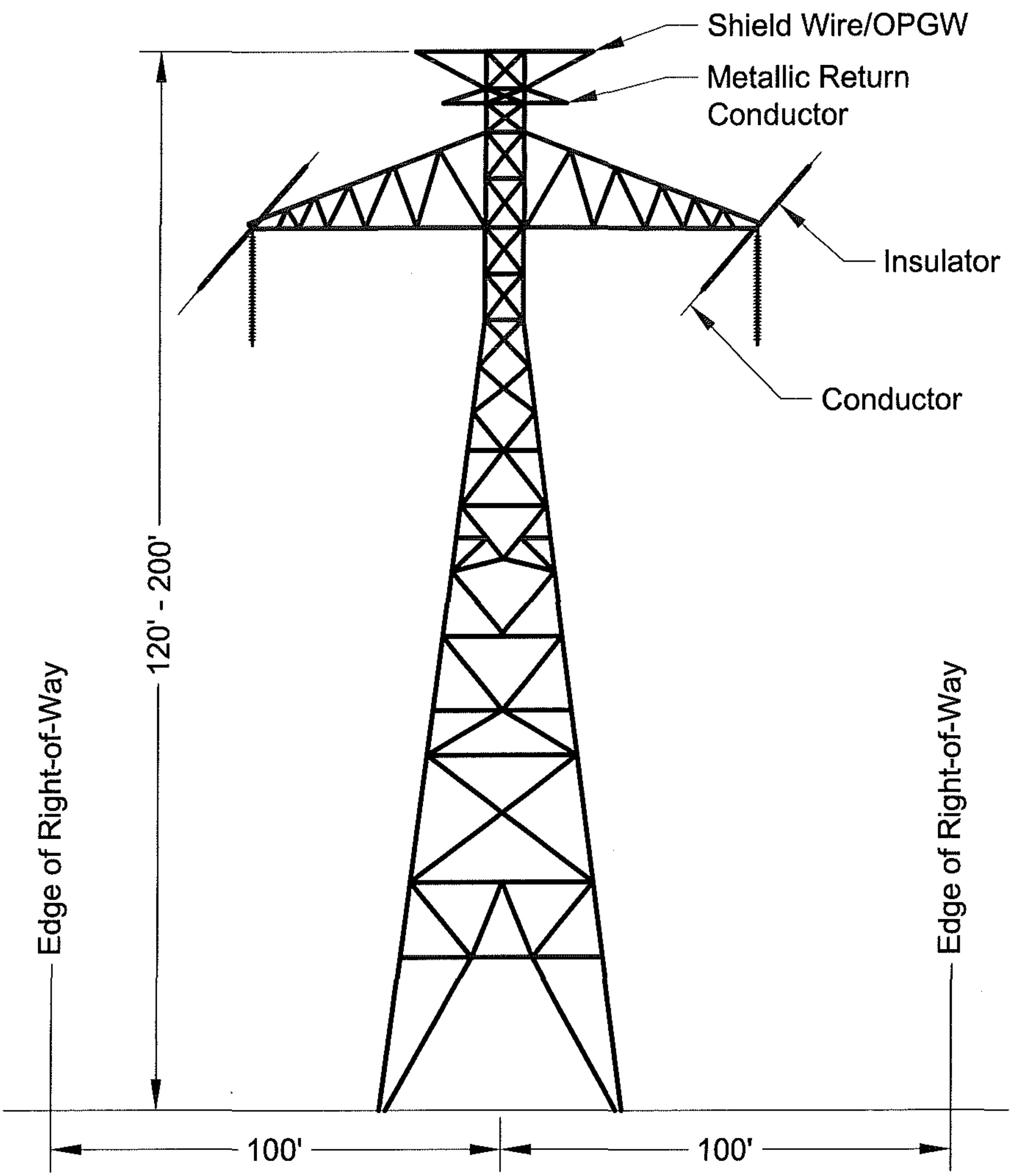


Figure 2-7a

600kV Lattice Deadend

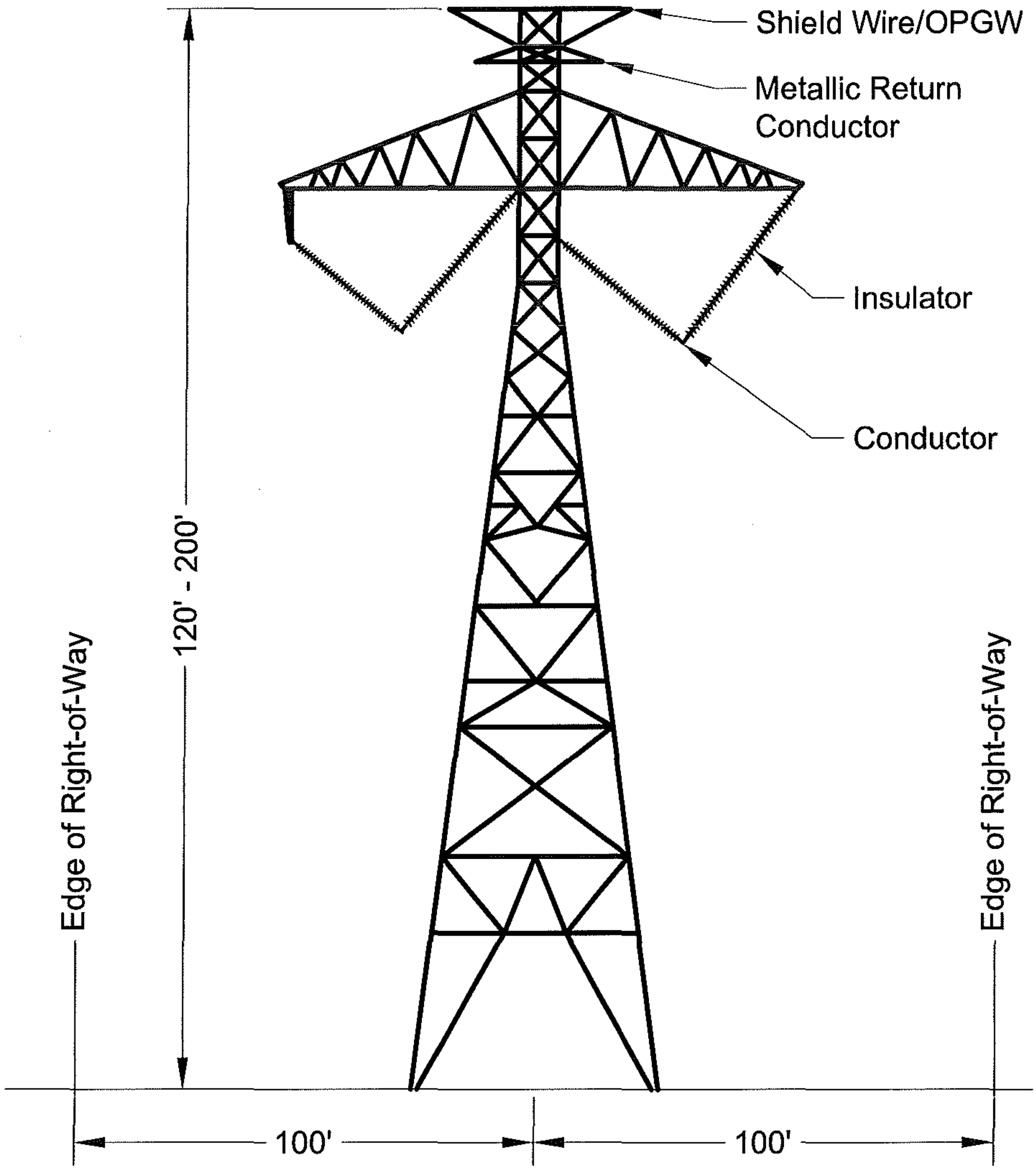


Figure 2-7b

600kV Lattice Running Angle

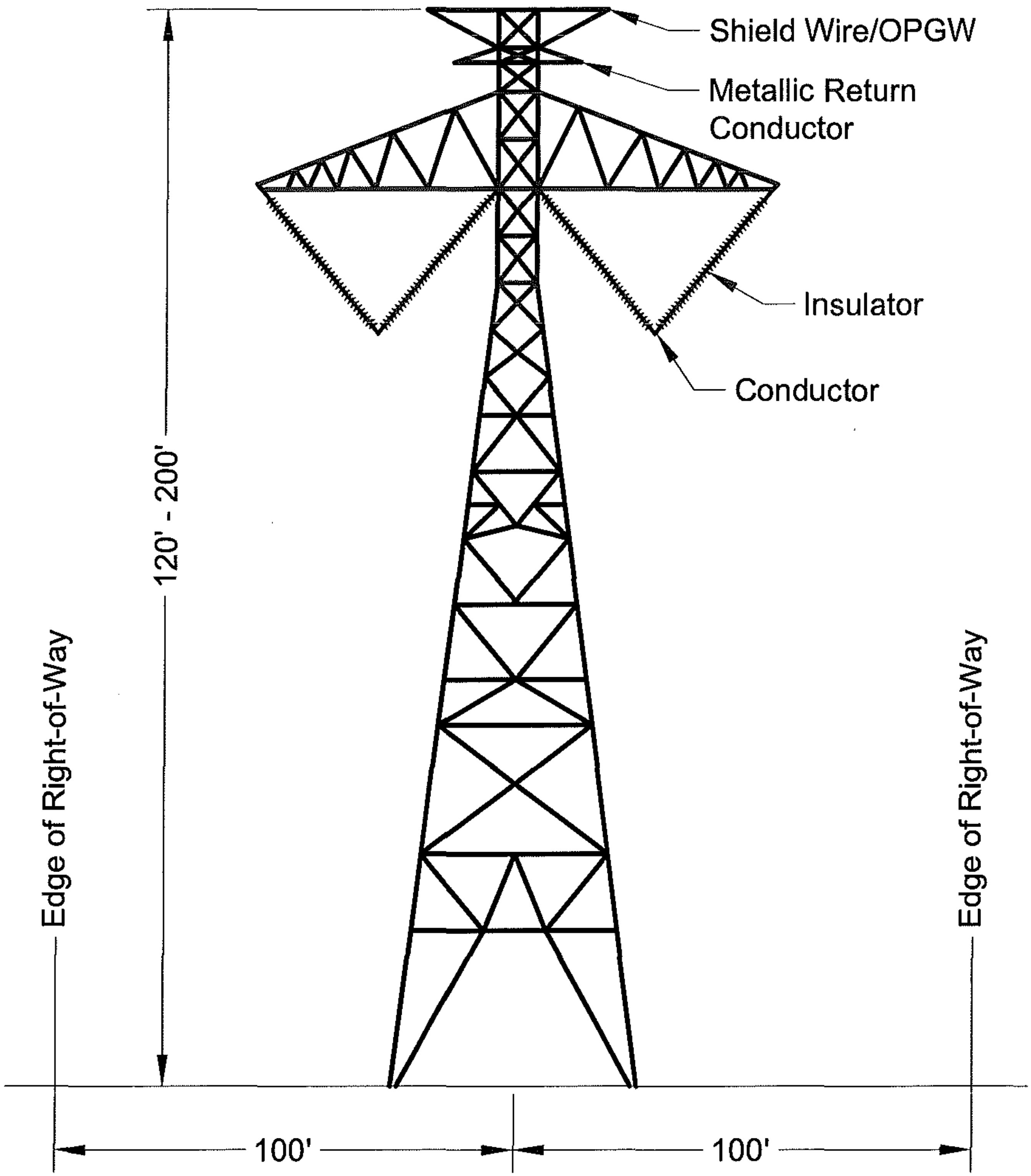


Figure 2-7c

600kV Lattice Tangent

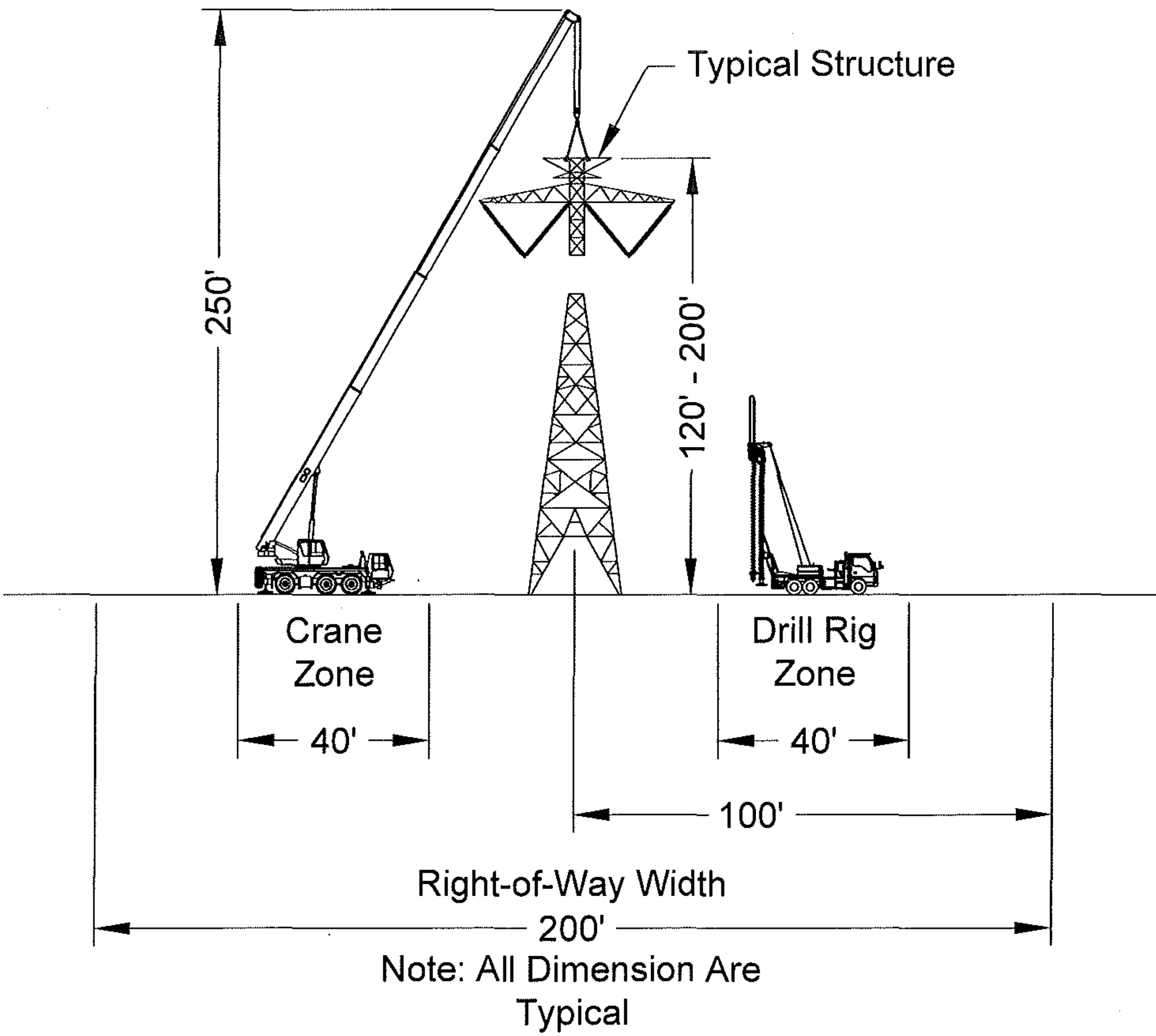
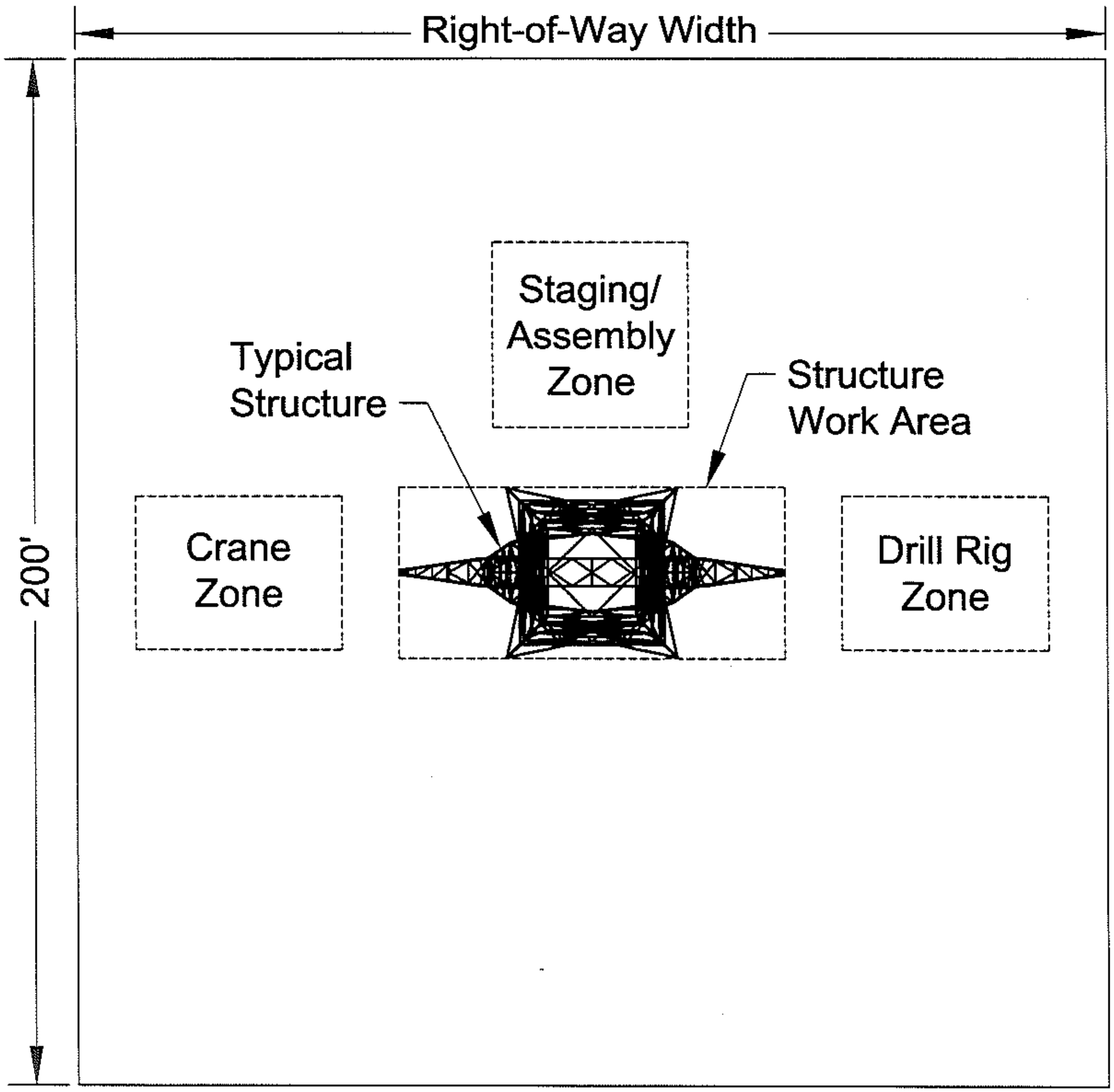


Figure 2-8

600kV DC Lattice Work Area



Not To Scale

Figure 2-9

600kV DC Lattice Foundation and Structure Construction Activities - Plan View

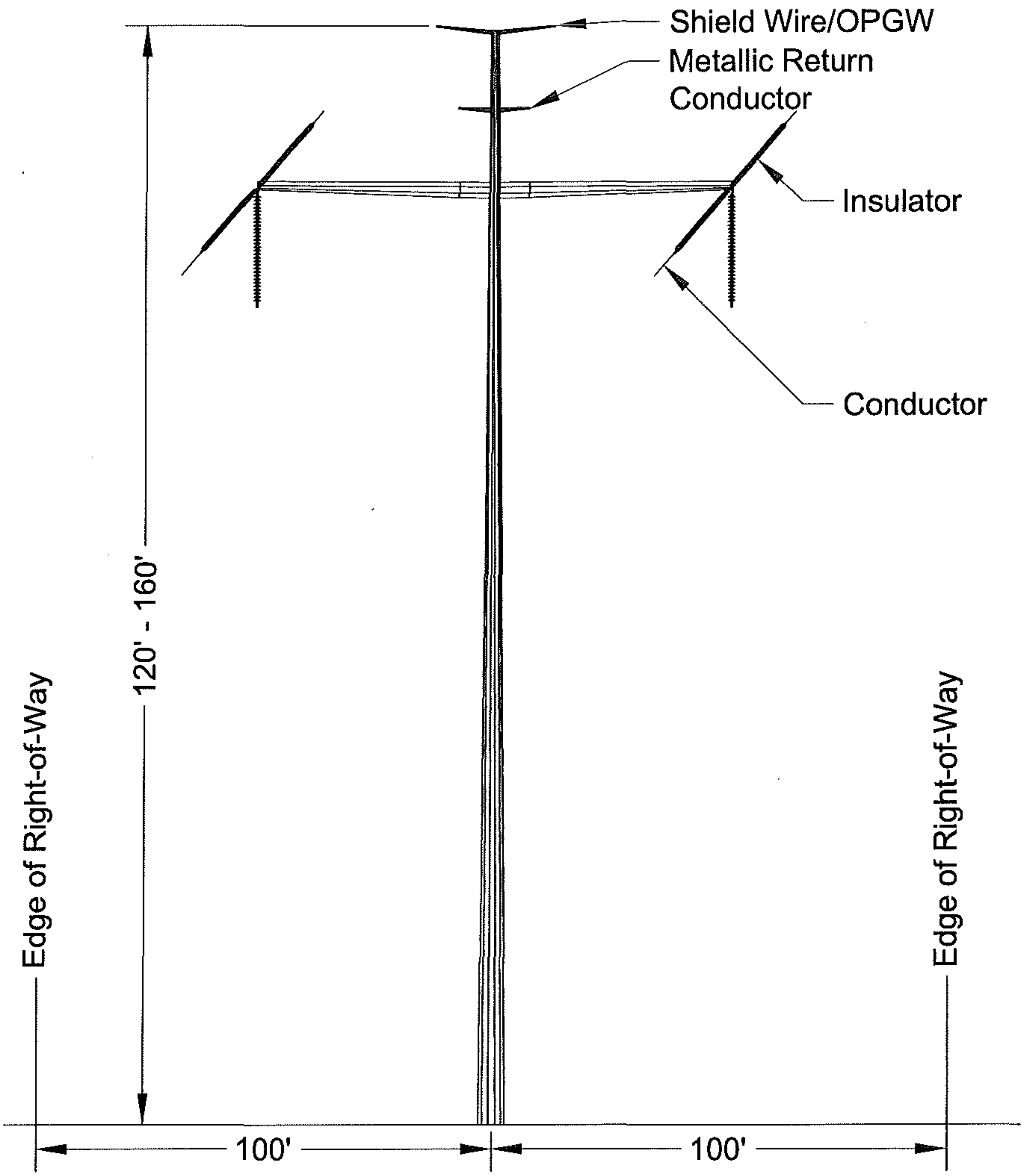


Figure 2-10a

600kV Monopole Deadend

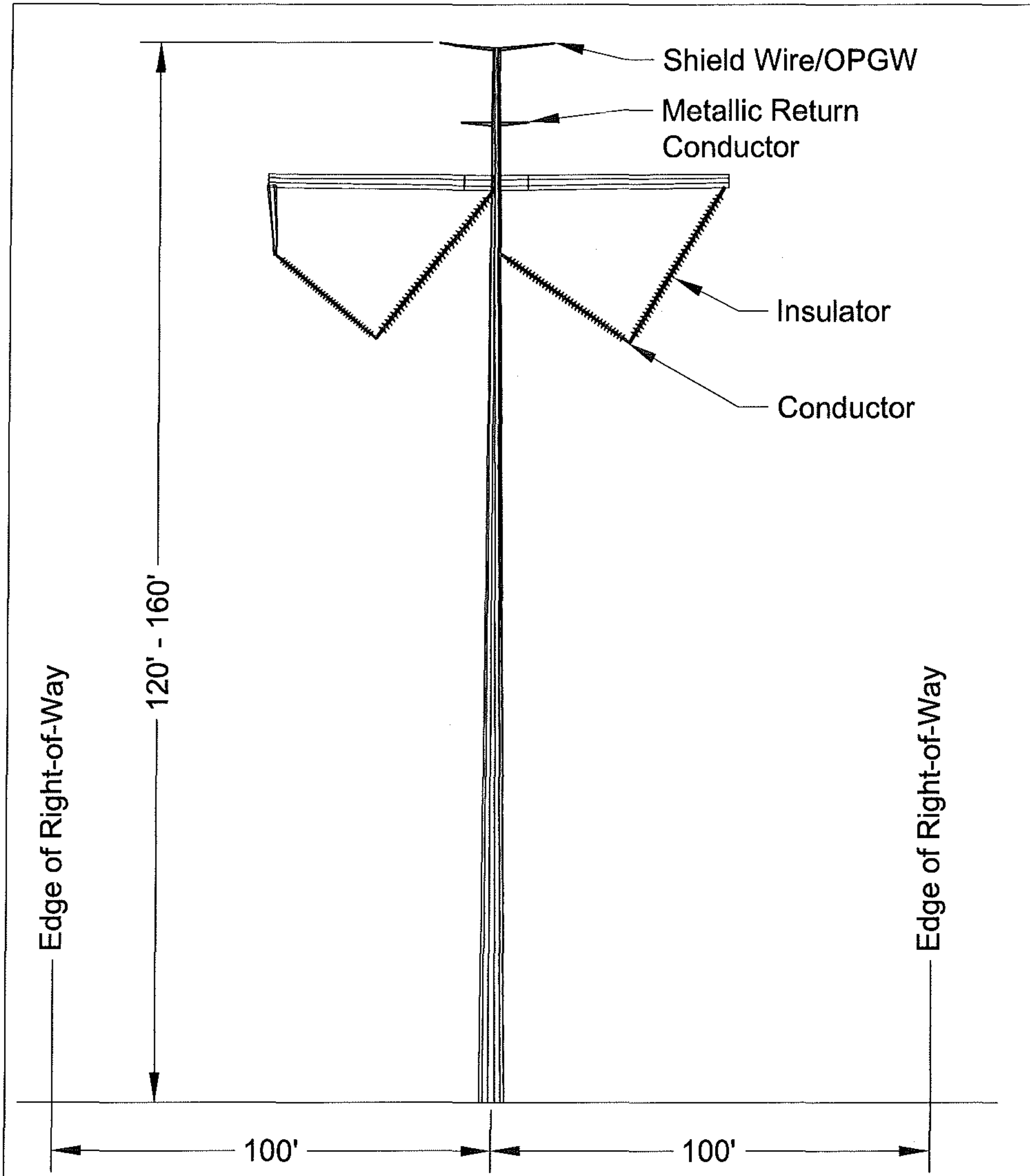


Figure 2-10b

600kV Monopole Running Angle

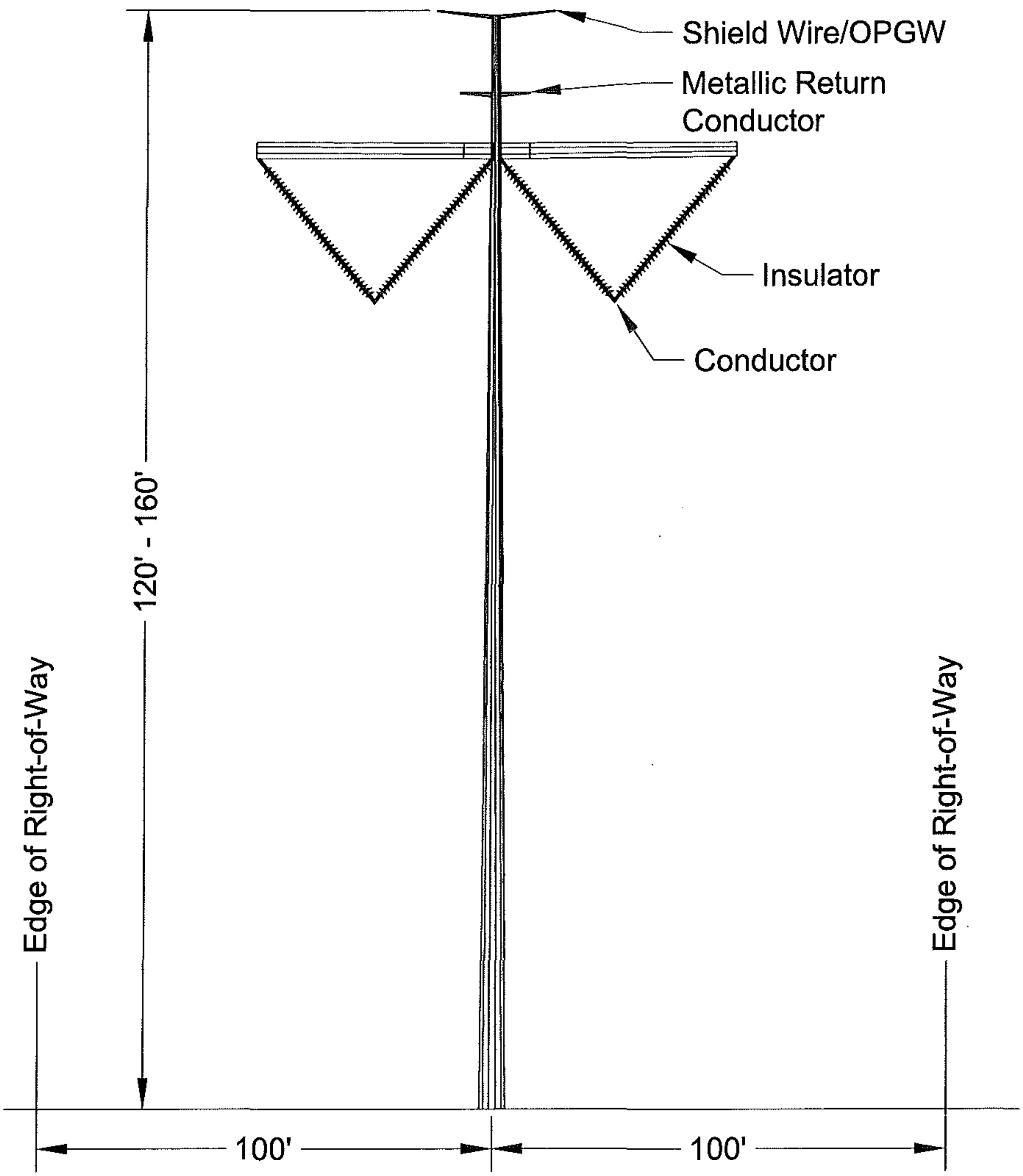


Figure 2-10c

600kV Monopole Tangent

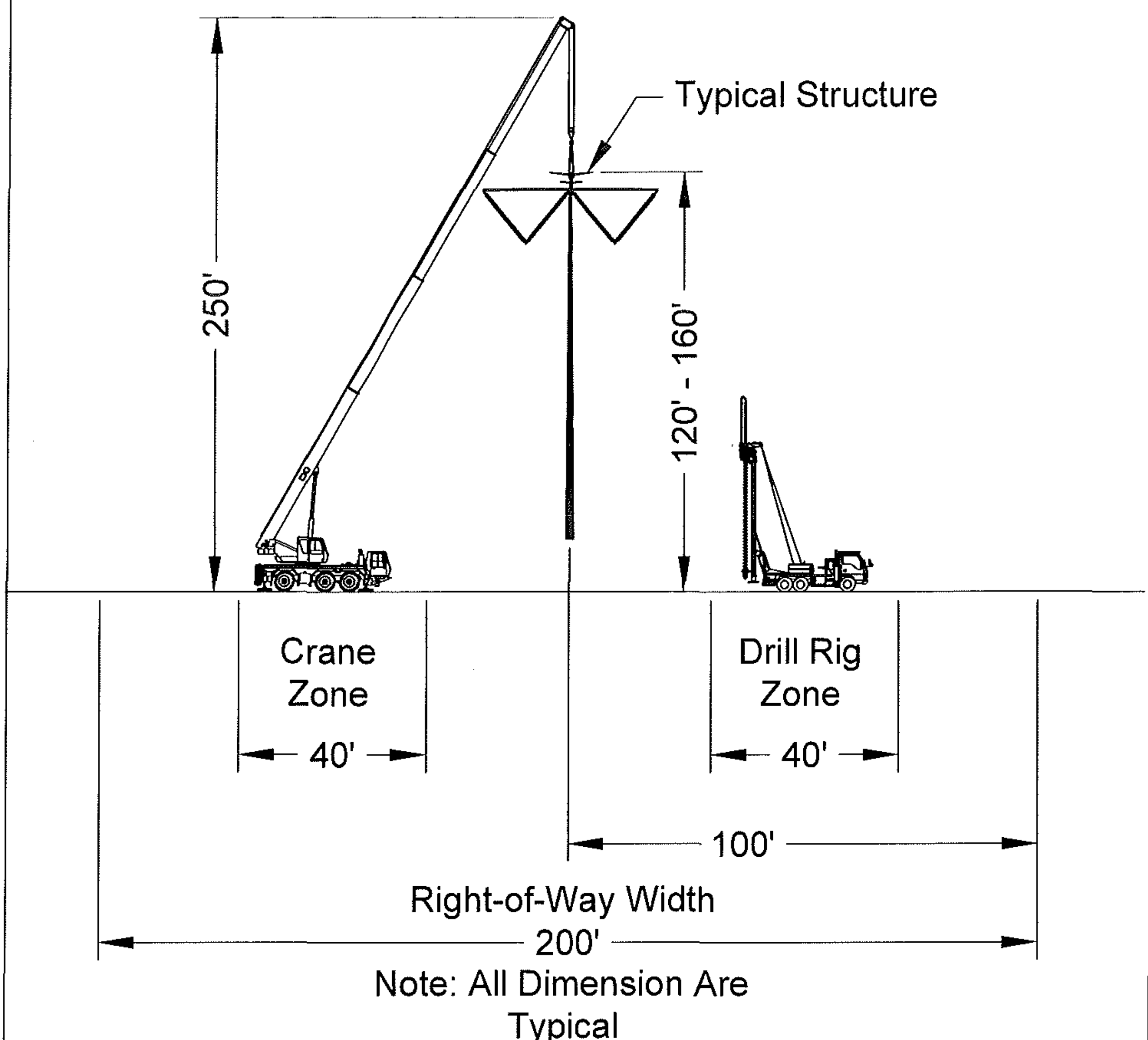
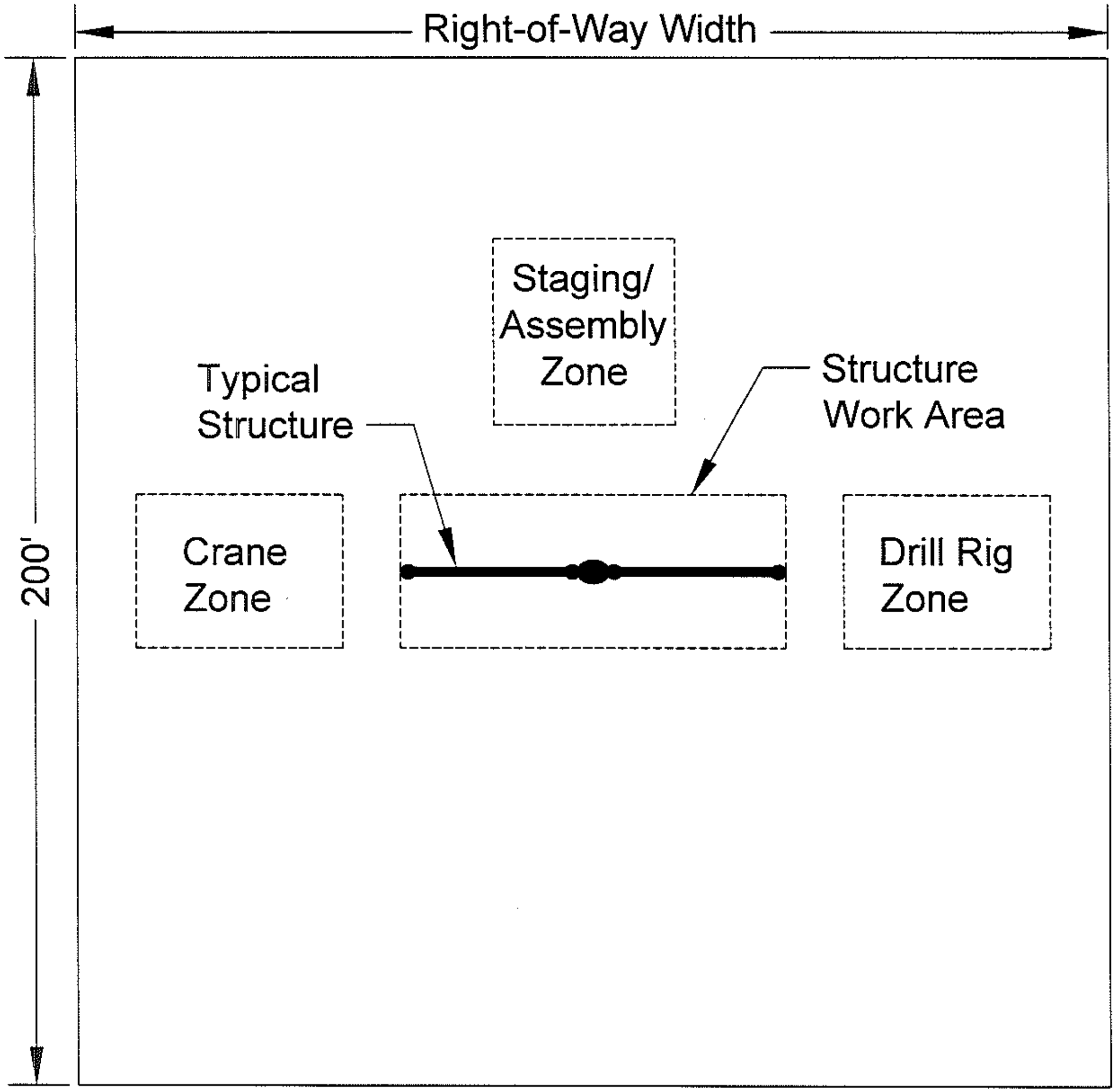


Figure 2-11

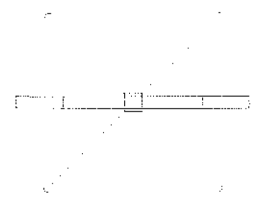
600kV DC Monopole Work Area



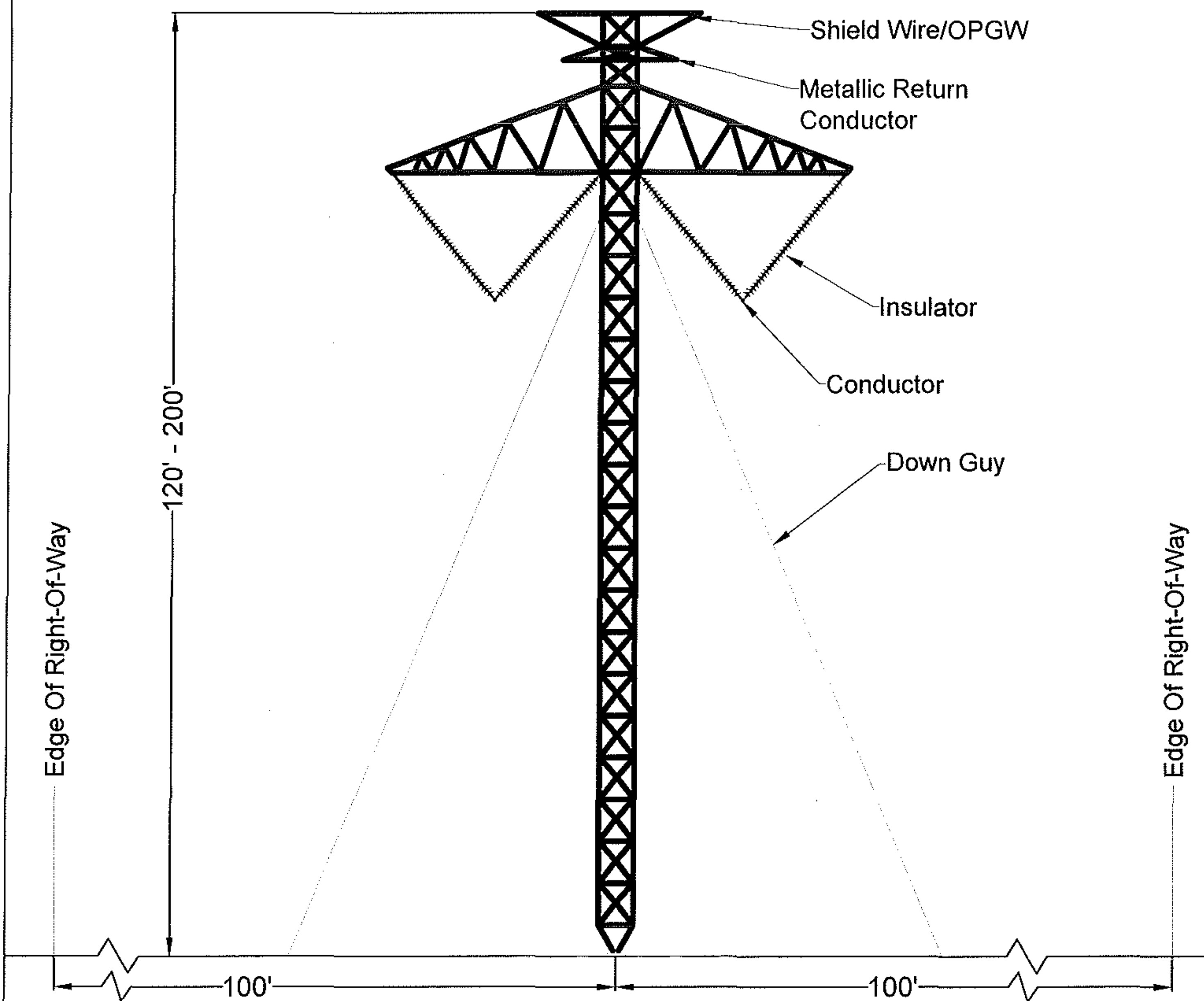
Not To Scale

Figure 2-12

600kV DC Monopole Foundation and Structure Construction Activities - Plan View



PLAN VIEW



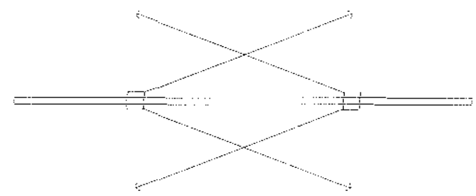
ELEVATION VIEW

NOT TO SCALE

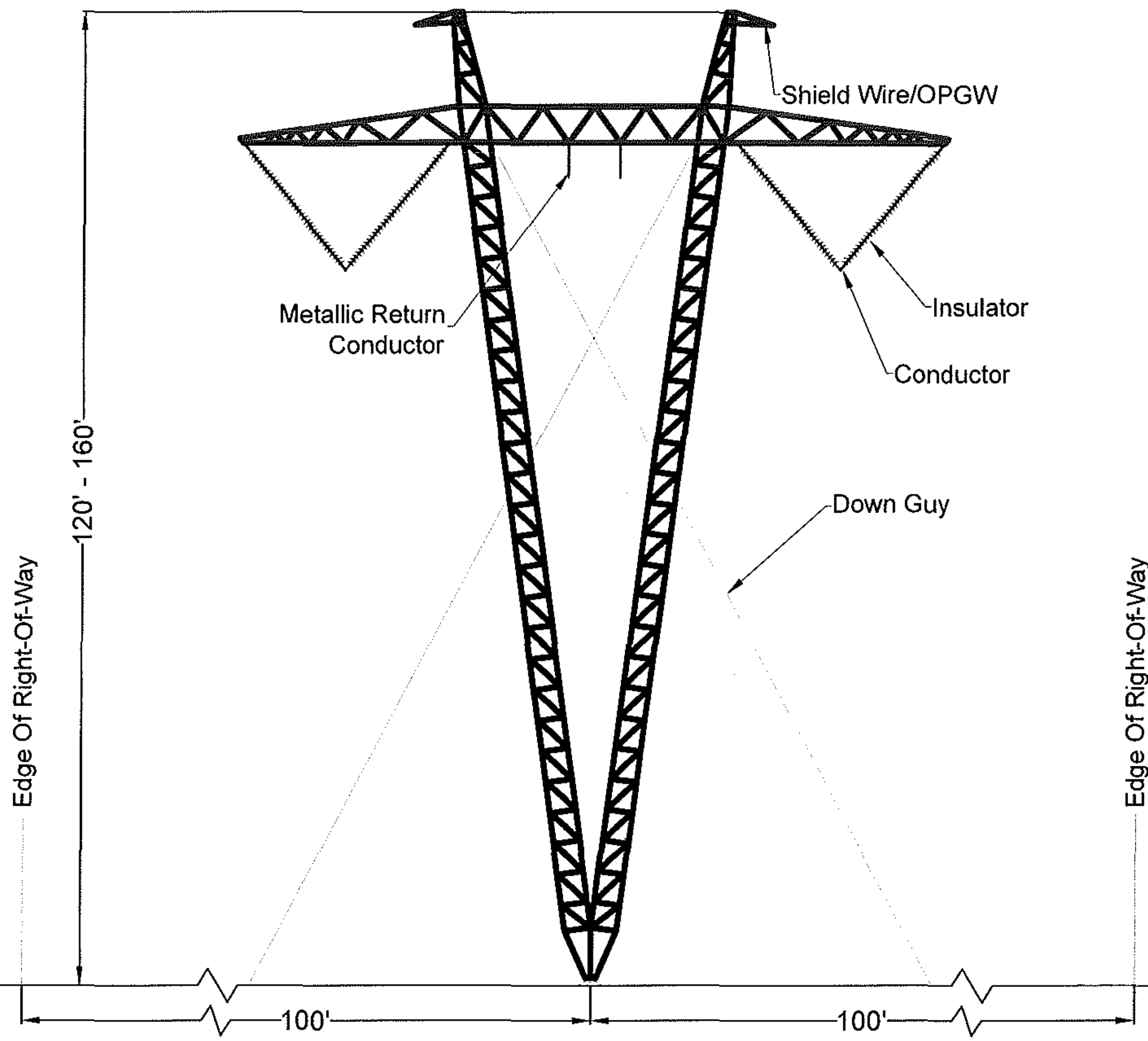
NOTE:
DEPENDING ON STRUCTURE HEIGHT AND LINE ANGLE, GUY EASEMENTS MAY BE REQUIRED BEYOND THE PROJECT 200 FOOT RIGHT-OF-WAY.

Figure 2-13

600kV Guyed Mast Lattice Tangent



PLAN VIEW



ELEVATION VIEW

NOT TO SCALE

NOTE:
DEPENDING ON STRUCTURE HEIGHT AND LINE ANGLE, GUY EASEMENTS MAY BE REQUIRED BEYOND THE PROJECT 200 FOOT RIGHT-OF-WAY.

Figure 2-14

600kV Guyed V-Lattice Tangent

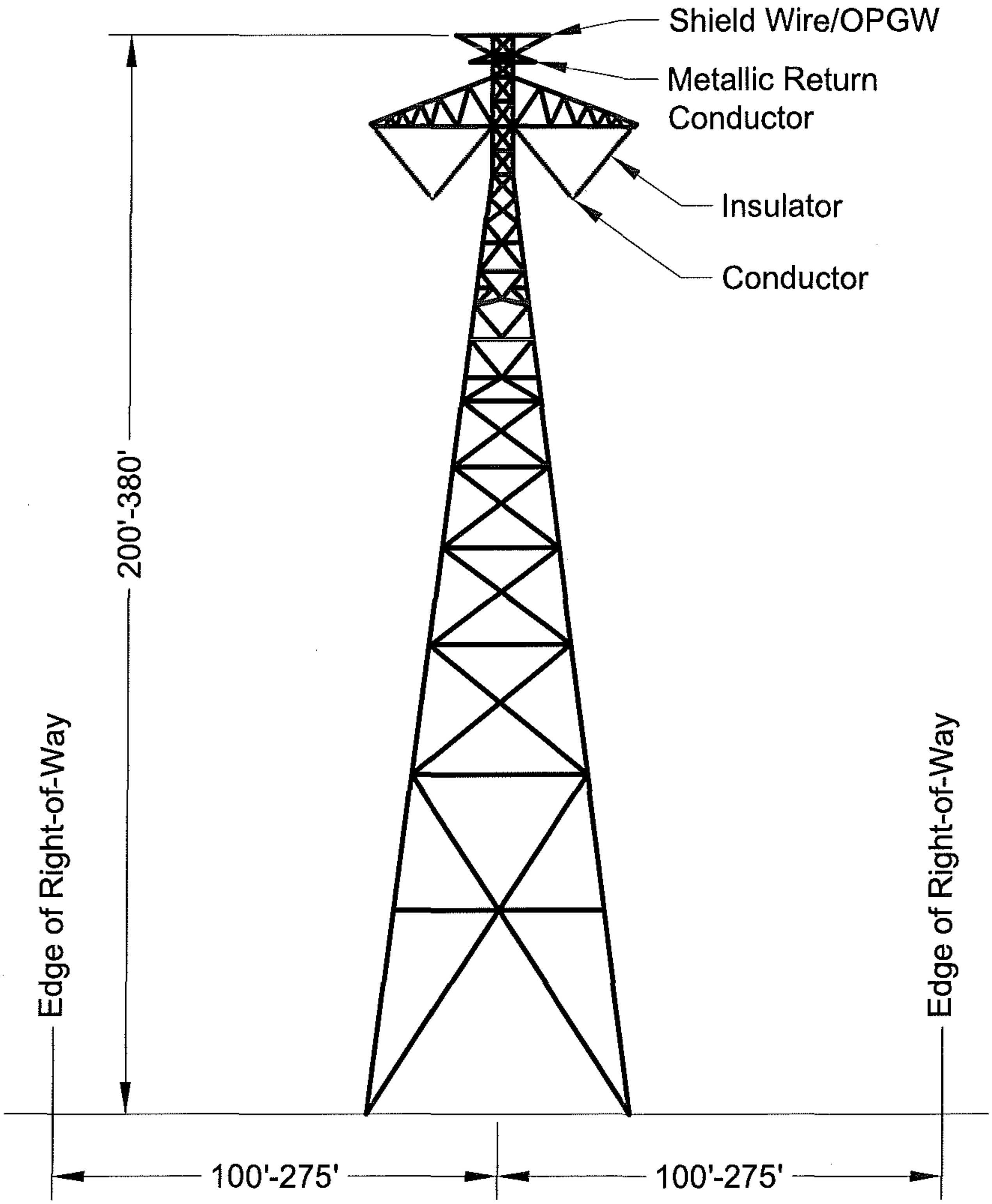


Figure 2-15

600kV Lattice Crossing Structure

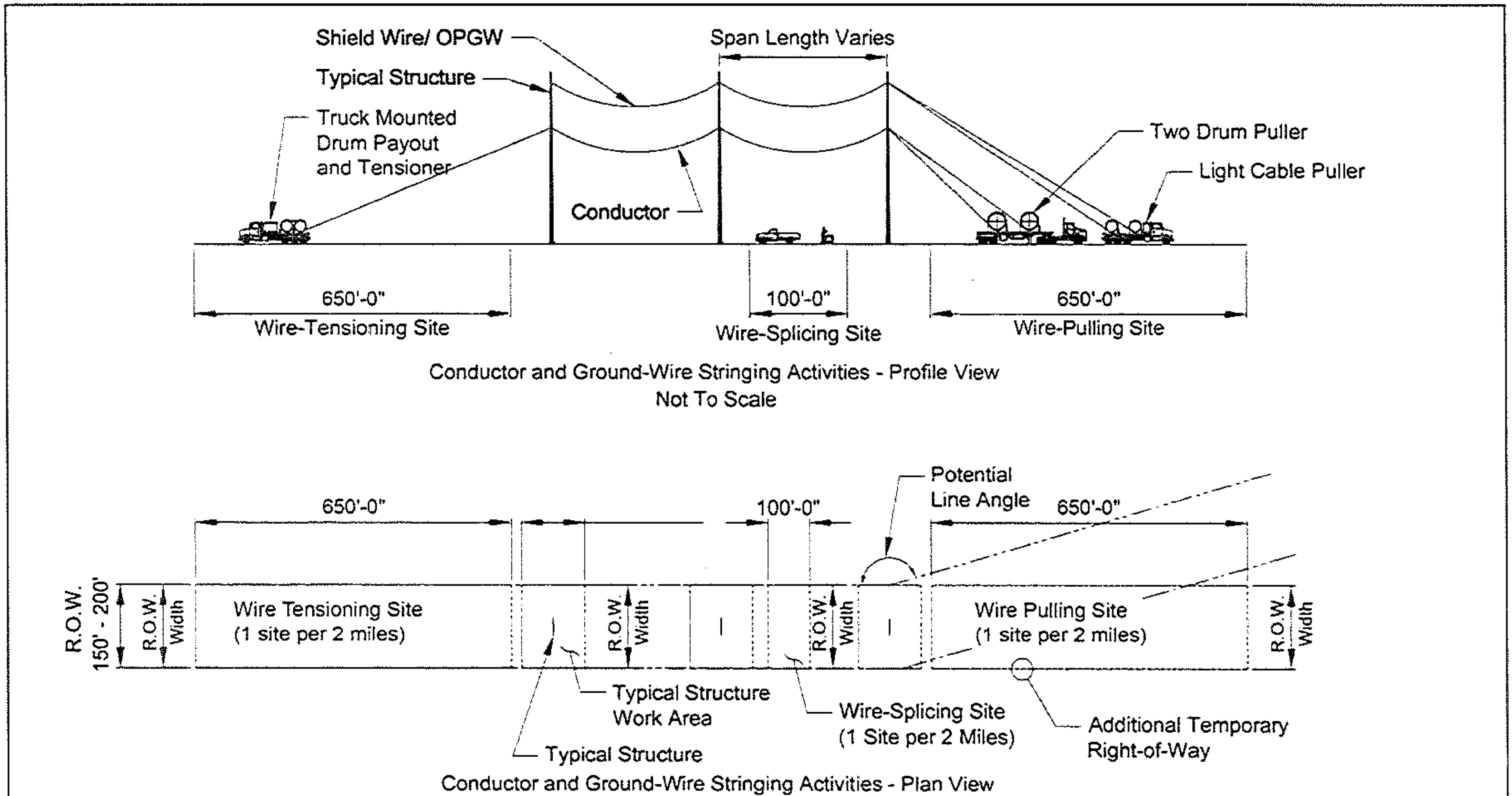


Figure 2-16

Conductor and Ground-Wire Stringing Activities

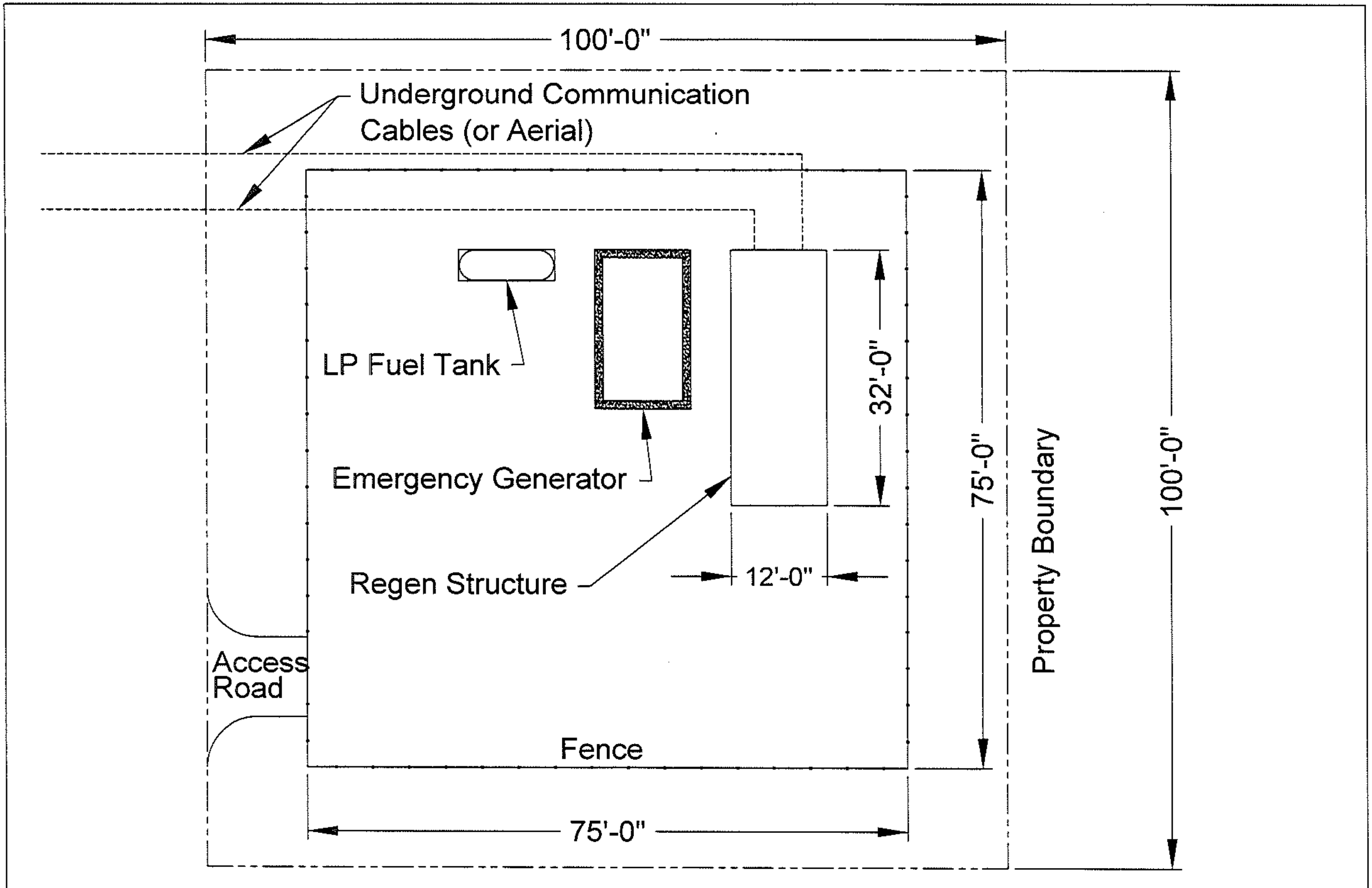
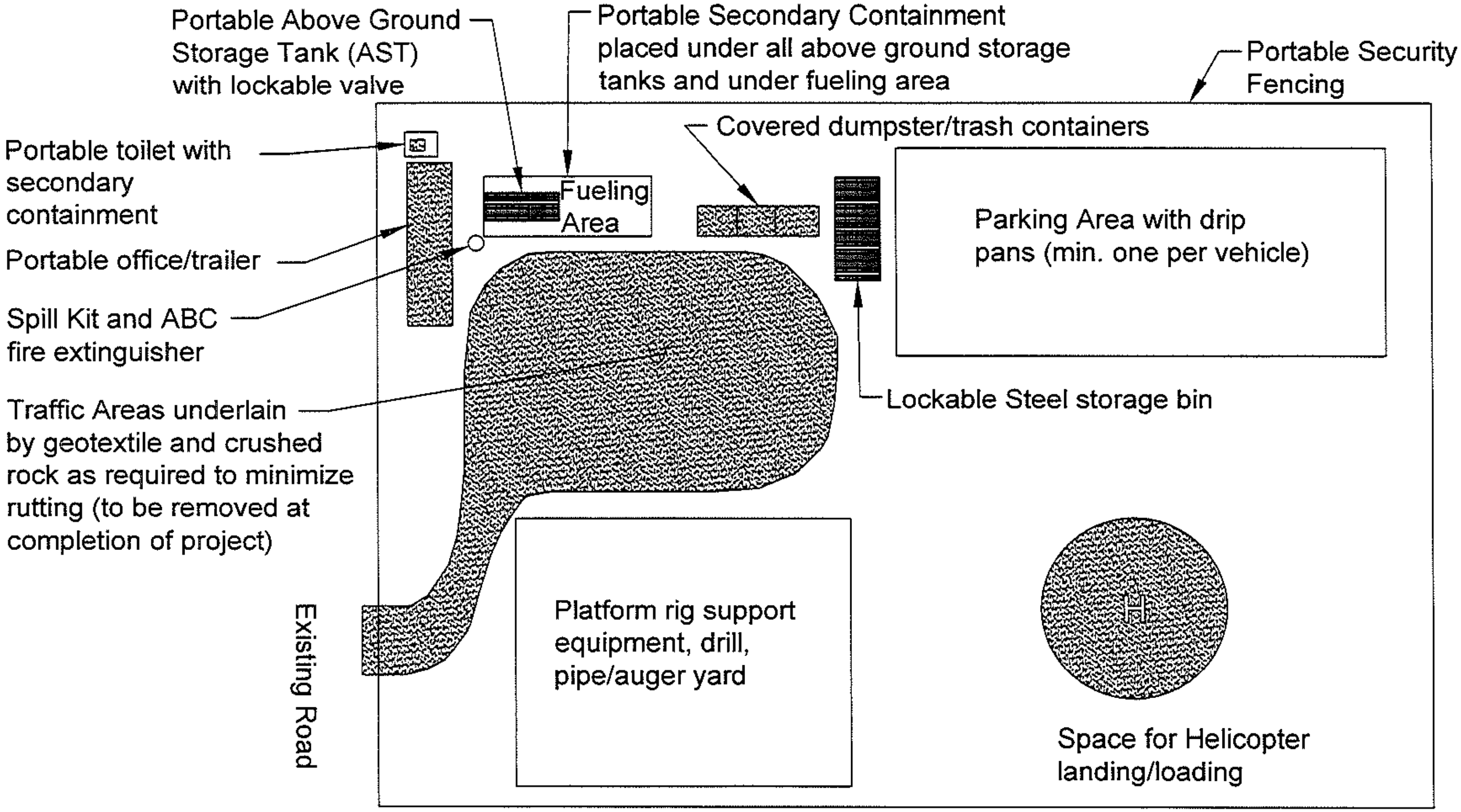


Figure 2-17

Regeneration Station Plan

Typical Multi-Use Construction Yard
Schematic Plan (Not To Scale)



Notes:

- Individual, Multi-Use Areas may be arranged differently but all sites will typically include areas designated for field office, crew parking and sanitation, waste management, fueling area, material storage, and equipment storage.
- Fuel trucks, maintenance trucks and construction crews will be based in Multi-Use Areas.
- Vehicle wash stations may be located at multi use yards.
- Multi-Use Areas can also be used as fly yards (landing areas for helicopters) when needed for assembly and
- erection of tower sections prior to transport to final structure location. Staging areas will be reclaimed unless otherwise directed by landowner by removing all element from the site, raking, repairing ruts and seeding disturbed areas.

Figure 2-18

Multi-Use Construction Yard

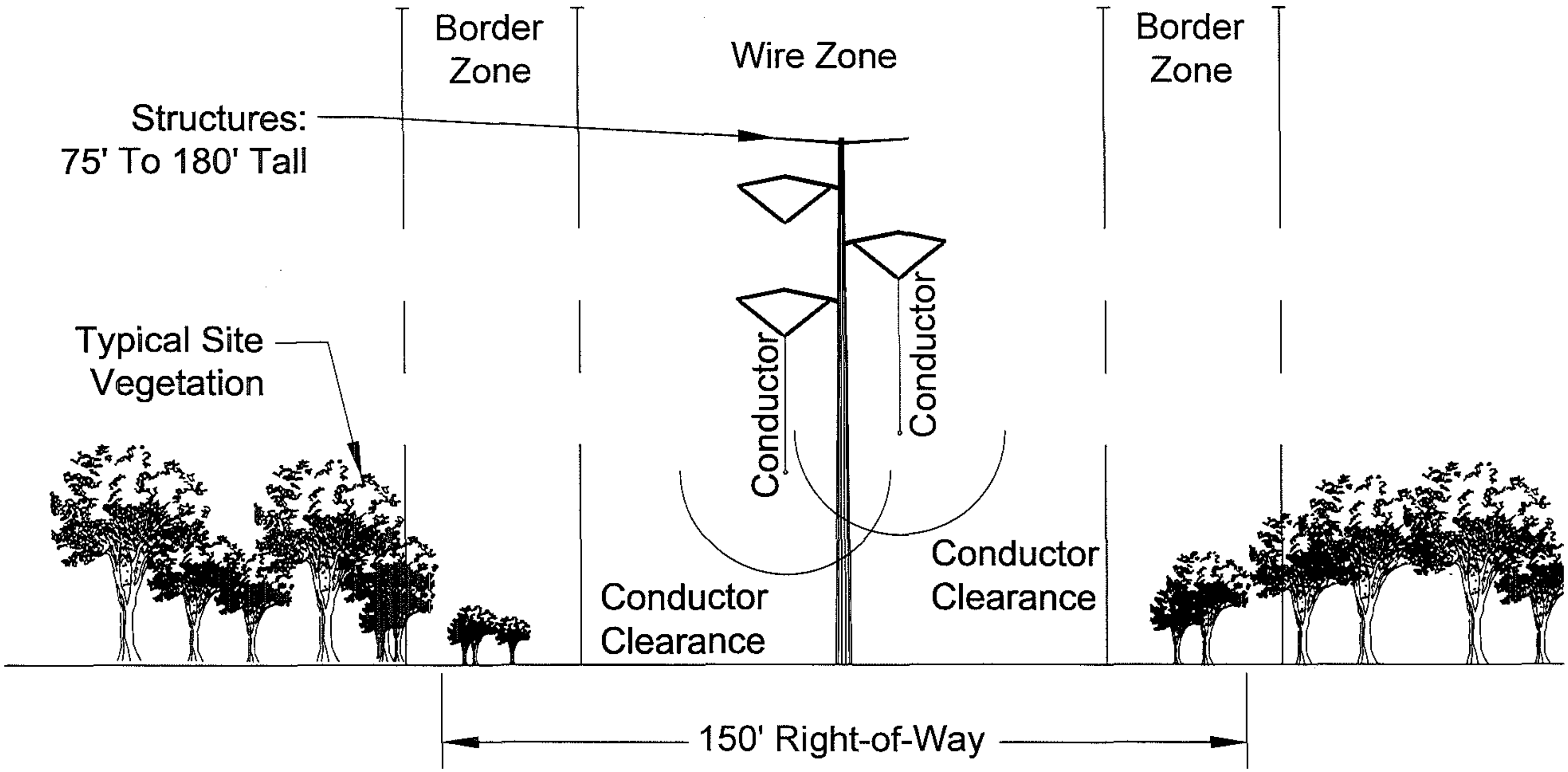


Figure 2-19

AC R.O.W. Limits

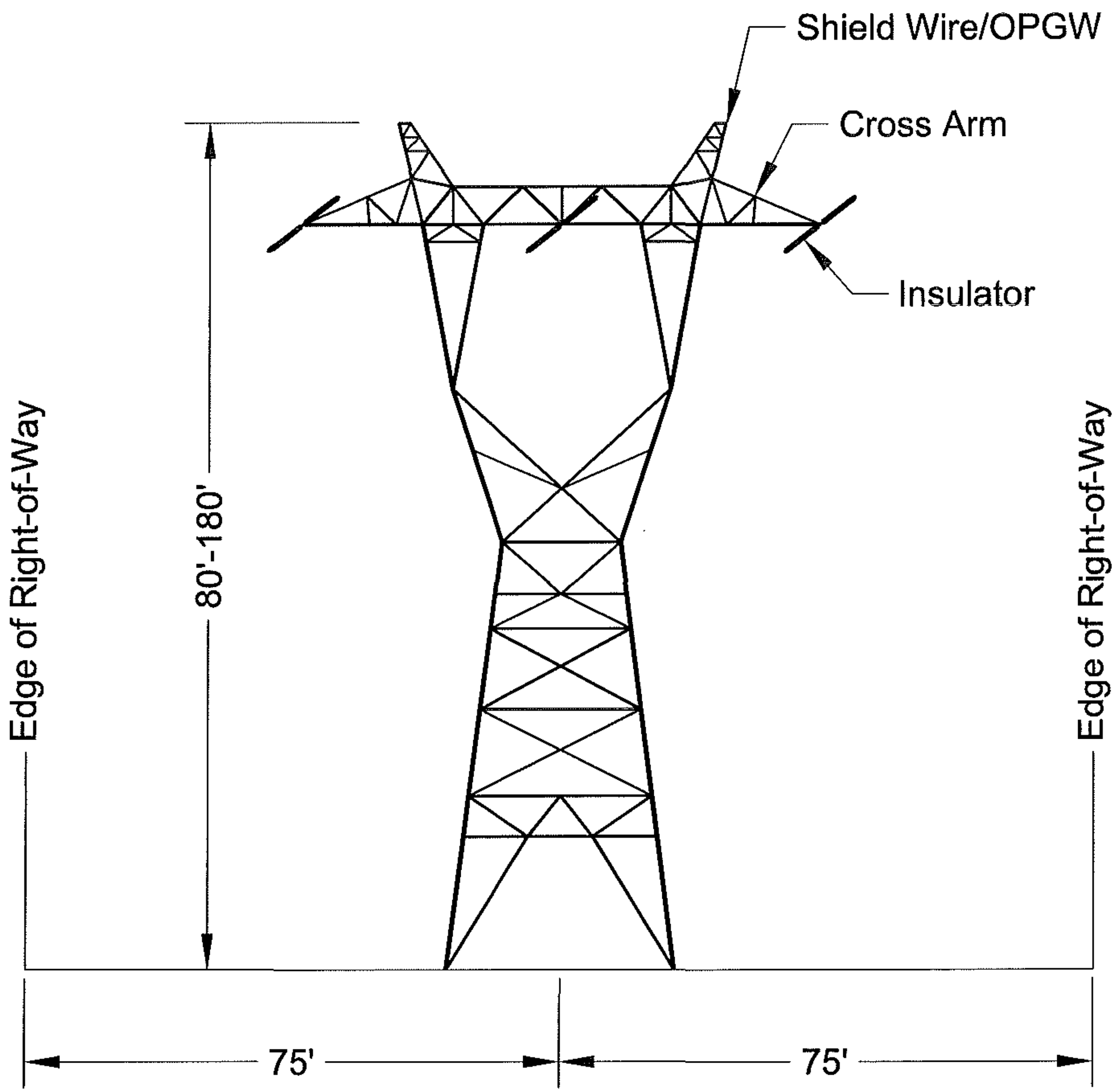


Figure 2-20a

345kV Lattice Deadend

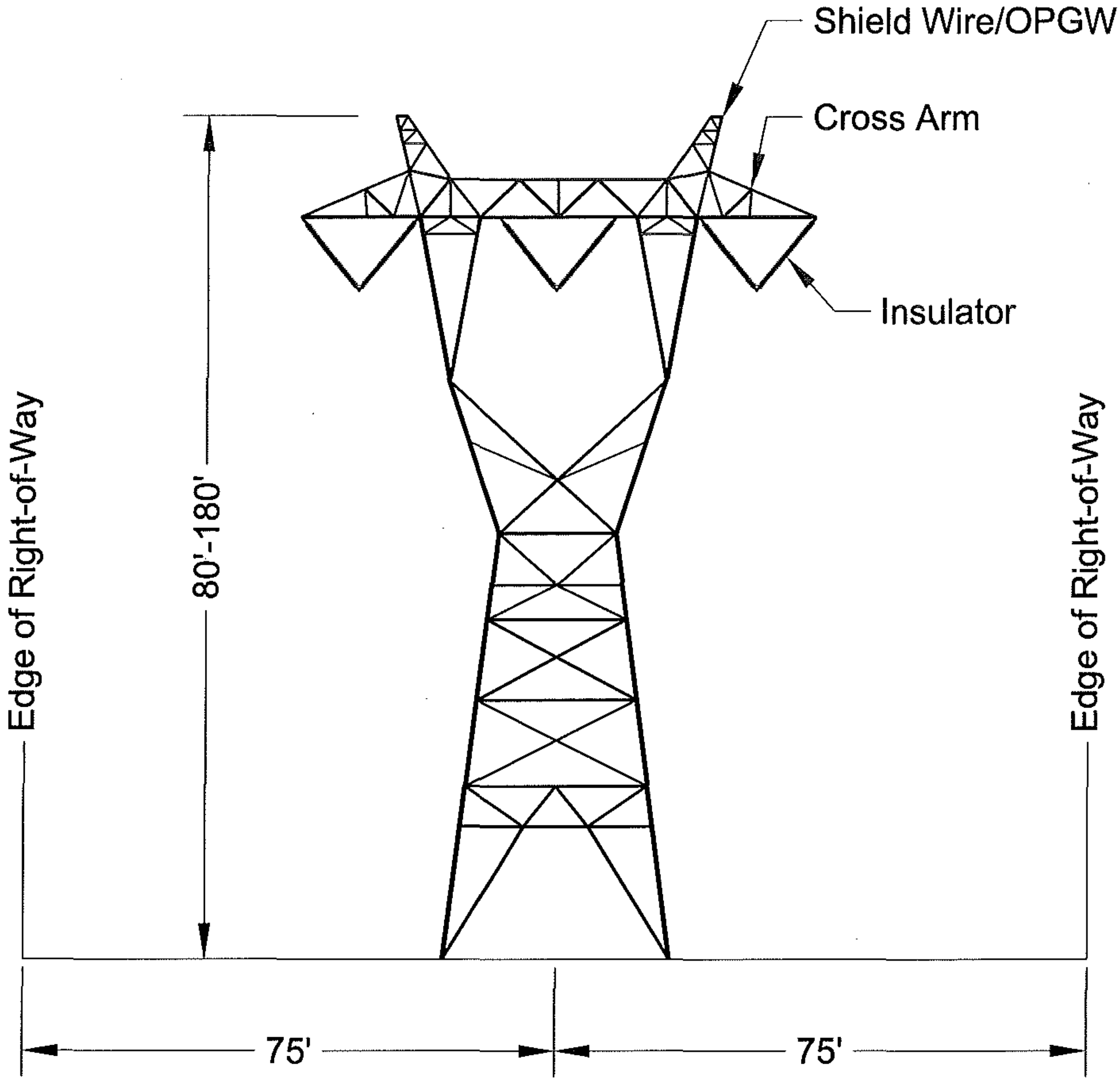


Figure 2-20b

345kV Lattice V-String

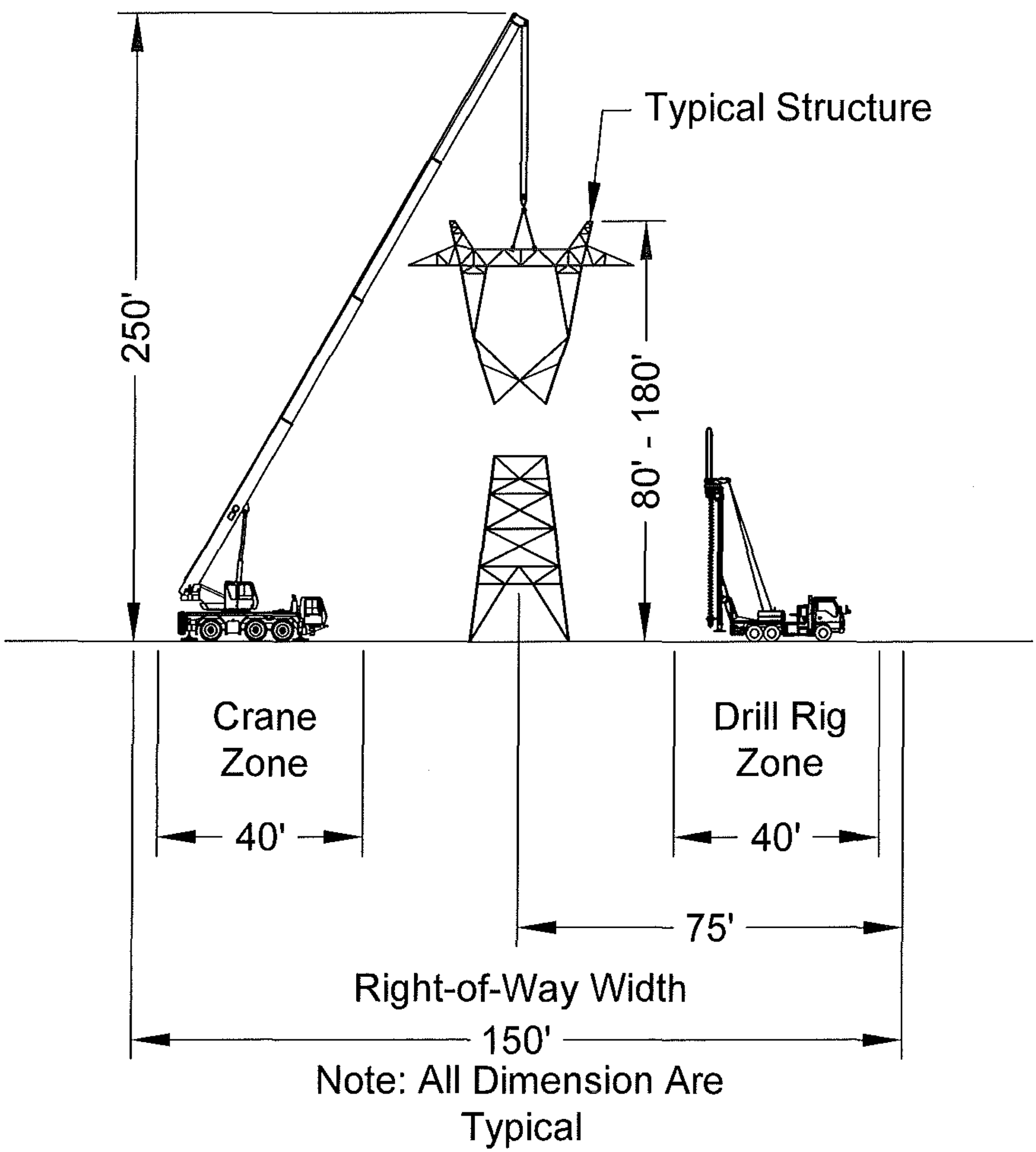
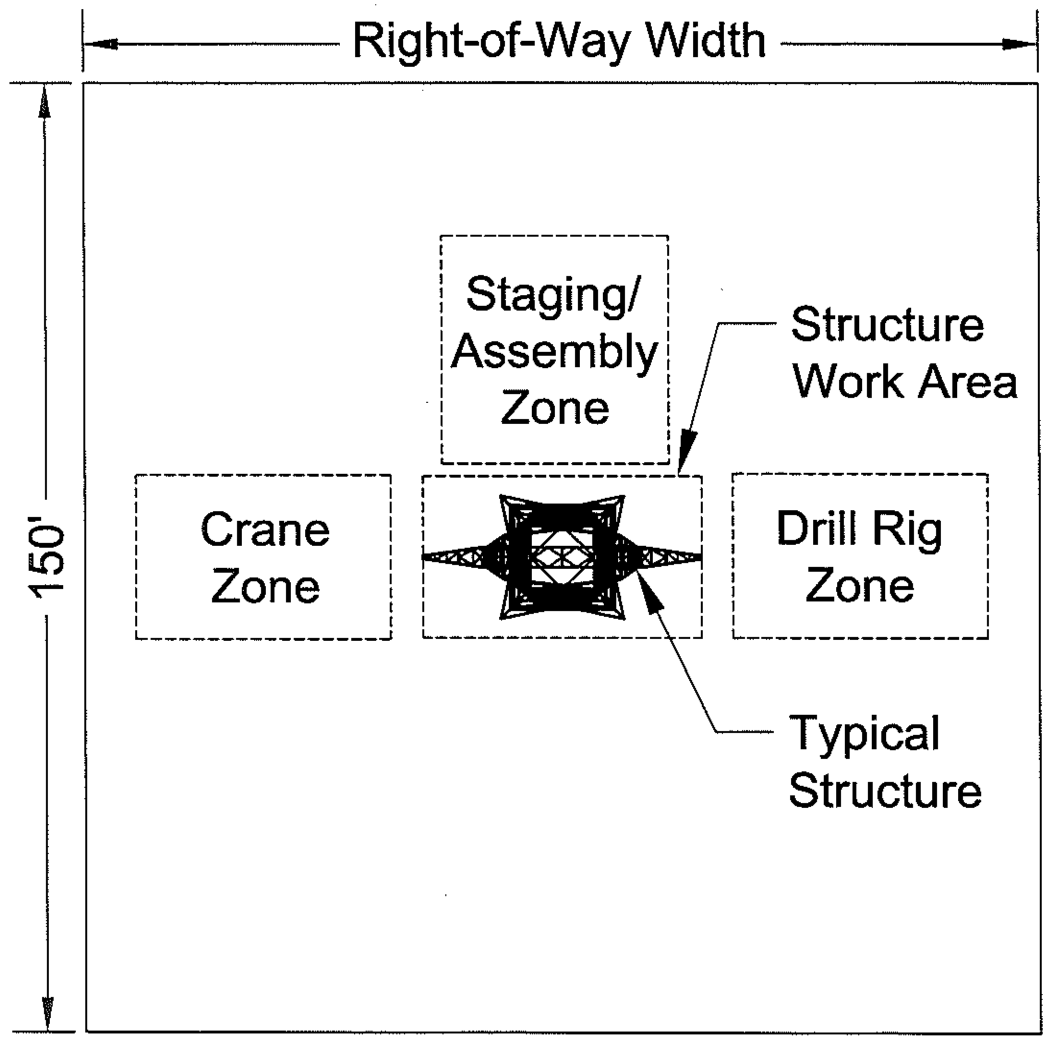


Figure 2-21

345kV Lattice Work Area



Not To Scale

Figure 2-22

345kV Lattice Foundation and Structure Construction Activities - Plan View

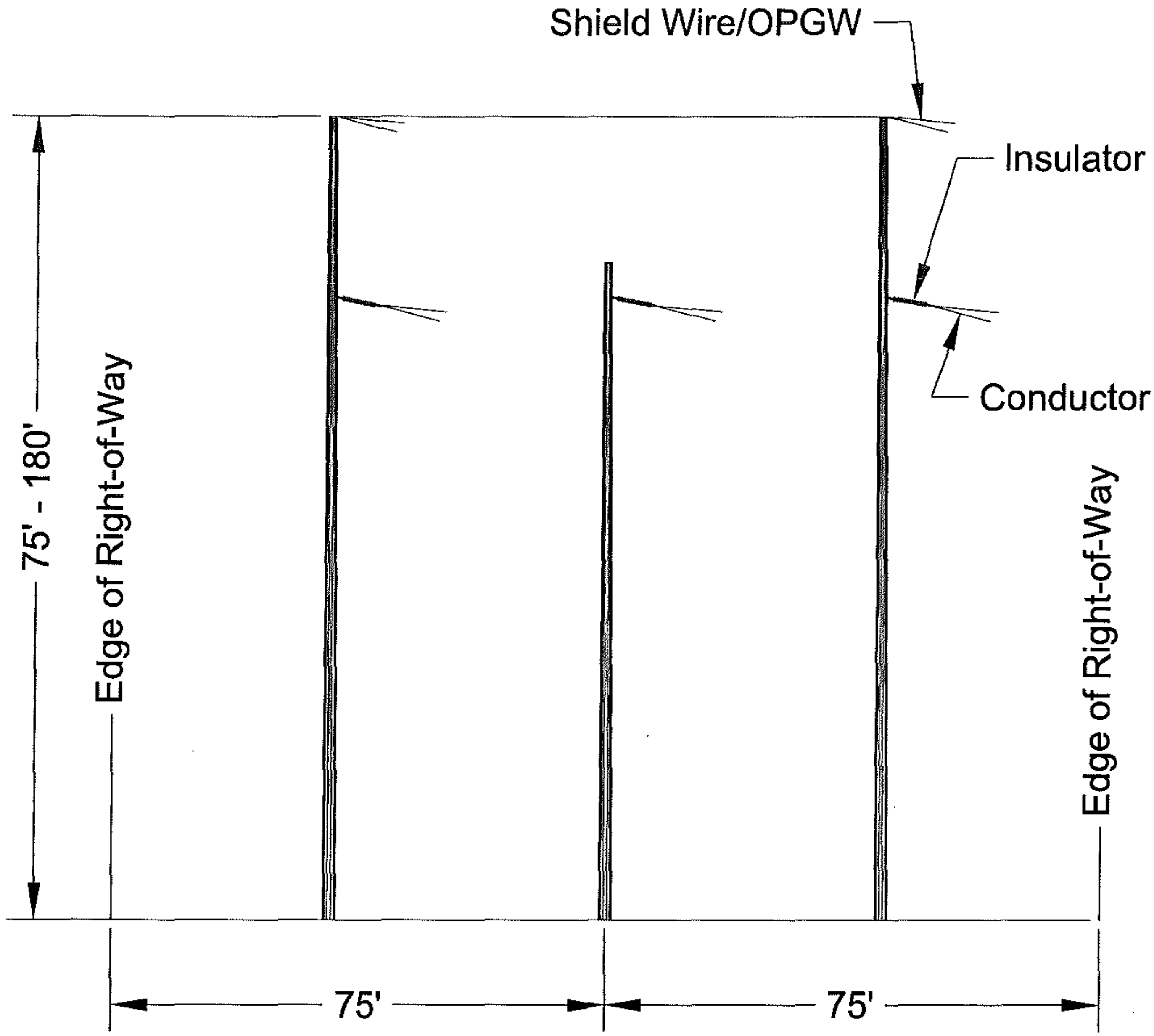


Figure 2-23a

345kV 3-Pole Running Angle

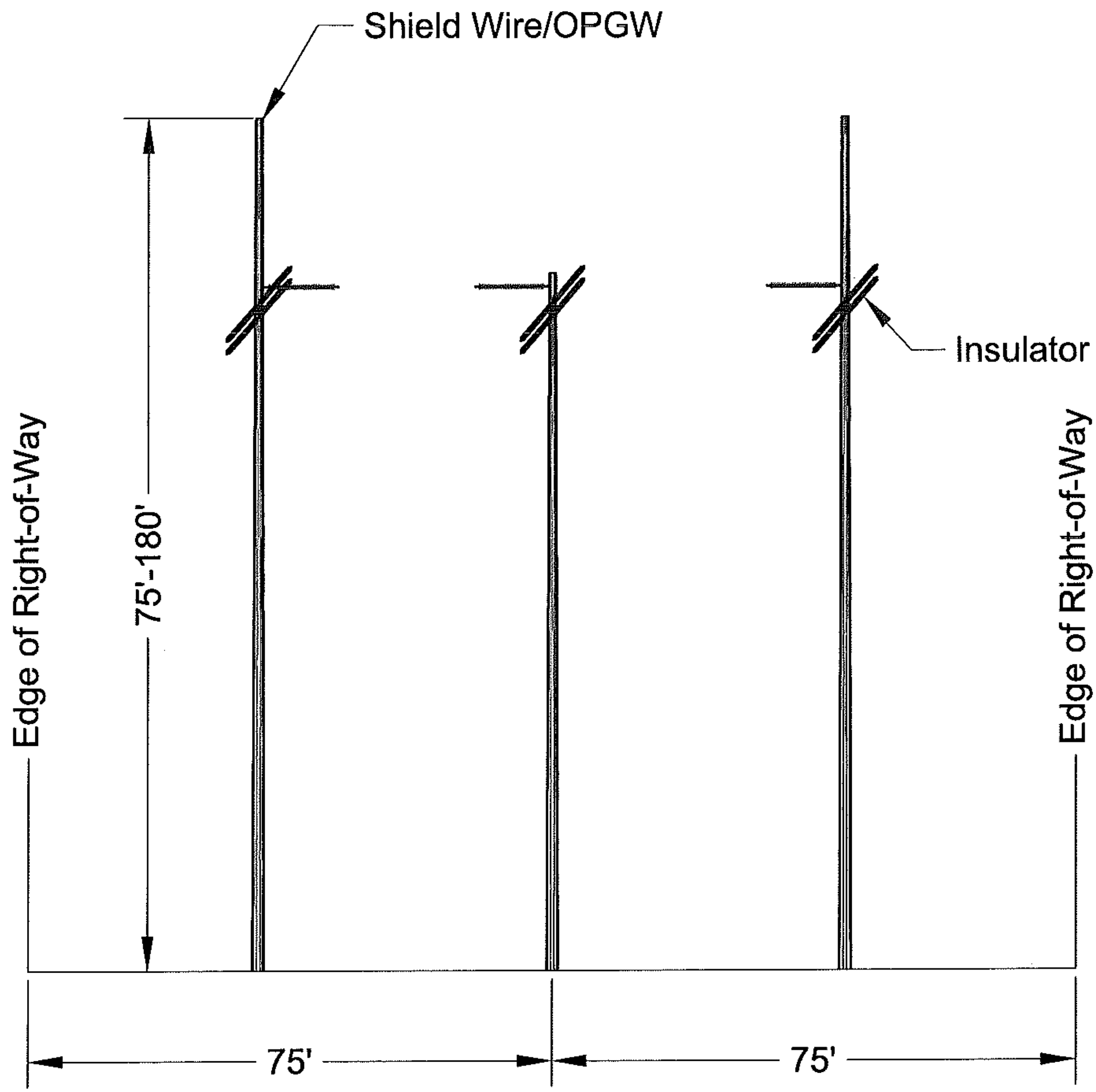
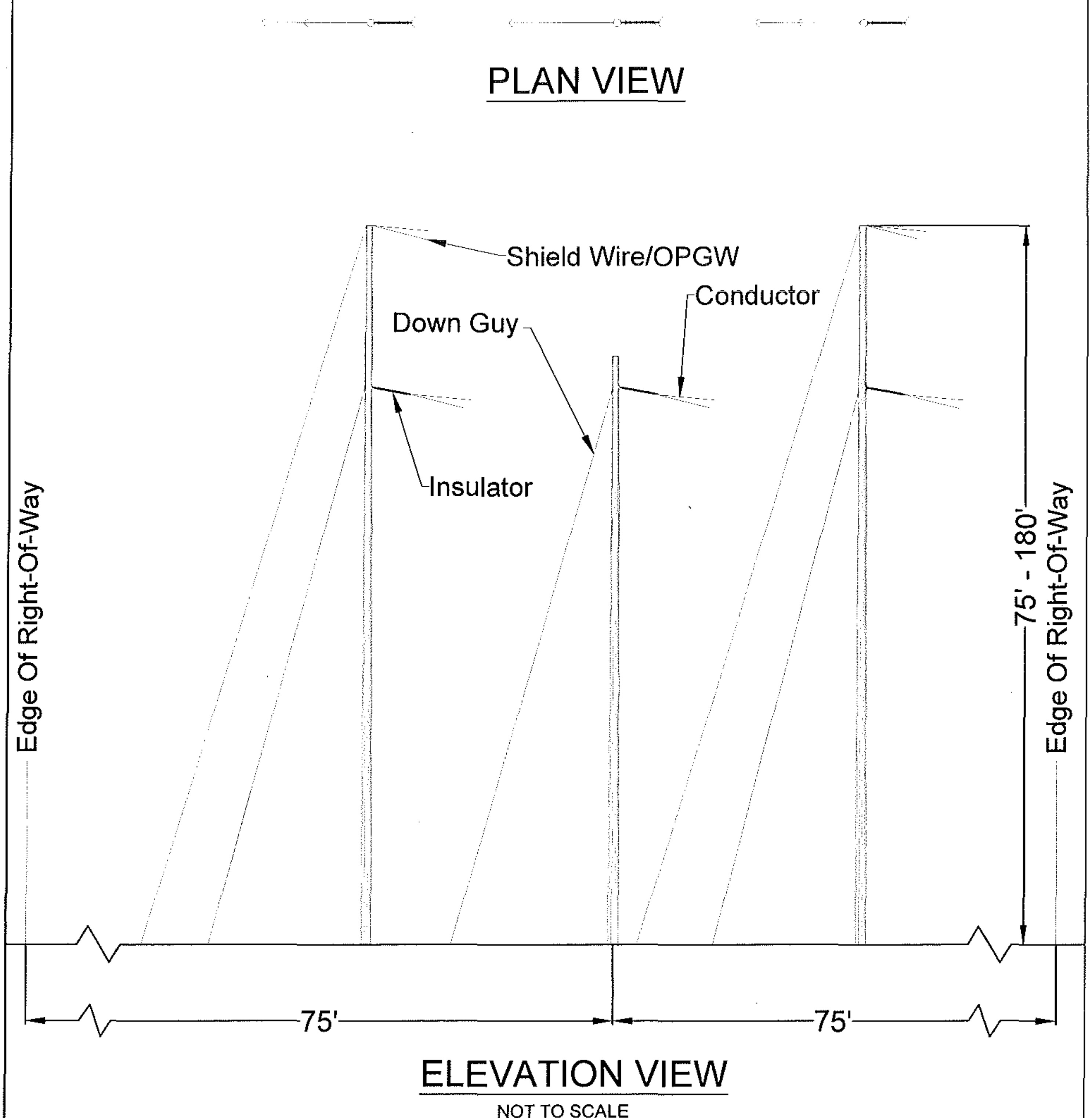


Figure 2-23b

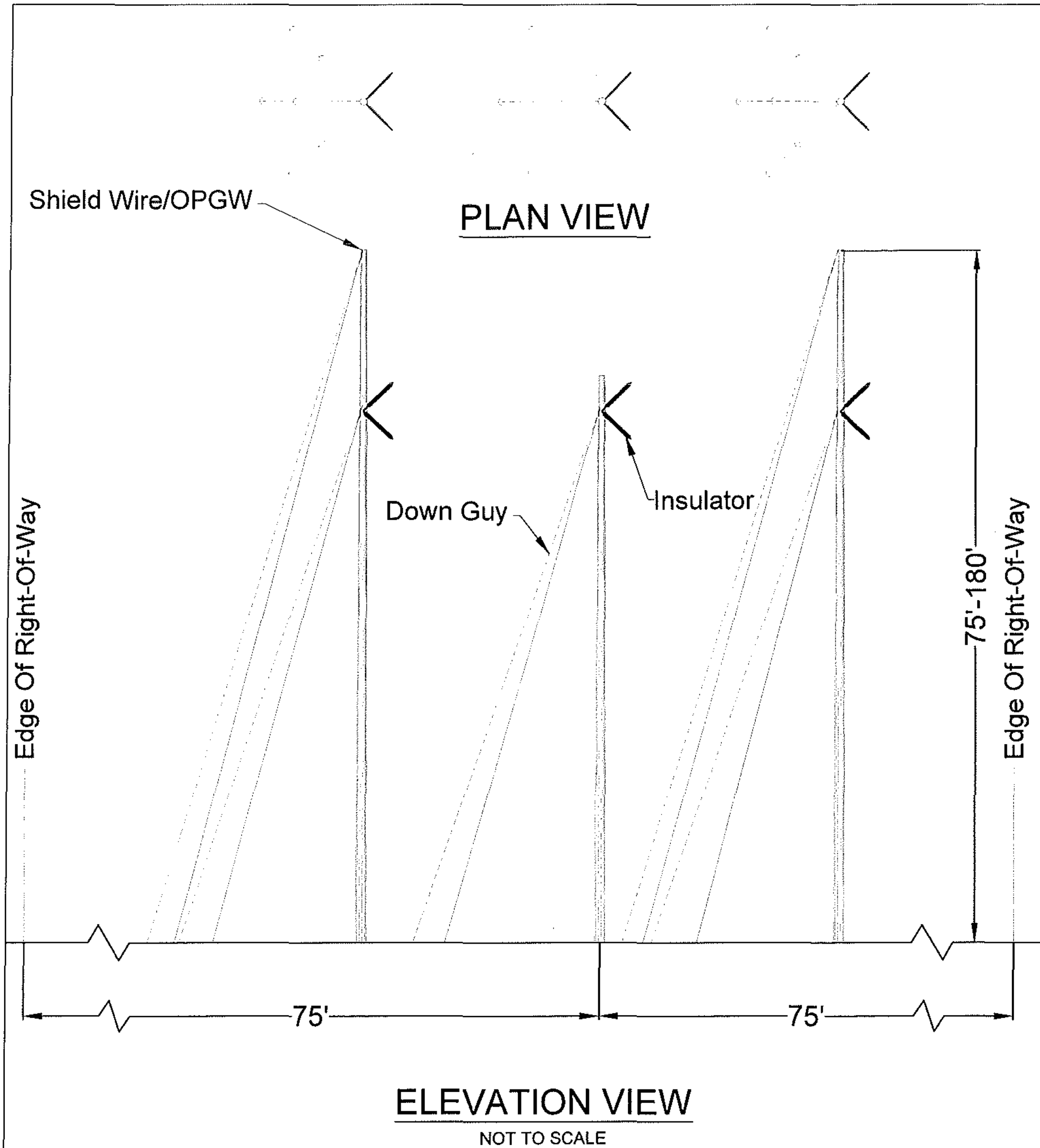
345kV 3-Pole Deadend



NOTE:
DEPENDING ON STRUCTURE
HEIGHT AND LINE ANGLE, GUY EASEMENTS MAY BE
REQUIRED BEYOND THE PROJECT 150 FOOT RIGHT-OF-WAY.

Figure 2-24a

345kV 3-Pole Guyed Running Angle



NOTE:
DEPENDING ON STRUCTURE
HEIGHT AND LINE ANGLE, GUY EASEMENTS MAY BE
REQUIRED BEYOND THE PROJECT 150 FOOT RIGHT-OF-WAY.

Figure 2-24b
345kV 3-Pole Guyed Deadend

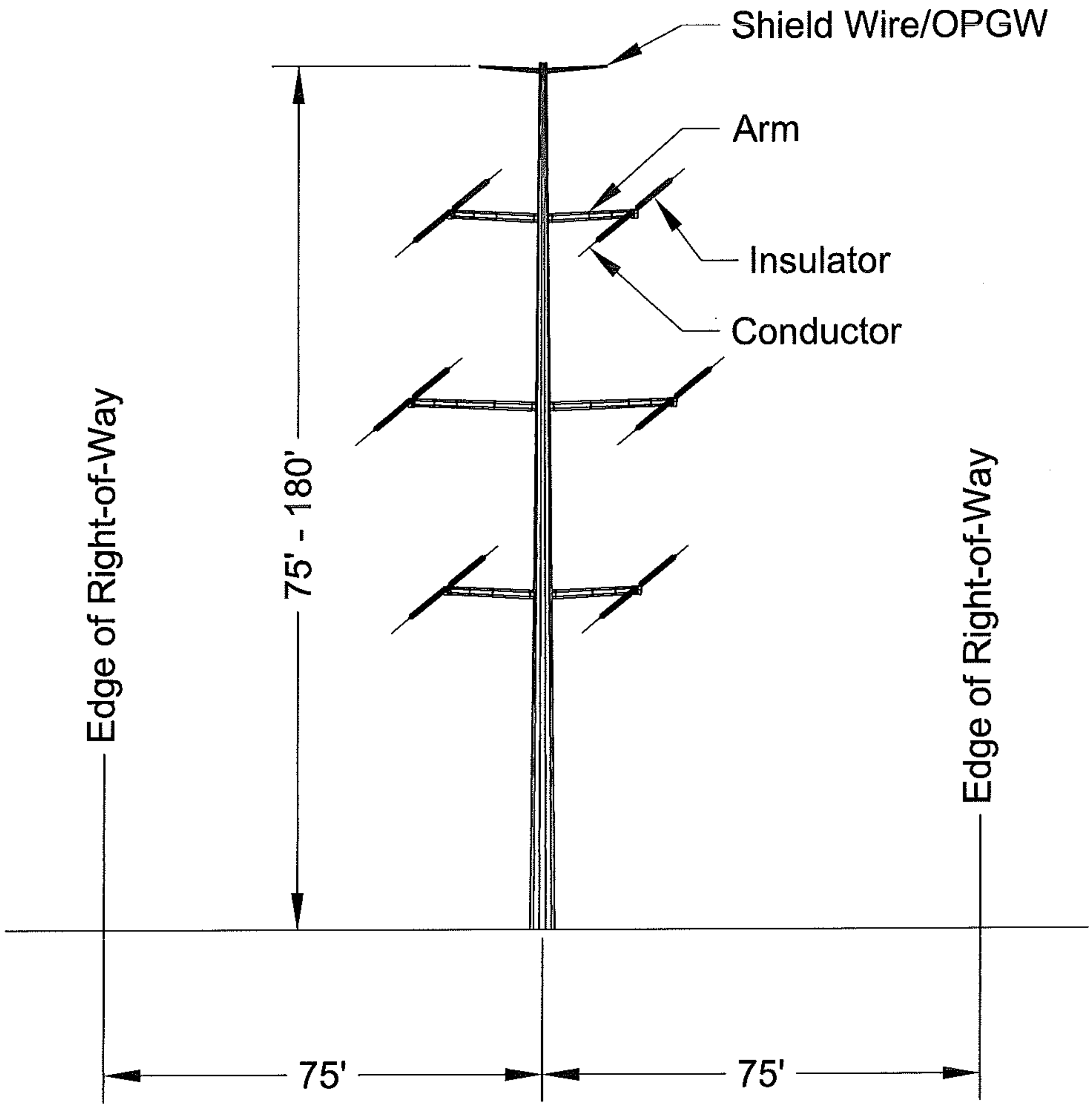


Figure 2-25a

345kV Double Circuit Pole Deadend

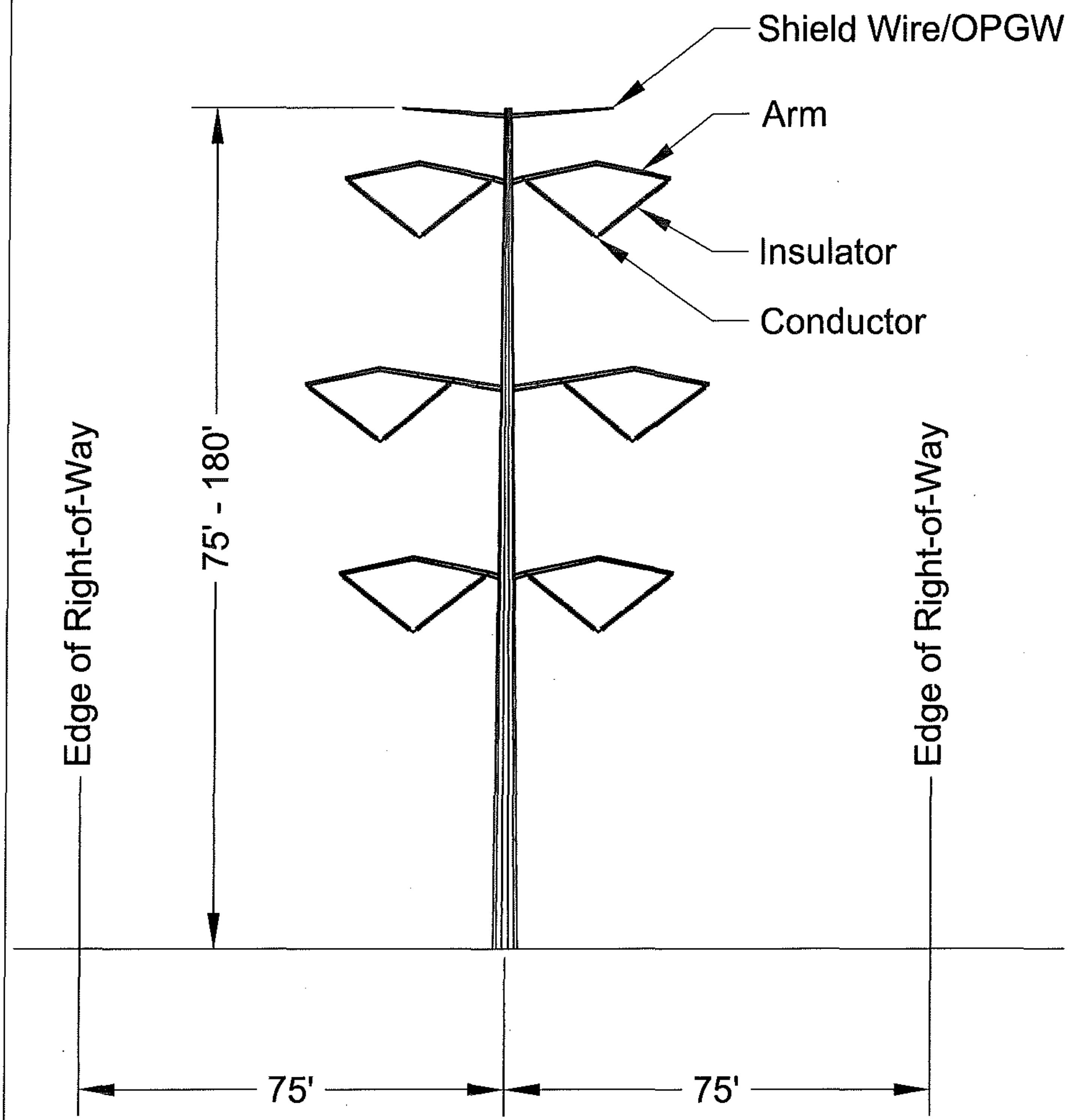


Figure 2-25b

345kV Double Circuit Pole V-String

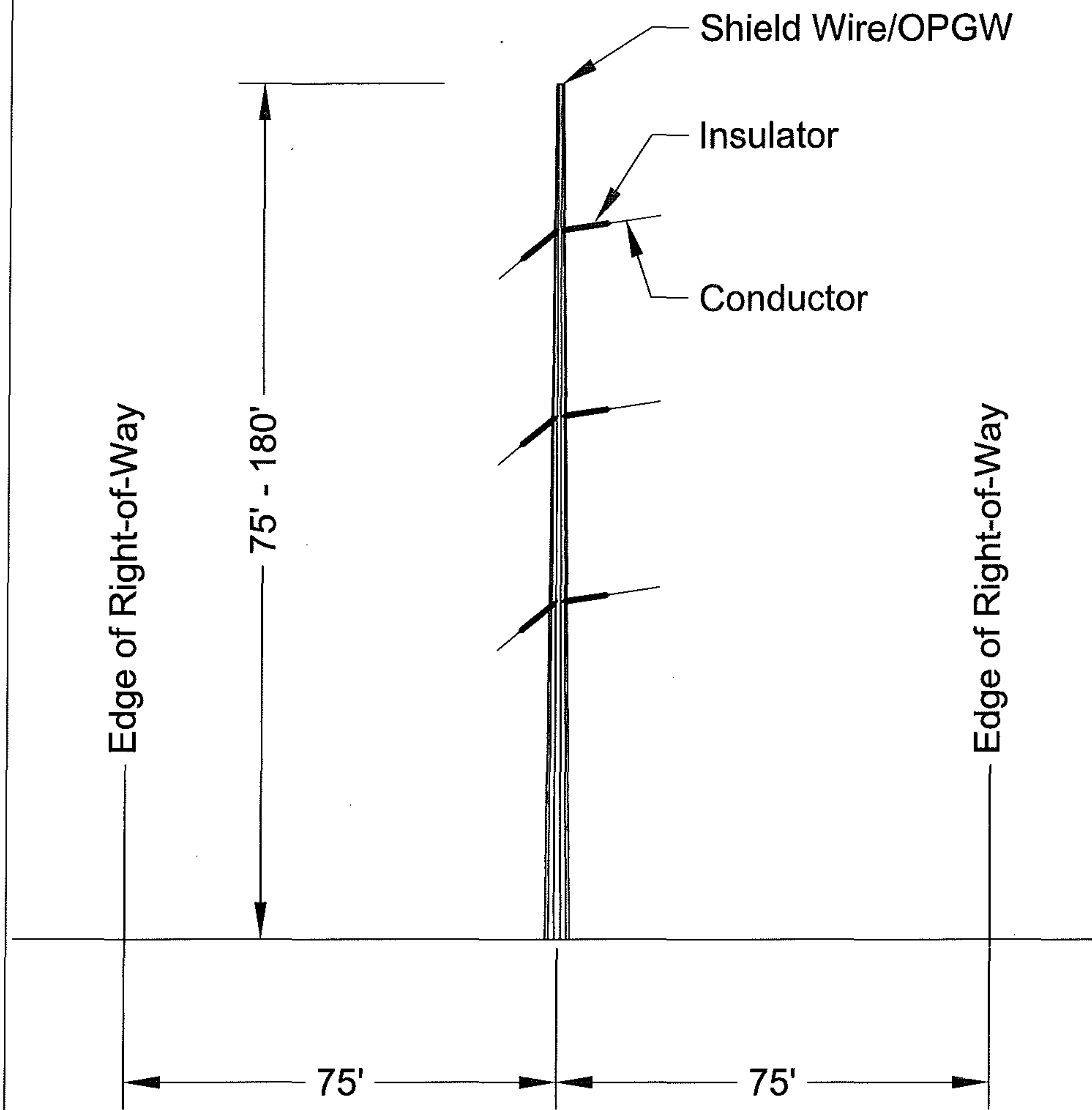


Figure 2-26a

345kV Single Circuit Pole Deadend

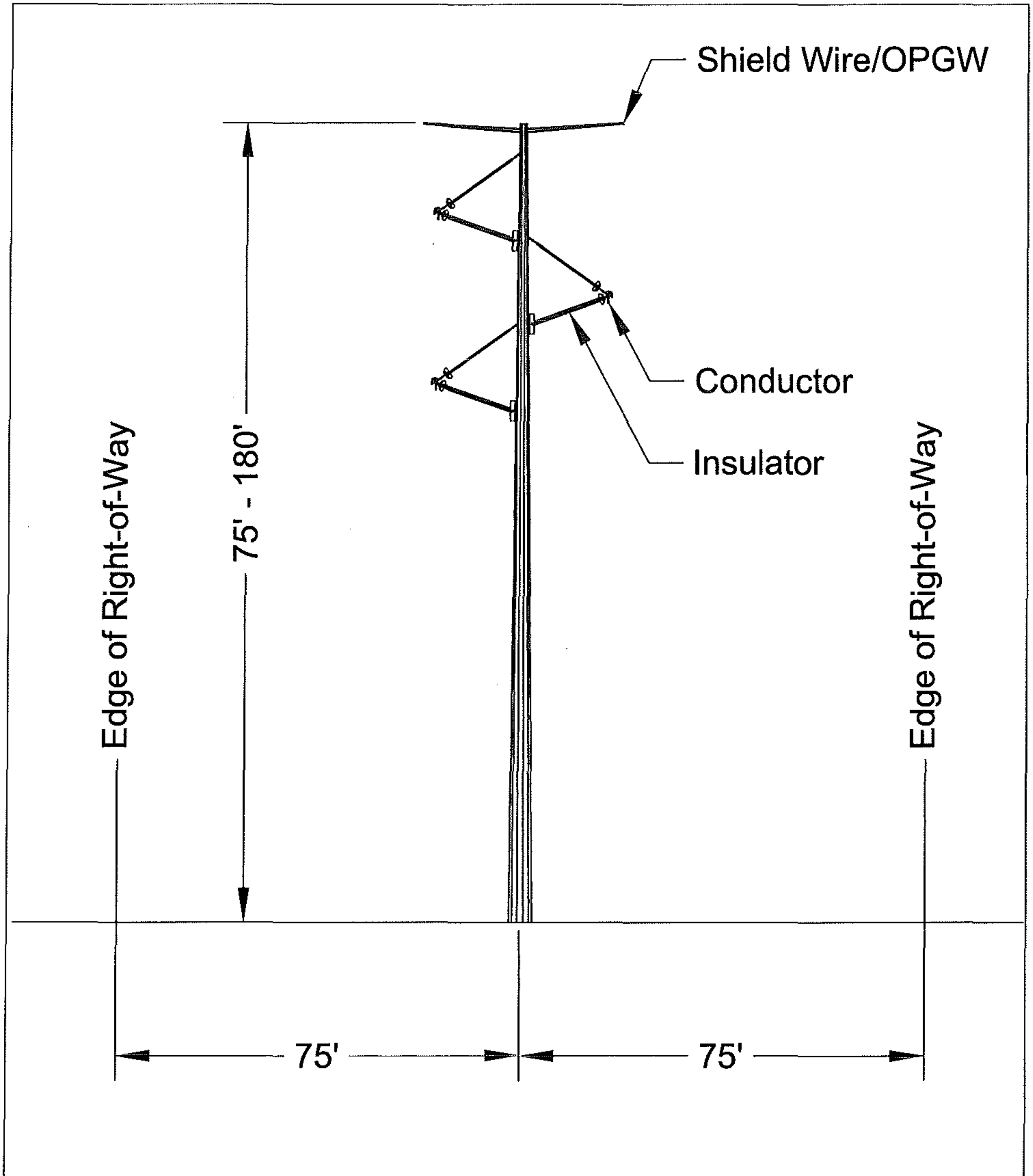


Figure 2-26b

345kV Pole Braced Post

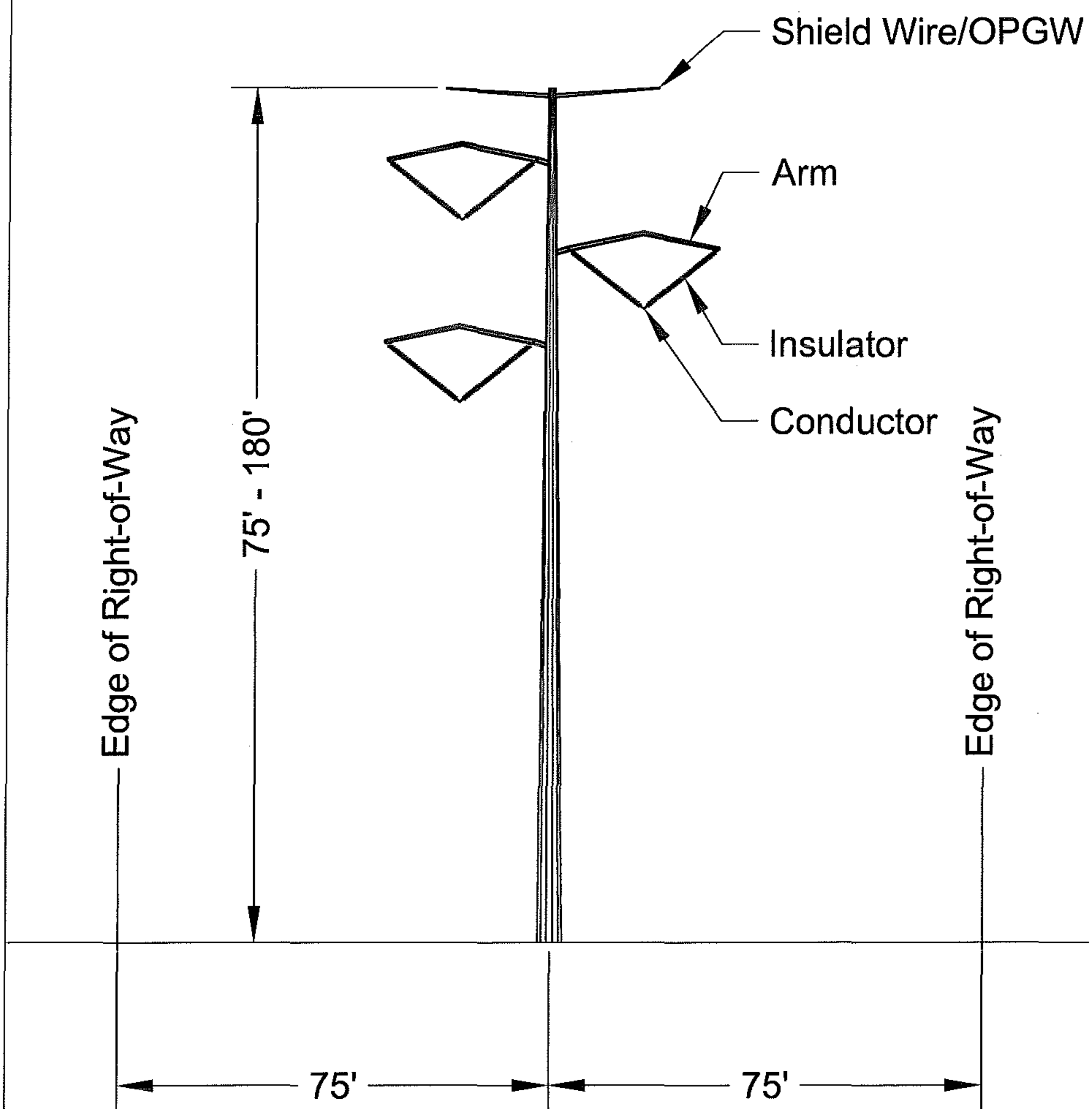


Figure 2-26c

345kV Single Circuit Pole V-String

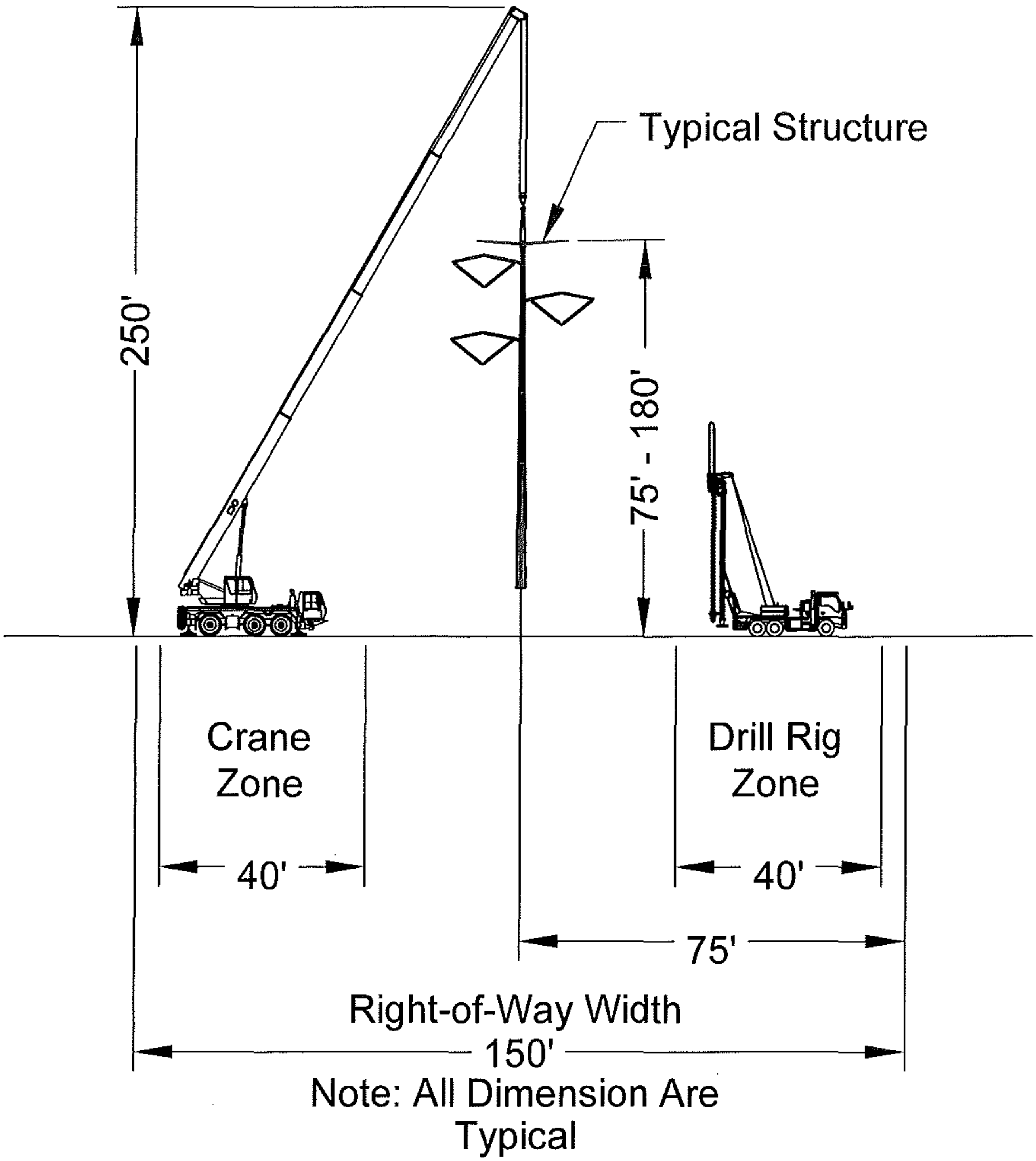


Figure 2-27

345kV Monopole Work Area

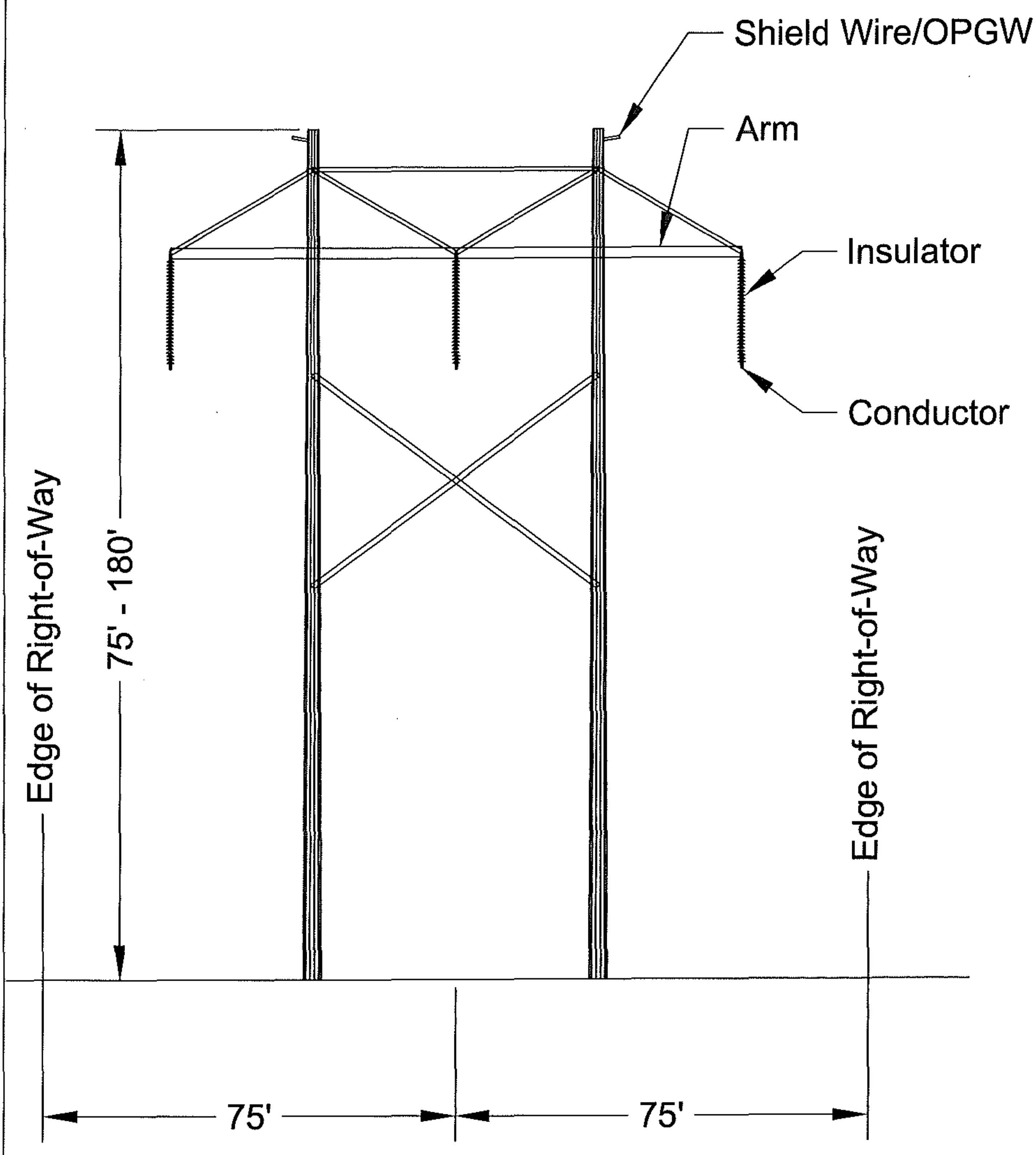


Figure 2-28a

345kV Braced H-Frame

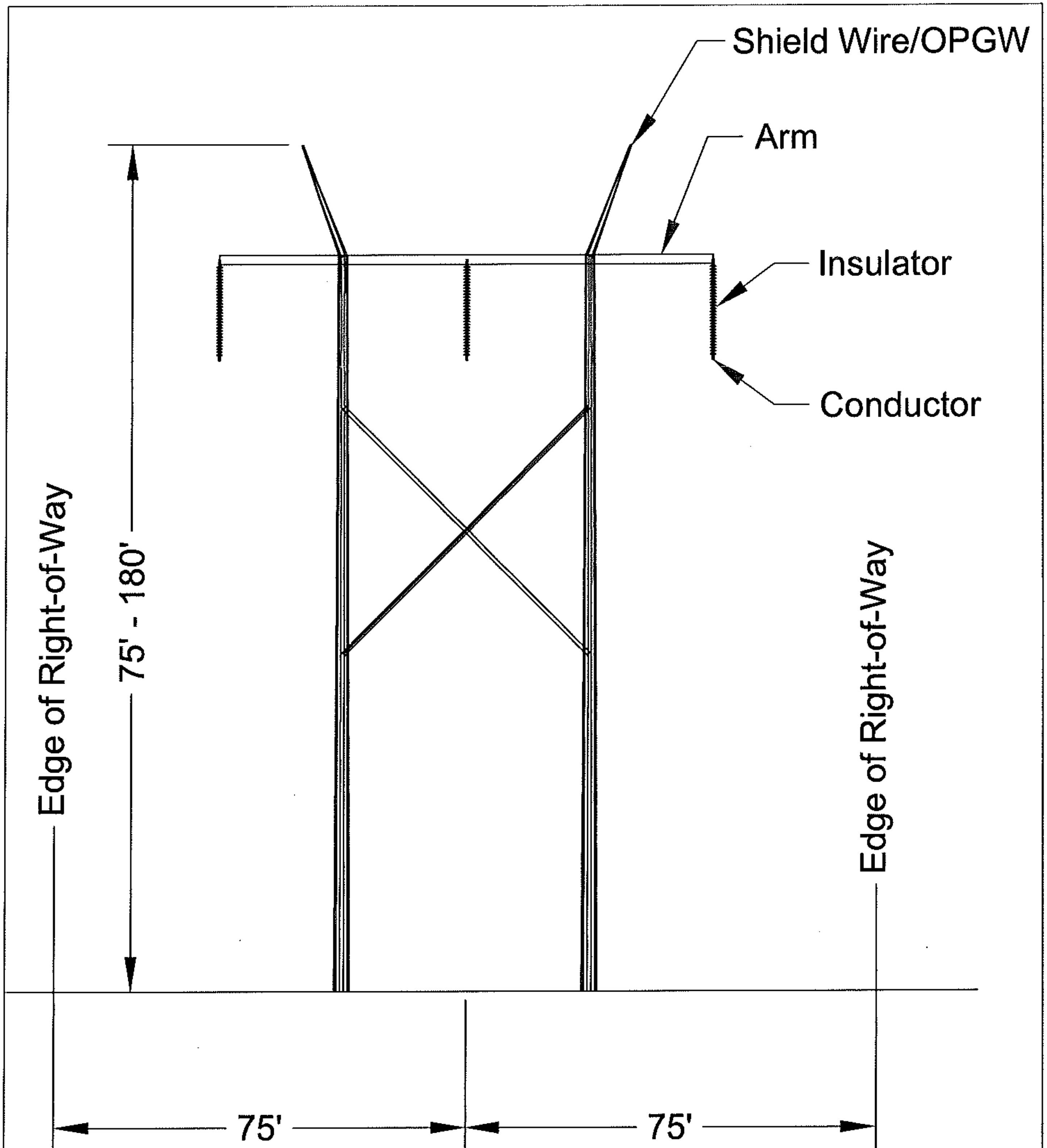


Figure 2-28b

345kV H-Frame Tangent

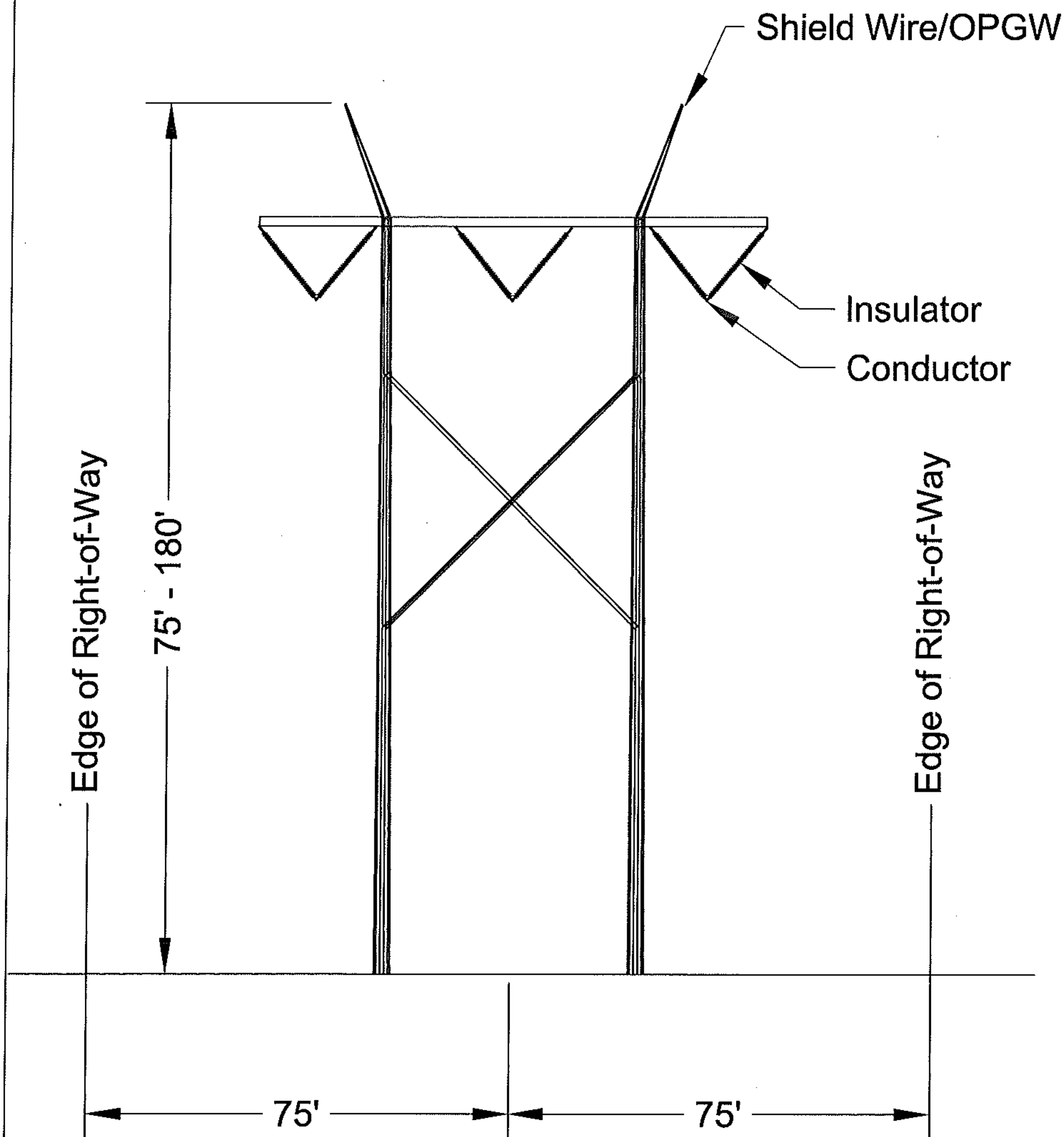


Figure 2-28c

345kV H-Frame V-String

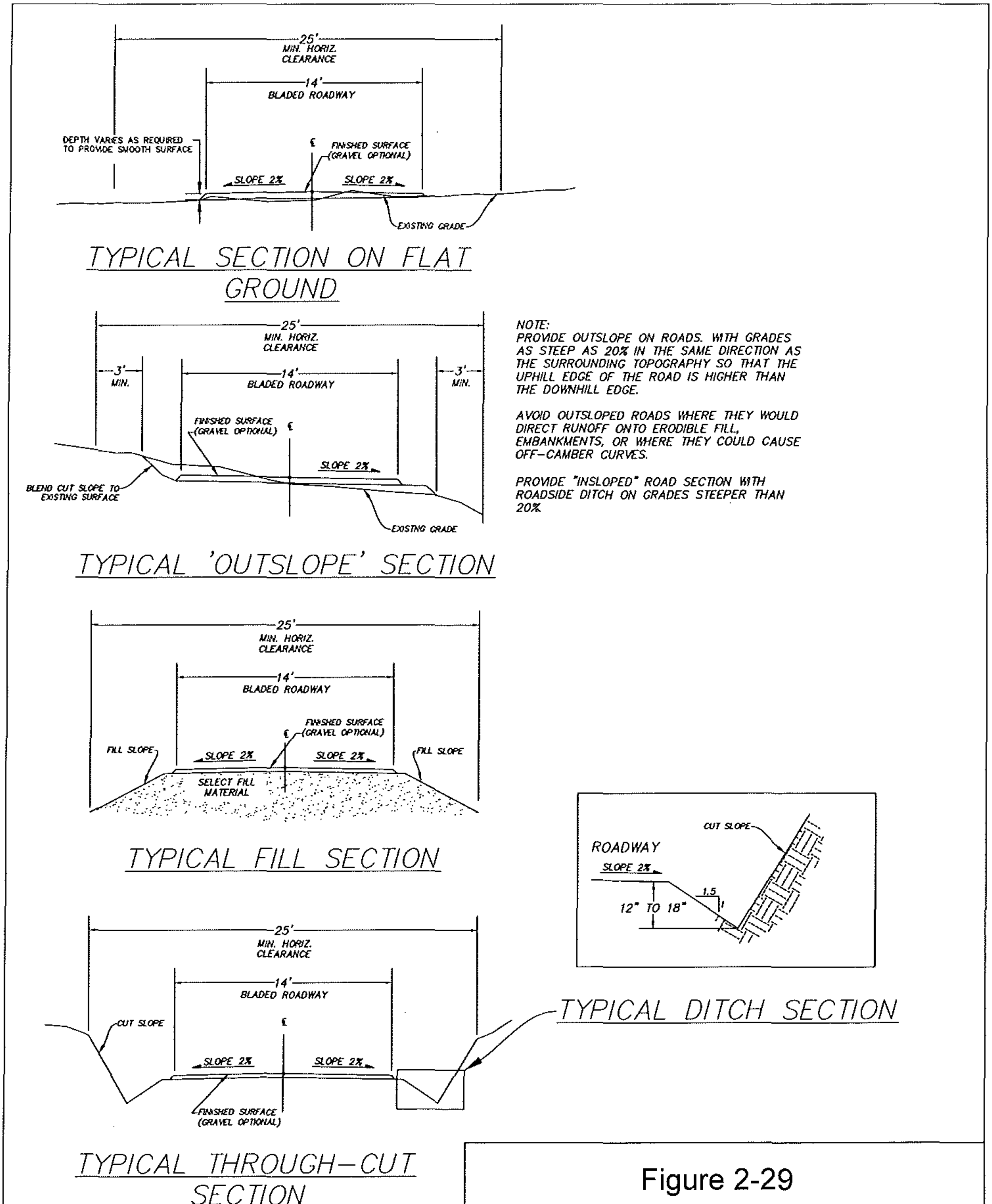


Figure 2-29

TYPICAL ACCESS ROADS

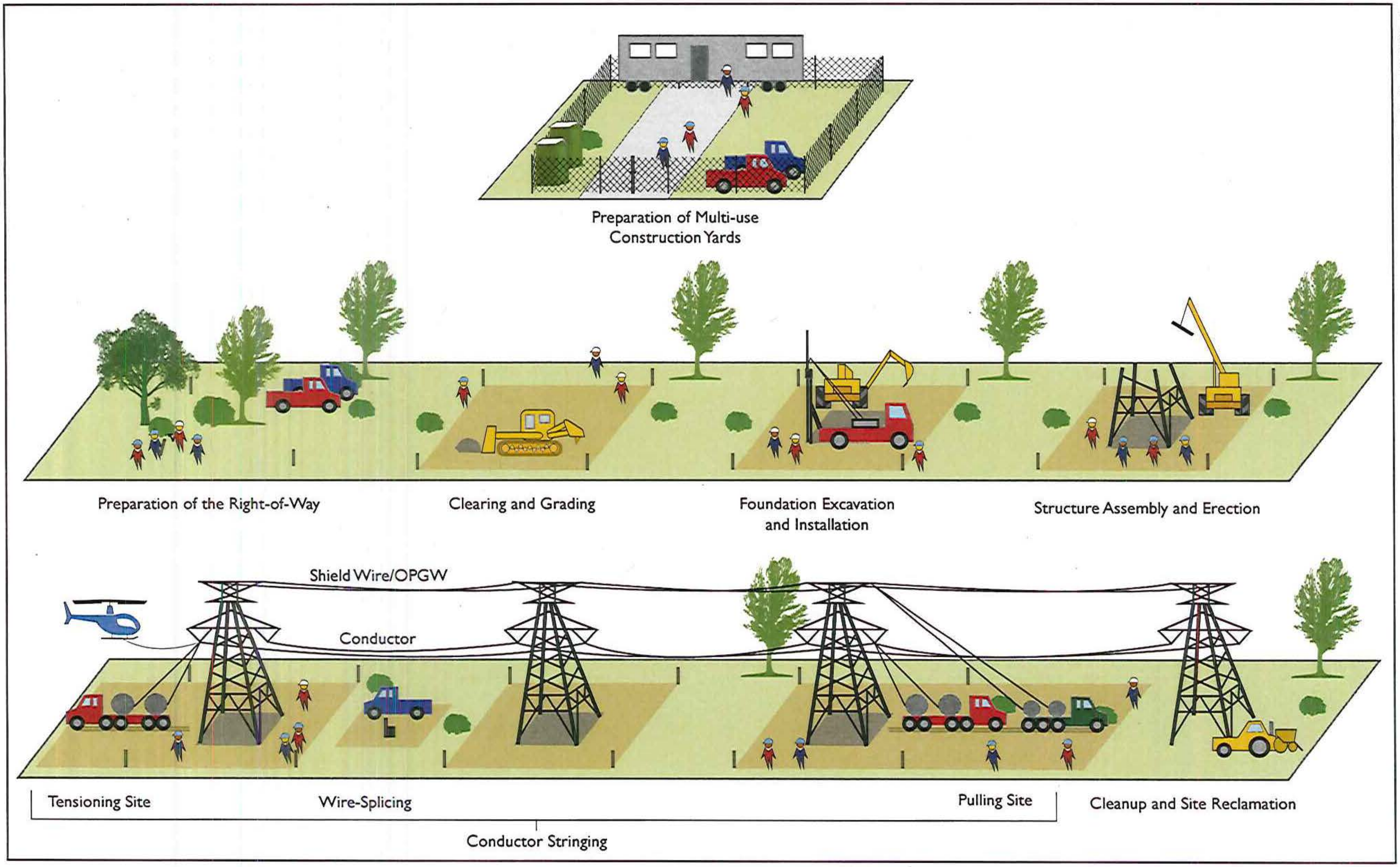


Figure 2-30
HVDC Transmission Line Construction Sequence
Plains & Eastern Clean Line
Oklahoma, Arkansas, and Tennessee

Appendix B
Workforce and Crews

HVDC Transmission Line Workforce and Crews

Resource Name	Resource ID	June	July	August	Sept.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	August	Sept.	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	August	Sept.	Oct	Nov	Dec
MH Material Handling	R-63	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20															
	Segment 1a																															
R1 50 Man Crew	S1AR	50	50	50	50	50	50	50																								
F1 60 Man Crew	S1AF				60	60	60	60	60	60	60	60																				
H1 25 Man Crew	S1AH					25	25	25	25	25	25	25	25	25																		
A1 45 Man Crew	S1AA					45	45	45	45	45	45	45	45	45	45	45	45															
S1 12 Man Crew	S1AS						12	12	12	12	12	12	12	12	12	12																
W1 25 Man Crew	S1AW								25	25	25	25	25	25	25	25	25	25	25	25	25											
C1 24 Man Crew	S1AC								24	24	24	24	24	24	24	24	24	24	24	24												
RT1 20 Man Crew	S1ART																	20	20	20	20	20	20	20								
Seg 1		70	70	70	130	200	212	212	211	211	211	211	151	151	126	126	114	69	69	69	45	20	20	20	0	0	0	0	0	0	0	0
	Segment 1B																															
R2 50 Man Crew	S1BR		50	50	50	50	50	50	50	50																						
F2 60 Man Crew	S1BF				60	60	60	60	60	60	60	60	60																			
H2 25 Man Crew	S1BH					25	25	25	25	25	25	25	25	25																		
A2 45 Man Crew	S1BA					45	45	45	45	45	45	45	45	45	45	45	45															
S2 12 Man Crew	S1BS						12	12	12	12	12	12	12	12	12	12	12	12														
W2 25 Man Crew	S1BW								25	25	25	25	25	25	25	25	25	25	25	25	25											
C2 24 Man Crew	S1BC								24	24	24	24	24	24	24	24	24	24	24	24	24	24										
RT2 20 Man Crew	S1BRT																	20	20	20	20	20	20	20								
Seg 2		0	50	50	110	180	192	192	241	241	191	191	191	131	106	106	106	81	69	69	69	44	20	20	0	0	0	0	0	0	0	0
	Segment 3																															
R3 50 Man Crew	S3R									50	50	50	50	50	50	50	50	50														
F3 60 Man Crew	S3F												60	60	60	60	60	60	60	60	60											
H3 25 Man Crew	S3H													25	25	25	25	25	25	25	25	25	25									
A3 45 Man Crew	S3A																45	45	45	45	45	45	45	45	45	45	45	45				
S3 12 Man Crew	S3S																	12	12	12	12	12	12	12	12	12	12	12	12			
W3 25 Man Crew	S3W																					25	25	25	25	25	25	25	25	25	25	
C3 24 Man Crew	S3C																					24	24	24	24	24	24	24	24	24	24	
RT3 20 Man Crew	S3RT																						20	20	20	20	20	20	20	20	20	
Seg 3		0	0	0	0	0	0	0	0	50	50	50	110	135	135	135	180	192	142	142	142	131	151	126	126	126	126	126	81	69	69	0
	Segment 4																															
R4 50 Man Crew	S4R								50	50	50	50	50	50	50	50	50	50	50	50												
F4 60 Man Crew	S4F											60	60	60	60	60	60	60	60	60	60	60	60									
H4 25 Man Crew	S4H												25	25	25	25	25	25	25	25	25	25	25	25	25							
A4 45 Man Crew	S4A															45	45	45	45	45	45	45	45	45	45	45	45					
S4 12 Man Crew	S4S															12	12	12	12	12	12	12	12	12	12	12	12	12	12			
W4 25 Man Crew	S4W																				25	25	25	25	25	25	25	25	25	25	25	25
C4 24 Man Crew	S4C																					24	24	24	24	24	24	24	24	24	24	24
RT4 20 Man Crew	S4RT																							20	20	20	20	20	20	20	20	20
Seg 4		0	0	0	0	0	0	0	50	50	50	110	135	135	135	192	192	192	192	192	167	191	191	151	151	126	126	81	81	69	69	69
Total		70	120	120	240	350	404	404	502	552	502	552	587	552	522	559	592	534	472	472	423	356	392	317	277	252	252	207	162	138	138	69

Resource loading per HVDC Converter Station Construction

Task	Crew Size	Crew Use In Month # 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Site Management	20	0.1	0.25	0.25	0.5	1	1	1	1	1	1	1	1	1	1	1	1
Surveyors	5	0.25	0.5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Site Development	61	0.2	0.25	0.25	0.5	0.75	1	1	1	1	1	1	1	1	0.75	0.75	0.5
Fence Installation	22			0.25	0.25	0.75	1	1	1	0.5	0.25						
Equipment Footings	65					0.25	0.25	0.5	0.5	0.5	0.75	1	1	1	1	1	1
Cable Trench, Conduits, Grounding	30				0.25	0.25	0.5	0.75	0.75	1	1	1	1	1	1	1	1
Steel Structures, Electrical Equipment	42					0.25	0.25	0.25	0.5	0.75	0.75	0.75	1	1	1	1	1
Control Building and Wiring	36														0.25	0.5	1
Traffic Control	5		0.5	0.5	0.5	0.75	1	1	1	1	1	1	1	1	1	1	1
Construction Inspection	5	0.25	0.25	0.25	0.5	1	1	1	1	1	1	1	1	1	1	1	1
Materials Testing	5	0.25	0.25	0.5	0.5	0.5	1	1	1	1	1	1	1	1	1	1	0.75
Total Workers		**18**	**28**	**37**	**66**	**133**	**165**	**189**	**199**	**206**	**217**	**228**	**238**	**238**	**232**	**241**	**242**

Task	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Site Management	1	1	1	1												
Surveyors	0.75	0.75	0.75	0.5	0.5	0.5	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Site Development	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.1	0.1
Fence Installation																
Equipment Footings	1	1	1	0.5	0.5	0.5	0.25	0.25	0.25	0.25						
Cable Trench, Conduits, Grounding	1	0.75	0.5	0.75	0.75	0.5	0.5	0.5	0.5	0.25	0.25	0.25	0.25			
Steel Structures, Electrical Equipment	1	1	1	1	0.75	0.75	0.5	0.5	0.5	0.5	0.5	0.25	0.25	0.25	0.25	0.25
Control Building and Wiring	1	1	1	1	0.75	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.25	0.25	0.1
Traffic Control	1	1	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.25						
Construction Inspection	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.1	0.1
Materials Testing	0.75	0.75	0.75	0.75	0.75	0.75	0.25	0.25	0.25	0.25						
Total Workers	**240**	**216**	**207**	**180**	**140**	**133**	**94**	**92**	**92**	**83**	**64**	**54**	**54**	**37**	**27**	**22**

Total Duration (in weeks):	*128*	**Weekly Work Schedule (day/wk):**	*5*
Total Number of Work Days:	*640*	**Daily Work Schedule (hr/day):**	*8*
Avg. Number of Workers:	*138*	**Max. Number of Workers:**	*242*

Example of Typical Construction Activities and Durations on Agricultural Property

The following example timeline describes a typical construction sequence that could occur on a single parcel currently in agricultural use (with row crop or hay / grass pasture). This hypothetical situation assumes the following: 0.5 miles of HVDC right-of-way (ROW) on the parcel; two tangent lattice structures are planned within the parcel; no grading is needed; and access is obtained by driving only within the ROW from adjoining parcels through existing gates. The following timeline also assumes that the ROW has been surveyed and the clearing boundaries have been staked. The timeline describes the major planned activities associated with construction. During the construction period, other activities, usually smaller in scale (such as inspections or monitoring) may require intermittent access to and presence in the ROW between the activities listed below. Note that there will be breaks in the construction process. The duration of these breaks may vary from the periods identified below.

Typical Construction Activities on Agricultural Property			
Activity	**Access typically restricted?**	**Day**	**Description**
ROW mowing and/or clearing	Yes	1 to 2	Mowing equipment enters from adjoining parcel and mows portions of the ROW. The area mowed would include an access path down the ROW (approximately 16 to 35 feet wide) and two areas (each 100 x 100 ft) for future structure construction pads. Access to the construction area is restricted during mowing operations for safety.
None	No	3 to 14	There is a period of inactivity between mowing and/or clearing (above) and the beginning of surveying and staking (below). This period may be shorter or longer depending on construction schedule.
Survey and staking	No	15	A survey crew stakes each structure location with wooden lath.
Install storm water protection measures	No	16	According to state requirements, any storm water protection measures (e.g., silt fences) are installed. Silt fences would be discontinuous, and would not limit livestock movement. This typically requires one or two pickup trucks with trailers, possibly a small excavator, and a small crew of workers.
Drill and pour foundations	Partially	17 to 19	Auger equipment drills holes for footings, rebar cages are set, concrete trucks delivery concrete to the pad, stub angles are set, and concrete is poured into holes and mold surrounding stub angles. Access is prohibited in a small area within a protective fence around foundation sites, and periodically restricted around the construction area for safety due to the movement of trucks and other equipment.
None (Concrete curing)	Partially	20 to 22	Access to ROW is not restricted, except for a small area within a protective fence around foundation sites.

Typical Construction Activities on Agricultural Property			
Activity	**Access typically restricted?**	**Day**	**Description**
Remove concrete forms	Partially	23	Access to ROW is not restricted, except for a small area within a protective fence around foundation sites.
None (Concrete curing)	Partially	24 to 33	Access to ROW is not restricted, except for a small area within a protective fence around foundation sites.
Equipment set up, assembly, and structure erection	Partially	34 to 41	Structure material delivered to each structure site with a heavy truck, structure sections are assembled, and sections are lifted by crane and set into place. Access to ROW may be periodically restricted around the construction area for safety due to the movement of trucks, cranes, and other equipment.
Insulator assemblies fixed to structure	Partially	42	Insulators and associated hardware are pre-assembled into strings, strings are then lifted by crane or lift truck and fixed to tower arms. Access to ROW is periodically restricted around the construction area for safety due to the movement of trucks, cranes, and other equipment.
None	Partially	42 to 86	There is a period of inactivity between the end of insulator installation (above) and the beginning of wire stringing (below). This period may be shorter or longer depending on location and site conditions. During this period, access to the ROW outside of the structure pads is unrestricted.
Sock and Pilot line threading	Yes	87	A helicopter lifts a light weight sock/pilot line, which is threaded through rollers attached to the insulators. During stringing operations, access to the ROW is restricted for safety.
Conductor pulling and tensioning	Yes	88 to 92	Conductor is attached to the end of the sock/pilot and pulled through. Pulling and tensioning equipment (located on other parcels in this example) ensure that the proper clearance and sag is achieved for each span of the conductor. During stringing operations, access to the ROW is restricted for safety.
Clipping in	Yes	93	Conductor is permanently attached ("clipped in") to hardware connection at the end of insulator strings using one to three bucket trucks. Access to ROW is periodically restricted around the construction area for safety due to the movement of trucks and other equipment.
None	No	94 to 122	There is a period of inactivity between the end of clipping in and the start of final restoration activities. This lag could be considerably shorter, depending on season and site conditions.

Typical Construction Activities on Agricultural Property			
Activity	**Access typically restricted?**	**Day**	**Description**
ROW restoration	Partially	123 to 130	Repair of construction damage occurs, which may include re-seeding, recontouring, and restoration of drainage patterns. In row crop areas, this may also include decompaction, ripping, and/or tilling to restore ROW. Access to ROW is periodically restricted around the construction area due to the movement of trucks and other equipment for safety.
Vegetation Re-establishment	No	131 –	Depending on site conditions, vegetation will be allowed to become reestablished. Depending on the season, for row crops areas, crops or cover crops could be planted or re-established following restoration. Any storm water protection measures are removed after the site meets or exceeds state reclamation thresholds.

Appendix B
Workforce and Crews

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CLEAN LINE
ENERGY PARTNERS

June 1, 2016

RESTORATION PLAN

GRAIN BELT EXPRESS PROJECT

PAR ELECTRICAL CONTRACTORS, INC.
A QUANTA SERVICES COMPANY

POWER ENGINEERS

In the event of an emergency related to the Grain Belt Express Clean Line, please call (855) 665-3438.

RESTORATION PLAN

GRAIN BELT EXPRESS PROJECT

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Last updated June 7, 2016

Table of Contents

Restoration Plan

RESTORATION PLAN

Introduction

As a part of the ongoing development of the Grain Belt Express Clean Line 600 kV HVDC project, Grain Belt Express Clean Line LLC ("Clean Line") has initiated development of the core components of the operations and maintenance plans that will ultimately become a portion of the operating procedures for the project. One of these components is a Restoration Plan, or the procedure to be implemented in response to an outage or other emergency conditions that will be encountered over the life of the project resulting in damages requiring structure or component replacement. This plan addresses the transmission line portion of the project. Other plans will be developed to address the stations that are associated with the project.

This Plan documents the materials, equipment, special techniques and general procedures for restoring the 600 kV DC line and associated AC interconnection lines owned and operated by Clean Line in the states of Kansas, Missouri, Illinois, and Indiana. The line length will ultimately be over 780 miles across these states, originating in western Kansas and crossing Kansas, Missouri, and Illinois. It will terminate in western Indiana. There will be three HVDC converter stations associated with the line; in western Kansas, eastern Missouri, and eastern Illinois. These station locations are noted in this Plan as likely operations bases since they will be facilities owned and operated by Clean Line and have office and operations functions present. As plans are developed, the locations may be off site or at nearby locations.

The Plan has four primary purposes:

1. Document potential materials, equipment, techniques and resources available for use in restoring the line after an outage has occurred, assuming failure of a facility component required for energized operations or safety, such as wire or a structure. For simplicity in this document, such components may be referred to as a structure or component;
2. Provide process outlines and critical decision making information for use in the event of structure failure;
3. Provide the initial conceptual plan to be enhanced as project design details and operations strategies are finalized;
4. Once completed in detail, serve as a training manual for engineering, management and field personnel who were not involved in the initial development of this program; and
5. Provide decision makers with a single source reference for critical design, engineering, construction, and access information for use in the event of a structure or component failure.

The Plan is divided up into several sections, each with a distinct purpose. The first section is a general overview of the restoration plan, followed by a more detailed description of restoration options.

The second section is a detailed decision making outline of what to do in the event of a failure. This is intended to help a manager or other decision maker rapidly make the right choices when reacting to a failure.

Subsequent sections and appendices describe in more detail individual aspects of the restoration plan and may be used for reference as needed. In certain sections, additional content or detail will be added or integrated at a later date.

On-going Development of the Plan

The Plan will be revised and additional detail will be added as the project continues to develop through receipt of regulatory approvals, final routing, detailed engineering, design, and construction.

Executive Summary

Clean Line is developing the Grain Belt Express Clean Line, a 600 kV HVDC transmission project that will traverse approximately 780 miles across Kansas, Missouri, Illinois, and into Indiana. The project includes three HVDC converter stations that will provide the ability to transfer energy from wind farms in Western Kansas to Missouri, Illinois, Indiana and surrounding areas. See Figure 1-1 for an overall Project Map.

Electrically, the line is continuous, but from an asset operations and maintenance perspective, it will ultimately be divided into multiple sections for identification, monitoring, and maintenance purposes. As the response plan is developed in detail, it will likely correlate to these more detailed section identifications.

For the purposes of this initial development, the major project sections are by state, with the eastern sections of the project in Indiana and Illinois grouped together. Terrain, accessibility, and primary challenges associated with restoration activities will be expanded upon during detailed design and construction.

The detailed plans that are ultimately developed and outlined in this document will address the known challenges to restoring any segment of the 600 kV HVDC line as rapidly and safely as possible.

The restoration concepts which have been initially identified and developed are as follows:

1. Ground Based Access – Solutions with access using existing or easily constructible ground access for structure sites which are within reasonable proximity to a road with established access rights for Clean Line. This will include access via roads or trails to be developed during detailed design and construction of the line.
2. Air Based Access – Solutions will be developed as necessary for locations that will need to be accessed entirely by air. Locally available helicopters would be used initially for mobilization and preparation work followed by a heavy lift helicopter for setting structures. These aerial access requirements will be defined and developed during detailed design and construction of the line. Initial assessment of outages may also include helicopter inspections.
3. Hybrid Access – Solutions will also be developed as necessary for locations that may need to be accessed using a combination of ground based access for crews and equipment followed by tower setting by heavy lift helicopter.

The restoration plan will address public safety, new restoration structures, replacement conductor, and other special equipment. The structures and most of the other special equipment will be in lay-down yards and warehouse facilities along the project route. Placement of these locations and the materials to be stored in each will be determined by final design of the line, since it will determine the actual placement of different structure types and associated hardware. It is assumed that there will be at least three substantial warehouse facilities, one at or near each converter station. The major material items are listed below.

1. Structures – Structures to be kept on-hand for restoration activities include the following types, depending on location and utilization in the final design.
    a. A combination of tangent, dead end and angle structures (lattice towers or steel poles) of the original design may be kept in inventory.
    b. A specialty structure designed and inventoried to serve as a replacement for several of the standard structure types in emergency situations. Options include a unique guyed tower, lattice mast, or other specialty design for use where the conductors are intact and lifting intact conductor bundles is preferred.
    c. A single mast tower for use where the conductor will be re-strung.
2. Mats – For portions of the project with terrain requiring matting, an inventory of mats will be stored at the yards for emergency use or otherwise secured through prior agreement with matting contractors. The size and quantity will be determined based on the location and terrain during detailed design and construction.
3. Equipment – Equipment requirements will be determined during detailed design and construction, but will include pieces such as small cranes, large cranes, excavators, and other equipment required for handling materials and performing the ground work required in an emergency. Equipment may also be available locally for rental and contracted as an alternative to being owned and stored when not in use (see Appendix 3, Vendor Lists).
4. Special equipment – Winches, hydraulic cutters, tracked loaders, anchor installation tooling and numerous other items will be purchased or contracted to complete the restoration plan equipment requirements.
5. Miscellaneous Materials – The inventory of miscellaneous restoration materials will be defined during detailed design and construction. The material requirements will match the materials installed on the line for the response region supported by each facility.

Materials and equipment which are readily available from commercial rental fleets, contracted inventories or ordinary tool inventories will not be purchased as part of this program (see Appendix 3, Vendor Lists).

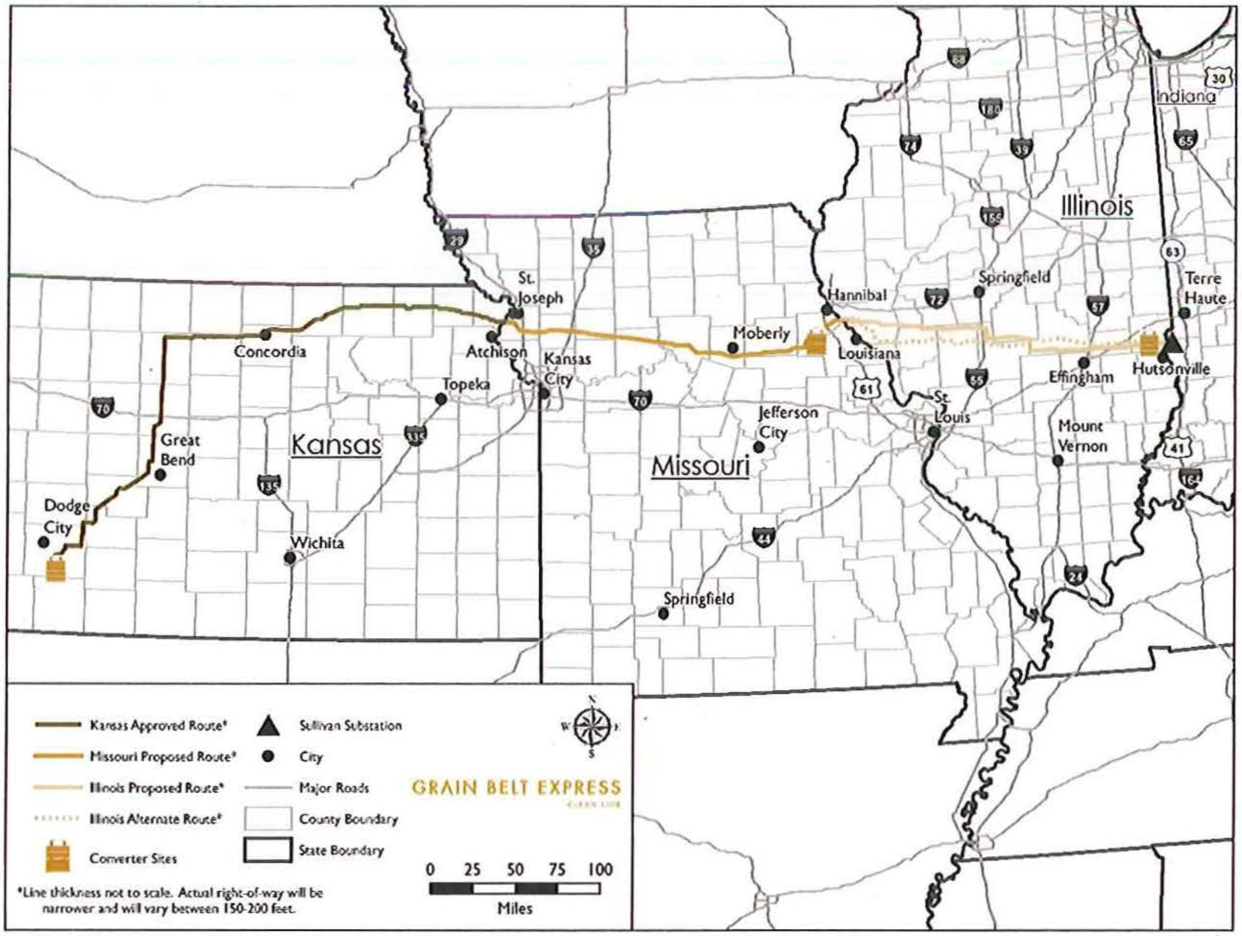
As with any storm or emergency situation in the power industry, successful execution of this plan requires that Clean Line divert all available field, engineering, administrative and executive resources toward restoring the line in event of an incident. These resources include contracted or partner entities as well as Clean Line resources.

A Restoration Manager will be responsible for the restoration effort and will be the primary decision maker during the restoration event. This manager may respond to the site, a location near the site, or control the operations from another location with direct coordination and communication with his/her representatives onsite. The Restoration Manager will have access to GPS-informed location data and as-built drawings to expedite the response.

Making the restoration successful requires the ability to very rapidly secure the area, and execute large purchase and rental contracts – for helicopter service, heavy equipment, cranes, mat rental etc. Securing Service or Rental Agreements with identified vendors in advance will aid in rapid response under this Plan.

In the event of an emergency related to the Grain Belt Express Clean Line, please call (855) 665-3438.

FIGURE 1-1 GRAIN BELT EXPRESS PROJECT MAP



1.0 Overview of the Plan

1.1 Line Description & Maps

The Grain Belt Express 600 kV HVDC transmission line begins in southwestern Kansas in Ford County. The line traverses generally to the northeast to Osborn County before turning generally in an eastward direction. It then traverses in a generally eastward direction to Doniphan County where it crosses into Missouri. In the western portion of the state the line is accessible due to its proximity to US and state highways. The northern section of the line in Kansas has localized access from Interstate, US, and state highways, with a significant portion of the access by County and township roads, making access for inspection and response slightly more challenging. Access to the Missouri River Crossing into Kansas will require crossing using bridges in Atchison to the south or St. Joseph to the north. See Figure 2-1 for the Kansas line segment.

In Missouri the line traverses generally west to east from Buchanan County to Ralls County where it crosses the Mississippi River into Illinois. There are limited locations where the line parallels east-west US or state highways, which will result in accessibility challenges for rapid inspection and restoration activities. Access to the Mississippi River Crossing will require crossing using bridges in Hannibal to the north or Louisiana to the south. See Figure 2-2 for the Missouri line segment.

In Illinois the line enters into Pike County and traverses generally eastward to Clark County where it crosses into Indiana to its destination near the state line. There are limited locations where the line parallels east-west US or state highways, which will result in accessibility challenges for rapid inspection and restoration activities. Access to the Wabash River Crossing will require crossing using the bridge in Hutsonville to the south. See Figure 2-3 for the Illinois line segment.

Figure 2-1 - Kansas Route Map

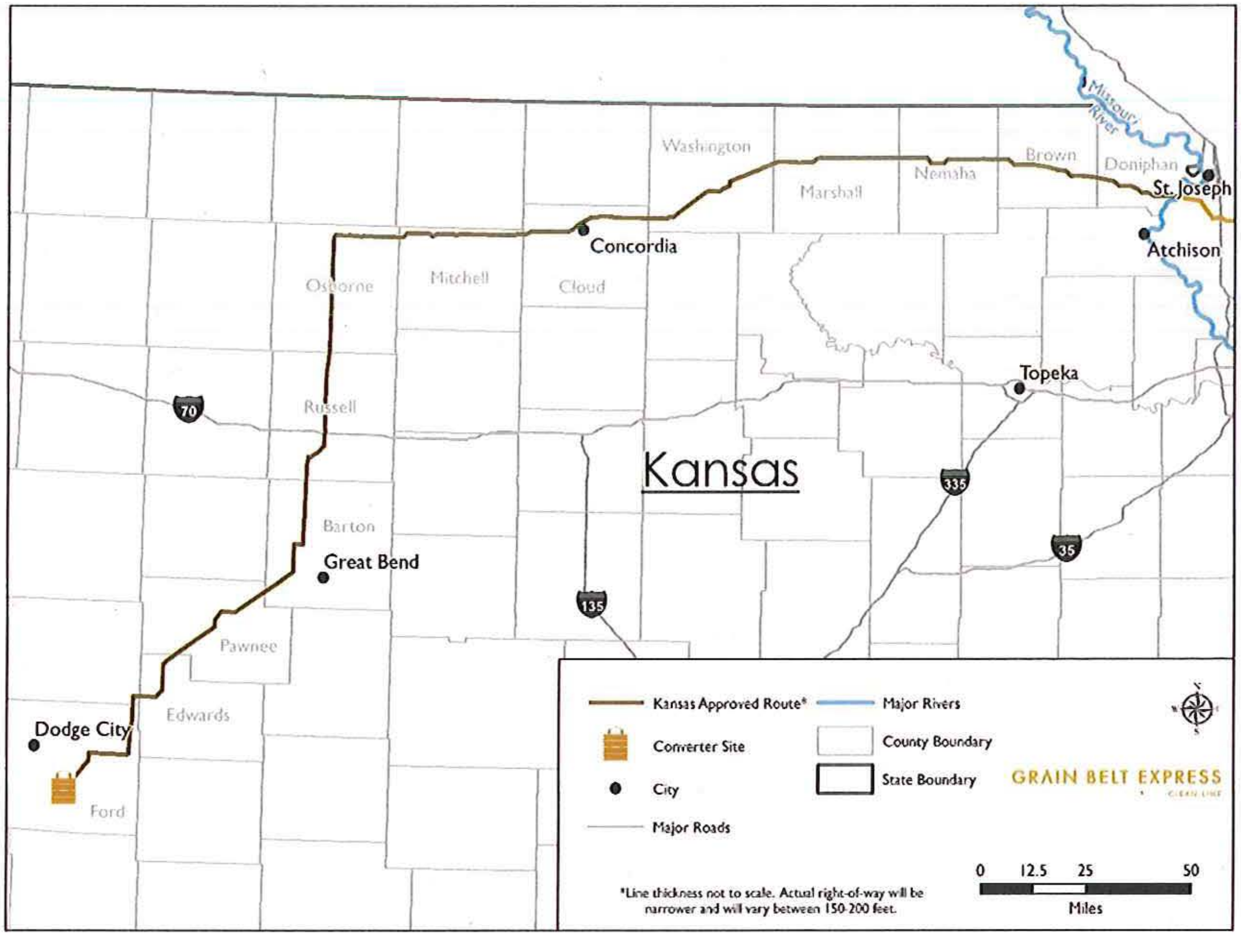


Figure 2-2 - Missouri Route Map

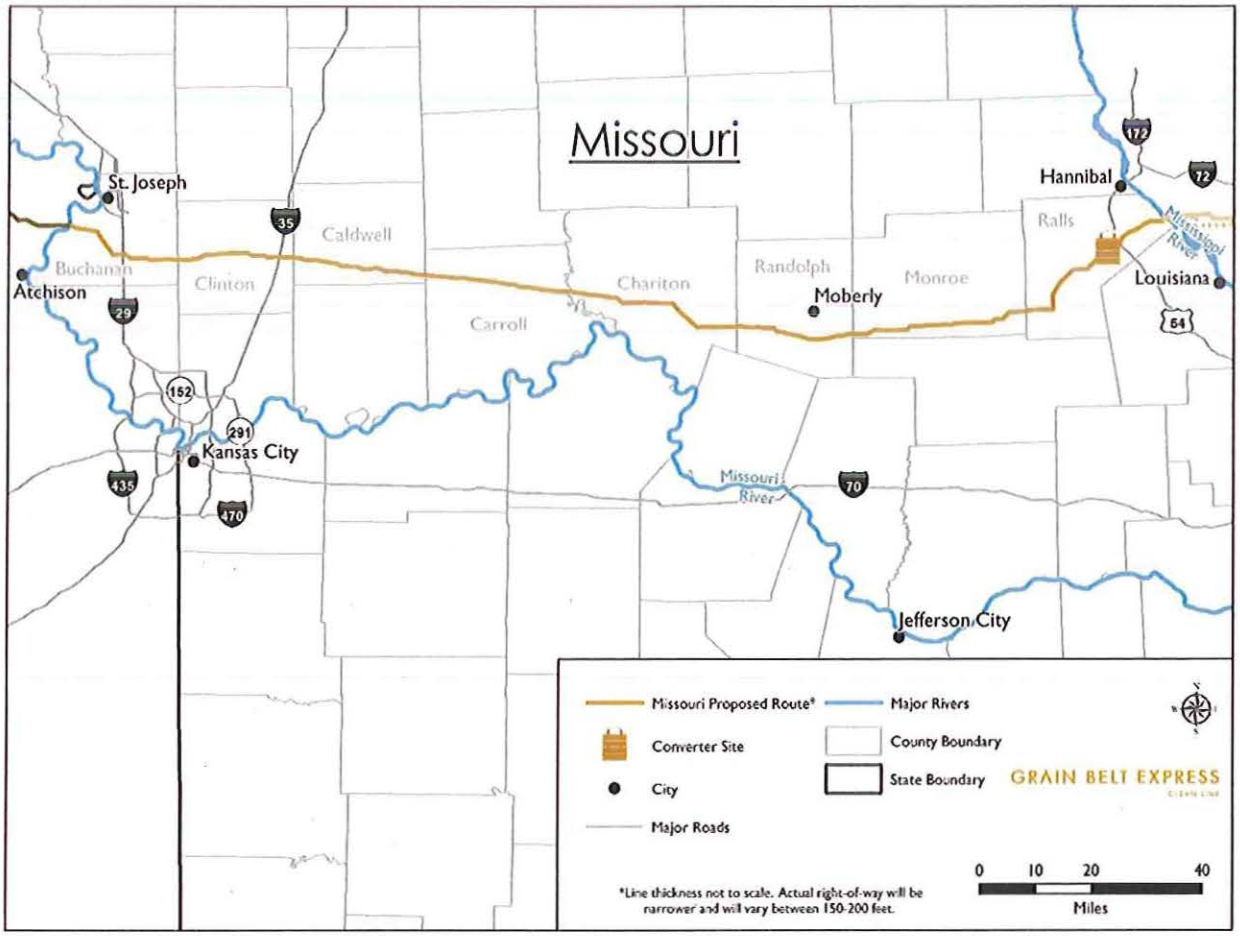
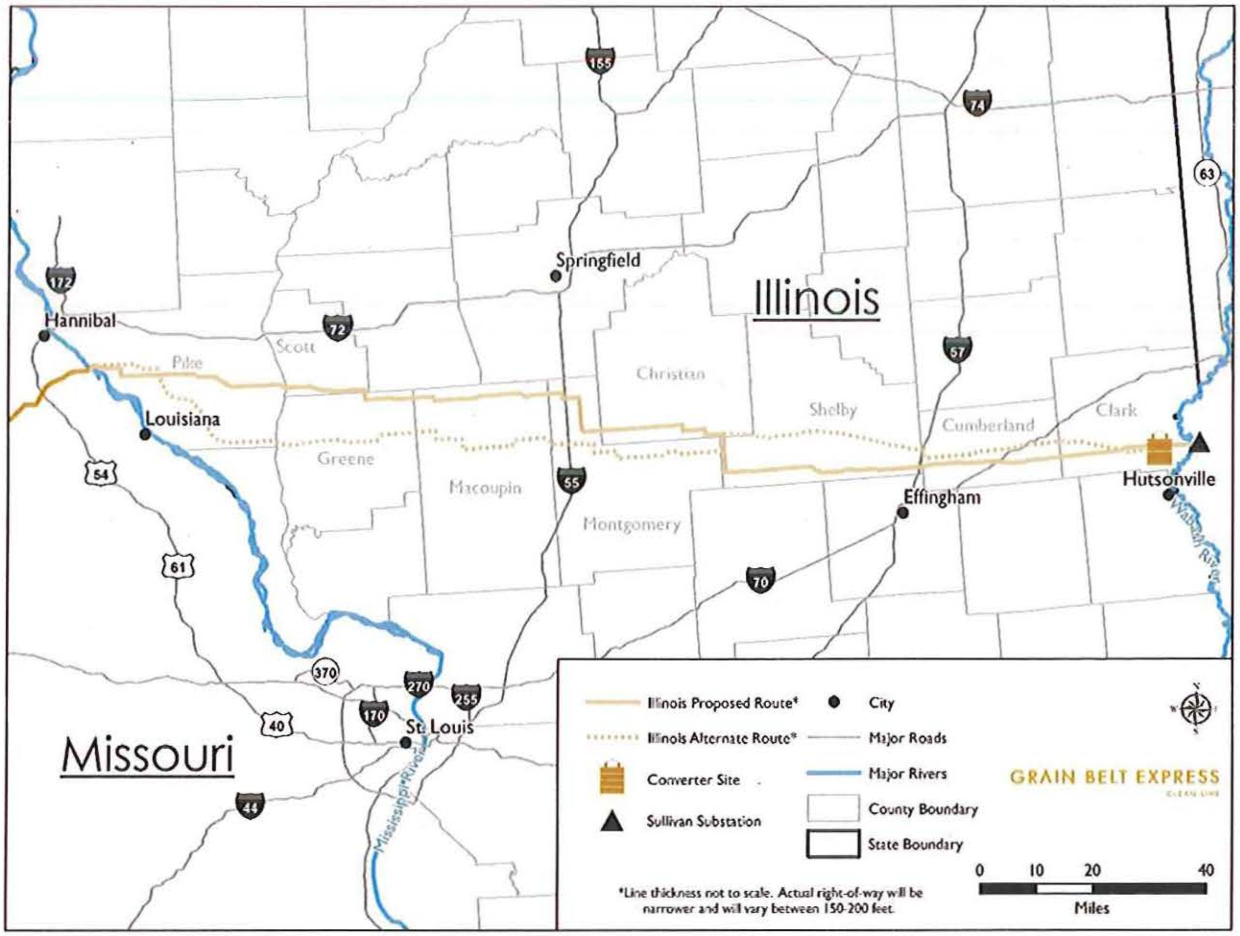


Figure 2-3 - Illinois Route Map



2.0 Detailed Summary

2.1 Restoration Options

2.1.1 Ground Based – The ground based option has been developed for restoration activities within close proximity to a permanent road and assumes little, if any, helicopter assistance. Small helicopters or fixed wing aircraft may be used initially to identify the area and establish initial steps. A small helicopter will remain at Clean Line's disposal throughout the restoration effort. The further use of helicopters in a land based approach will be described in paragraph 2.1.3, Hybrid Restoration.

Upon initial report, an Assessment Team, described in paragraph 3.1.3, will coordinate with local authorities to secure the area from the public and identity any potential hazards to other utilities or entities. The local authorities are to remain on site until security can be dispatched to the area. The Assessment Tem will be rapidly mobilized to the site. The purpose of this Team is to determine tasks to prevent additional damage, and make the damaged area safe to the public and restoration workers. The Team will determine the best access and ground conditions, coordination with local authorities, and determine mat requirements, equipment requirements, material requirements, and personnel needed for the restoration effort. The Assessment Team will guide the layout of access roads and work area requirements near the structure(s).

The purpose of the security team is to ensure the public does not cross into any potentially hazardous areas, ensure the construction area remains clear, and prevent further damage from looting.

Upon confirmation of restoration requirements, ground access preparations will begin immediately, including mobilizing mats and other equipment necessary to establish safe access and work areas.

Also upon confirmation of a restoration need, the dedicated storage containers (conex boxes) and other tools stored at the nearest response facility will be transported to the work site so damaged structure demolition can begin.

The timely arrival of necessary heavy equipment is important for successfully executing the ground based approach. Accordingly, activities to transport these large pieces of equipment will commence as soon as possible.

Upon securing an appropriate work area near the base of the structure, activities to remove the existing structure and install its replacement will commence. For specialty temporary replacement structures this may include the installation of temporary bases, helical piers or anchors if the replacement structure requires guying. If the replacement structure can be placed on the original foundation, then it will not require alternative construction appurtenances.

If the replacement structure requires a new foundation, appropriate equipment will be mobilized to install the foundation in close proximity to the existing structure while the damaged structure is removed.

Additionally, any temporary or permanent anchors will be installed before structure erection begins, using appropriate equipment for the site and conditions.

Conductor bundles will be correctly positioned to allow for installation of the replacement structure. Generally the configuration will require one group of wires positioned on either side of the replacement structure body. However, alternative structure types may require adjustments to the spacing and location of the wires during installation. After installation, the wires will be positioned to lift directly upward into their final positions.

For structure assembly, the Assessment Team will determine whether structure components will be pre-assembled or assembled at the work site. If pre-assembled, lifting equipment will be needed to off-load the components and position them for final field assembly. For a tower assembled at the worksite, smaller equipment can off-load the bundles, and the structure can be bolted up without the need for a large crane.

Lifting the structure will require a larger land based crane. Access roads and bearing pads will need to be sufficiently strong for a large land based crane. Less may be needed if a swamp buggy style crane is used with wider and longer tracks to reduce the concentration of ground loads.

Upon lifting the structure to the approximate final position, temporary guys may need to be installed from the ends of the cross arms to the ground to provide temporary support.

Upon positioning the structure, rigging diagrams are used as guidance to lift the conductor bundles in place, add permanent guying for guyed structures, and remove temporary guying. Skid mounted winches are necessary to carry out some of these rigging activities.

Upon installing the conductor bundles and any permanent guying, shield wires will be installed.

Demobilization will commence upon notification from the restoration manager.

2.1.2 Helicopter Lift

For a work site away from a permanent road or with restricted access, a fly-in option will be used. The same analysis and safety procedures will be followed as shown in the ground based option. Various stages of the restoration effort will require different capacity helicopters. Helicopter lift will be evaluated during detailed design so that helicopter work limitations are considered in structure design specifications.

Small three to four passenger helicopters with limited cargo capacity will be used initially for reconnaissance. One small helicopter will remain at Clean Line's disposal throughout the restoration effort.

With the exception of structure erection, a helicopter with a minimum lift capacity of 3,000 pounds will transport materials from the nearest marshalling yard to the work site.

Structure erection will require a helicopter with larger lift capacity, at least 10,000 pounds, based on regional availability. The erection of a typical structure would require multiple picks with this type of helicopter, which require increased safety precautions. A 20,000 pound capacity helicopter is required for erecting the structure in fewer picks. The mobilization time of large helicopters is often several days, therefore, arranging for a large helicopter to fly to the area will be one of the first steps during the restoration effort.

The Assessment Team will identify the location of a marshalling area. Most of the materials, tools, and small equipment would be trucked to the marshalling area and off-loaded. Personnel will be assigned there to rig the lifts for helicopters.

Initially a few small mats will be flown in to start building working areas. These will be manually assembled. After building a small working area, a skid steer such as an ASV60, the largest piece of ground based equipment in the fly-in option, will be flown in. A modified skid steer loader that can be broken down into pieces will likely be required. This allows the skid steer loader to be flown in multiple lifts, all of which are less than 3,000 pounds. The modified skid steer loaders is then reassembled on site with hand tools.

The restoration procedure for the fly-in option is similar to the ground based approach until the structure is lifted in position. As explained above, the structure will be lifted in multiple lifts depending on the availability of helicopters.

Demobilization will commence upon notification by the Restoration Manager.

2.1.3 Hybrid Restoration

Two aspects of the restoration effort make a hybrid approach desirable. The ground based approach relies on a narrow access road to import materials, equipment, tools, and personnel to the worksite. Helicopters allow for faster delivery of resources to the worksite. In addition, the use of the large heavy cranes for structure erection may be slow, difficult, or possibly unsafe. Using a helicopter to erect the structures may expedite restoration completion.

2.2 Structure Types

Information on the structure types, where each is used, demolition guidelines, assembly procedures, and other applicable structural information will be available in both hard copy and an electronic version with the Restoration Manager and in a designated office location.

The structure inventory and location(s) will be maintained and available in both hard copy and an electronic version with the Restoration Manager and in a designated office location.

Erection procedures for each structure type will be intended to restore the line without cutting the conductors.

Any consideration for helicopter construction must be included in structure designs and specifications.

2.2.1 Tubular Steel Poles

Tubular steel pole structures will be used on some portions of the Grain Belt Express project and will be maintained in inventory. Anchor bolt cages that match the designs of the inventoried structures will also be kept in smaller quantities in the event that a new foundation and pole structure are needed. The installation of a new foundation will also require rapid foundation design for the location and the use of rapid construction techniques and concrete to reduce potential delays.

2.2.2 Lattice Towers

Lattice tower structures will be used on the Grain Belt Express project, and will be maintained in inventory. Stub angles or other foundation adaptions that match the designs of the inventoried structures will also be kept in smaller quantities in the event that new foundations are needed. The installation of a new foundation will also require rapid foundation design verification for the location and the use of rapid construction techniques and concrete to reduce potential delays. Lattice tower designs with modular components that can bolt together for any desired structure height are also a potential special restoration structure. The structures to be designated for helicopter construction will be designed so they can be erected using a medium lift helicopter (10,000 lb capacity) or a large capacity helicopter (20,000 lb capacity), with the difference being the number of lifts required. Alternatively, the lattice structures can be erected with a crane.

2.2.3 Guyed Structures

In certain circumstances, there may be application for guyed structures on the Grain Belt Express project. Should they be used, an appropriate emergency restoration quantity would be included in inventory at the appropriate location(s). Guying and anchorage hardware and installation equipment would be required for their installation.

2.3 Resources

Restoration of the line will be completed by Clean Line or contract personnel. When the operations and maintenance procedures for the transmission line are established, internal versus contract staffing will be defined along with their location. A list of supplemental suppliers and contractors is discussed in Section 4. In addition, assistance may be available from other utilities through Mutual Assistance Groups.

2.4 Materials

Inventory requirements and storage locations will be determined during detailed design and construction to reflect the appropriate quantities as well as appropriate locations for the various materials. Materials needed beyond the designated emergency inventory and storage locations will be verified as available from regional Mutual Assistance Groups or from the suppliers discussed in Section 4.

2.5 Equipment

During the detailed design and construction phase of the project, the equipment required for operations, maintenance, and emergency restoration activities will be identified. The equipment will either be purchased and strategically staged along the Clean Line facilities, or it will be identified as available regionally and confirmed to be available to respond to restoration events.

Detailed specifications will be included as Appendix 2 to this plan with the listing noting the size, weight, capacity, and other useful information.

3.0 What to do first when 'THE CALL' comes in

3.1 Assess and Plan

Notification – The emergency response phone number will be posted prominently on the project web site and on file with state regulatory bodies and any other appropriate agencies or organizations, including local police and fire.

3.1.1 Initial indication of failure location.
Notification will be made to the Restoration Manager who will in turn notify the Assessment Team and the aerial patrol company as indicated in paragraph 3.1.2.

3.1.2 Contact and mobilize assessment helicopter or fixed wing, if available, to make initial report regarding location and extent (number of structures).
The Restoration Manager will notify the local authorities to have the damaged area secured to prevent the public from possible injury. A patrol helicopter company and line maintenance staff will also be notified to initiate an aerial patrol. An alternate company with a fixed wing aircraft may also be engaged.

3.1.3 The Assessment Team (Transmission Engineer, Construction Manager, Lineman) fly over the site in a small helicopter to document the extent of failure and to make primary decisions on the restoration effort.
The Assessment Team will report to a predetermined meeting site and fly with the small helicopter to the appropriate response yard, pick up the assessment tools, and then fly on to the worksite. The Assessment Team will determine tasks to prevent additional damage and make the damaged area safe to the public and restoration workers. The Team will determine the best access and ground conditions, coordination with local authorities, and determine mat requirements, equipment requirements, material requirements, and personnel needed for the restoration effort. The assessment team will guide the layout of the access roads and work area requirements near the structure(s).

3.1.4 Mobilize a medium-duty helicopter with 3,000 lb lift capacity for response operation.

A helicopter of this capacity will be mobilized even if a ground based approach has been decided.

Helicopters of this capacity are available from:

Brand	Model	Capacity	Company	Phone
Astar	AS350BE	2,700	Mt Air Helicopters	(505)865-7500
Bell (Huey)	UH1-B	3,000	Helicopter Transport Services	(503) 776-9300
Bell	205	3,600	Helicopter Transport Services	(503) 776-9300
Bell	212	4,500	Winco	(503) 678-6060
Kaman	Kmax	6,000	Timberline Helicopters	(208) 263-5987

Sikorsky	S61-R	6,500	Erickson Aircrane	(800)424-2413

3.1.5 Determine the type of restoration effort needed, i.e., ground-based, air lift or hybrid.

3.1.5.1 Ground-based efforts: For heavy crane operations in poor ground conditions, consideration will be given to the added time and risk associated with access roads and the potential need for mats and road building to accommodate crane loads.

3.1.5.2 The maximum for mat road construction will be determined by the amount of matting and other road stabilization materials available and may be less if heavy-section mat road is required for heavy crane operation. Otherwise, heavy lift air operation is necessary.

3.1.5.3 If airlift restoration, contact and mobilize heavy-lift helicopter.

Heavy lift helicopters are available from:

Brand	Model	Capacity	Company	Phone
Boeing	Vertol 107-II	10,000	Columbia Helicopters	(503) 678-1222
Boeing	Chinook 234-LR	20,000	Columbia Helicopters	(503) 678-1222
Sikorsky	SkyCrane S64E	20,000	Erickson	(800)424-2413
Sikorsky	SkyCrane S64F	25,000	Erickson	(800)424-2413
Boeing	Chinook 234-U	26,000	Columbia Helicopters	(503) 678-1222
Sikorsky	SkyCrane S64E	20,000	Siller Helicopters	(530) 674-946

The listing above is preliminary and will be continuously updated.

3.1.5.4 Notify all available resources of needed support.

3.2 Mobilize To Staging Location

3.2.1 Dispatch trucks with equipment
3.2.2 Dispatch restoration "tool boxes" from storage yards
3.2.3 Dispatch crew(s) to storage yards with crane to prepare new structure(s)
3.2.4 Dispatch civil crew to load and haul mats and equipment
3.2.5 Dispatch fleet mechanics and tool trucks
3.2.6 Deploy access mat layers if road accessible – run 24 hour shifts
3.2.7 Order large cranes to load and help assemble any heavy equipment broken down for transport
3.2.8 Mobilize to site from staging location, likely on right of way from nearest road

4.0 Contacts and Organization Charts

4.1 Emergency Contact List (to be updated upon final engineering)

Area	Contacts(s)	Office Phone	Home Phone	Pager	Cell Phone
Transmission Construction & Maintenance (PAR Electrical)	Dallas White	816-691-4254			816-206-0550
	Rusty Brookes Tim Warlen	515-249-2314 816-691-4254	515-963-7628 660-678-4191		515-249-2313 816-797-7749
Transmission Engineering Support	Curtis Symank, Senior Project Manager, POWER Engineers	512-963-8103			
	Daniel Copple, Manager, Clean Line Energy	832-319-6351			
Converter Station Engineering Support	Jonathan Abebe, Engineering and Transmission Manager, Clean Line Energy	832-627-7149			
	Deral Danis, Engineering and Transmission Director, Clean Line Energy	312-561-9703			
Converter Station Construction and Maintenance	Jonathan Abebe, Engineering and Transmission Manager, Clean Line Energy	832-627-7149			
Siting & Land Rights – Permits	Deann Lanz VP Land, Clean Line Energy	832-319-6310			
	Paula Priest, Land Manager, Clean Line Energy	314-330-8015			
Line Clearance	Curtis Symank, Senior Project Manager, POWER Engineers	512-963-8103			

4.2 Vendor List

During the detailed design and construction phase of the Project, the equipment and resources required for operations, maintenance, and emergency restoration activities will be identified in this Plan. The contractors or vendors for resources and equipment will be listed in Appendix 3.

Detailed contact information and specific information about the service or product from each vendor, including contractual information will be included with the listing to assist in making communications as efficient as possible during a restoration event.

5.0 Restoration Execution

The execution guide below outlines the steps in the restoration of a lattice tower. Steps for a steel pole structure would be similar. Additional detailed procedures will be prepared and included in this Plan for each structure type used on the line based on the final line design and knowledge learned during construction.

5.1 Access Work Site

5.1.1 Using Mats

5.1.1.1 Soil strength assessment – prior to construction of mat road
Soil strength testing using vane shear testing and probing with hand tool may be required to assess soil capabilities. Matting requirements will then be determined based on soil capability.

5.1.1.2 Mat Crew Resources –
The Mat Crew will have sufficient support personnel and equipment for transporting and shuttling mats to stay ahead of installation crew(s). This becomes more important as the access road gets longer. Mat configuration alternatives will be reviewed for the most appropriate installation to distribute load.

5.1.2 Using Helicopters

5.1.2.1 When ground access is not available or practicable, detailed job site planning will be conducted to determine if a helicopter is needed, and create the mobilization and execution strategy and step by step procedures.

5.2 Prep for Tower Work

5.2.1 Confirm with system manager visual confirmation of open switch, plant personnel tag out switch, onsite crew reconfirms open switch, and tag out. Crew checks for any other possible lines crossing in damage area and confirms same procedure with outside utility. Crew checks line voltage with tester and installs conductor grounds
5.2.2 Mobilize to site small mats and light ASV with equipment to begin site prep
5.2.3 Bring in tools and anchoring materials for securing conductors
5.2.4 Lower conductors on adjacent towers to relieve tension stresses, if necessary
5.2.5 Install anchors to restrain downed conductors so they can be detached from hardware assemblies
5.2.6 Cut tower parts to free conductors from tower debris
5.2.7 Move and protect conductors and shield wires. Do not cut conductors.
5.2.8 Demolition of downed structures to clear work area
5.2.9 Assess existing foundation conditions
5.2.10 Preliminary staking of new foundation area and possible anchor locations for staging of mat and work areas

5.3 Install New Foundations (if necessary)

5.3.1 Use same pier/pile material used on existing foundations (from inventory)
5.3.2 Installation details will vary based on foundation required

5.4 Structure Setting and Conductor Work

5.4.1 Tower Assembly
5.4.2 Rigging and Setting - Detailed procedures will vary based on actual tower being installed, including construction loads, max lifting weights, sling lengths, attachment/rigging points, etc.
5.4.3 Conductor assemblies, MRC assemblies, and shield wires will be staged prior to setting structure using supporting assemblies and equipment as required
5.4.4 Tower Base, adaptions, and top cage will be installed
5.4.5 Temporary guying will be installed to support the conductor attachment if necessary
5.4.6 Conductor lifting using support equipment or air winches
5.4.7 Conductor and shield wire assemblies will be reattached
5.4.8 Permanent guying will be installed if applicable
5.4.9 Structure grounding will be reinstalled or reconnected

5.5 Demobilize

5.5.1 Remove equipment
5.5.2 Dispose of waste material/debris
5.5.3 Remove matting and other temporary access measures
5.5.4 Perform any other necessary site restoration activities

6.0 Supporting Sections

As final design and construction plans are developed, the following sections will be finalized:

- Operations and maintenance facility location maps
- Predetermined staging area maps, particularly for helicopter operations
- Equipment yard layout drawings
- Equipment yard inventory
- Equipment mobilization detailed plans for the various pieces of equipment
- Material yard layout drawings
- Material yard inventory
- Material loadout and mobilization plans for truck mobilization
- Minimum inventory lists for each storage facility
- Office layout drawings indication locations of critical information, drawings, etc.
- Local rental typical items lists, such as light plants, that are reasonably anticipated

In the event of an emergency related to the Grain Belt Express Clean Line, please call (855) 665-3438.

Appendix 1 – Emergency Response Flow Chart

Grain Belt Express 600 kV HVDC Transmission Line
EMERGENCY RESPONSE FLOW CHART

Line Failure Event

Control Center Outage Reported

Network Reliability Leader

1 **Clean Line Management**

2 **Clean Line Communications**

Coordinate external communications of outage.

3 **Clean Line Energy Market**

Wind Interface
PJM Interface
MISO Interface

Transmission System Operations

1 **Contact Security Coordinator**

2 **Transmission Maintenance Contact**

3 **Air Patrol**
Coordinate w/transmission maintenance

4 **Converter Station Maintenance (Contact all stations)**

5 **Warehouse/Stores**
Contact All

PROCEDURE

The Clean Line's operator will contact all personnel listed above to inform them that a major outage of the transmission system has occurred.

Clean Line's Network Reliability Leader will initiate the Call Tree to inform management of the situation.

Clean Line Communications will provide a media relations representative to compile information to provide the media.

Transmission Maintenance will initiate the crews to begin the restoration process.

Appendix 2 –Emergency Response Equipment

During the detailed design and construction phase of the project, equipment required for operations, maintenance, and emergency restoration activities will be identified in this Appendix along with locations.

Appendix 3 – Vendor Lists

Primary Construction Contractors:
- Transmission Line Contractors
- Substation Contractors
- HVDC Station Contractors
- Foundation and Anchorage Contractors

Primary Material & Hardware Suppliers:
- Pole Conductor
- MRC Conductor
- Shield Conductor
- OPGW
- Transmission Line Hardware
- Substation Hardware
- HVDC Station Hardware
- Civil Construction Materials
- Concrete

Structure Vendors:
- Lattice Towers
- Steel Poles
- Foundation and Anchorage

Aerial Response Contractors:
- Patrol Helicopter
- Medium Lift Helicopter
- Heavy Lift Helicopter

Heavy Equipment:
- Cranes
- Excavators
- Skid Steer Units
- Foundation Drilling Contractors

Tool:
- Portable Storage Units
- Winches
- Hoists
- Cutting Equipment

Access Equipment:

- Matting
- Matting Placement Equipment & Tools
- Erosion Control Measures
- Soils Testing
- Right of Way Clearing
- Right of Way Restoration
- Grading Contractors

Miscellaneous Vendors and Resources:

- Emergency Response Support (Medical Air Services)
- Emergency Transportation (Charter Air Freight)
- Mutual Utility Assistance Group Contacts