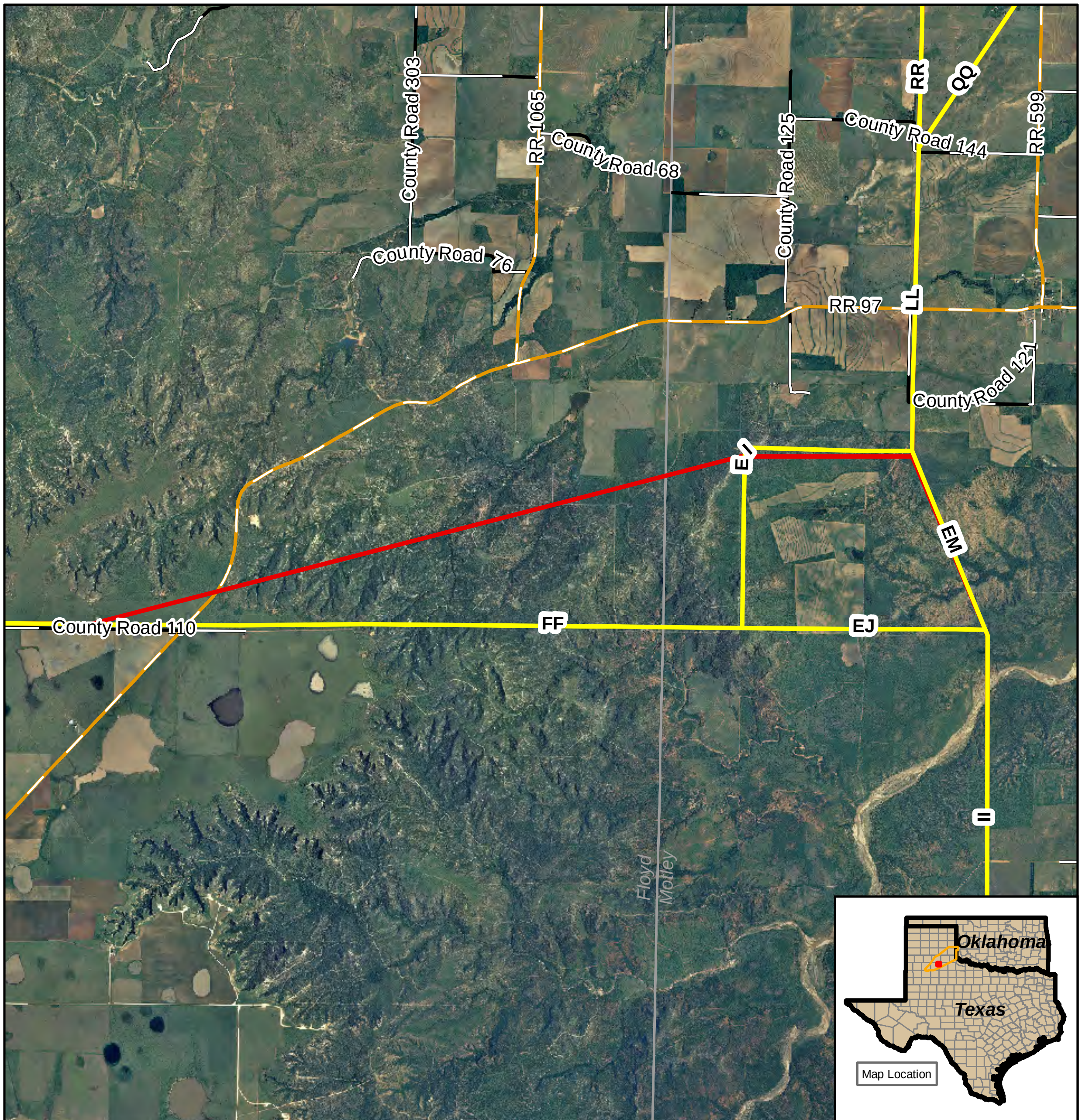

Legend

- 40 Interstates
- 83 US Highways
- 160 State Highways
- Ranch Roads
- Farm To Market Roads
- County Roads
- Routing Developed With Public Comments
- Routing Proir to Public Comments
- County Boundary
- State Boundary

N

1:85,000

0 3,000 6,000 9,000 Feet

Data Sources: Texas General Land Office 2009; ESRI 2006

Xcel Energy

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Figure 2-17
PRELIMINARY ALTERNATIVE ROUTE SEGMENT REMOVED FROM CONSIDERATION FF MAP

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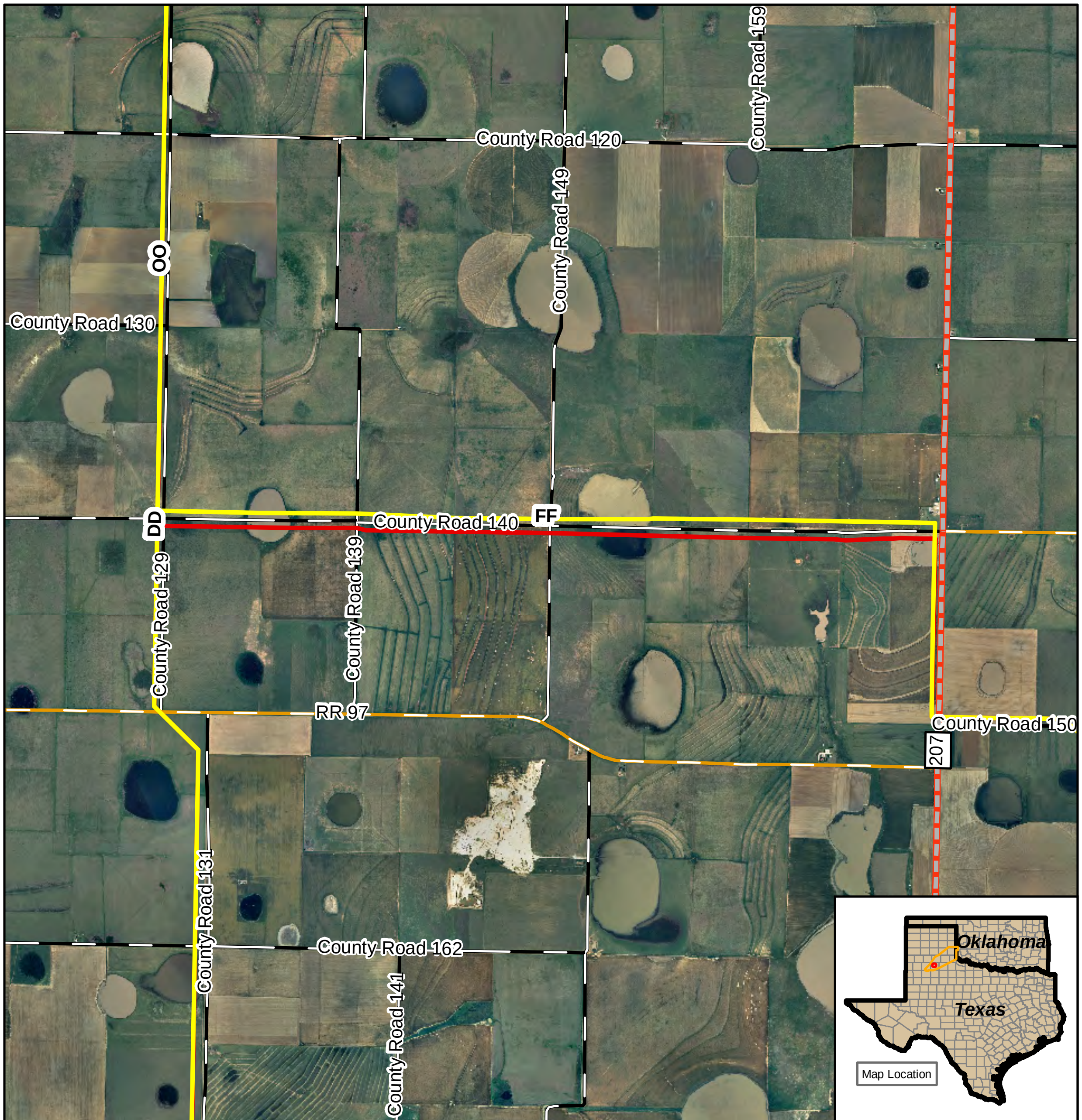

Legend

- Interstates (40)
- US Highways (83)
- State Highways (160)
- Ranch Roads
- Farm To Market Roads
- County Roads
- Routing Developed With Public Comments
- Routing Proir to Public Comments
- County Boundary
- State Boundary

1:55,000

0 3,000 6,000 9,000 Feet

Data Sources: Texas General Land Office 2009; ESRI 2006

Xcel Energy — XCEL ENERGY INC

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Figure 2-18
PRELIMINARY ALTERNATIVE ROUTE SEGMENT REMOVED FROM CONSIDERATION FF MAP

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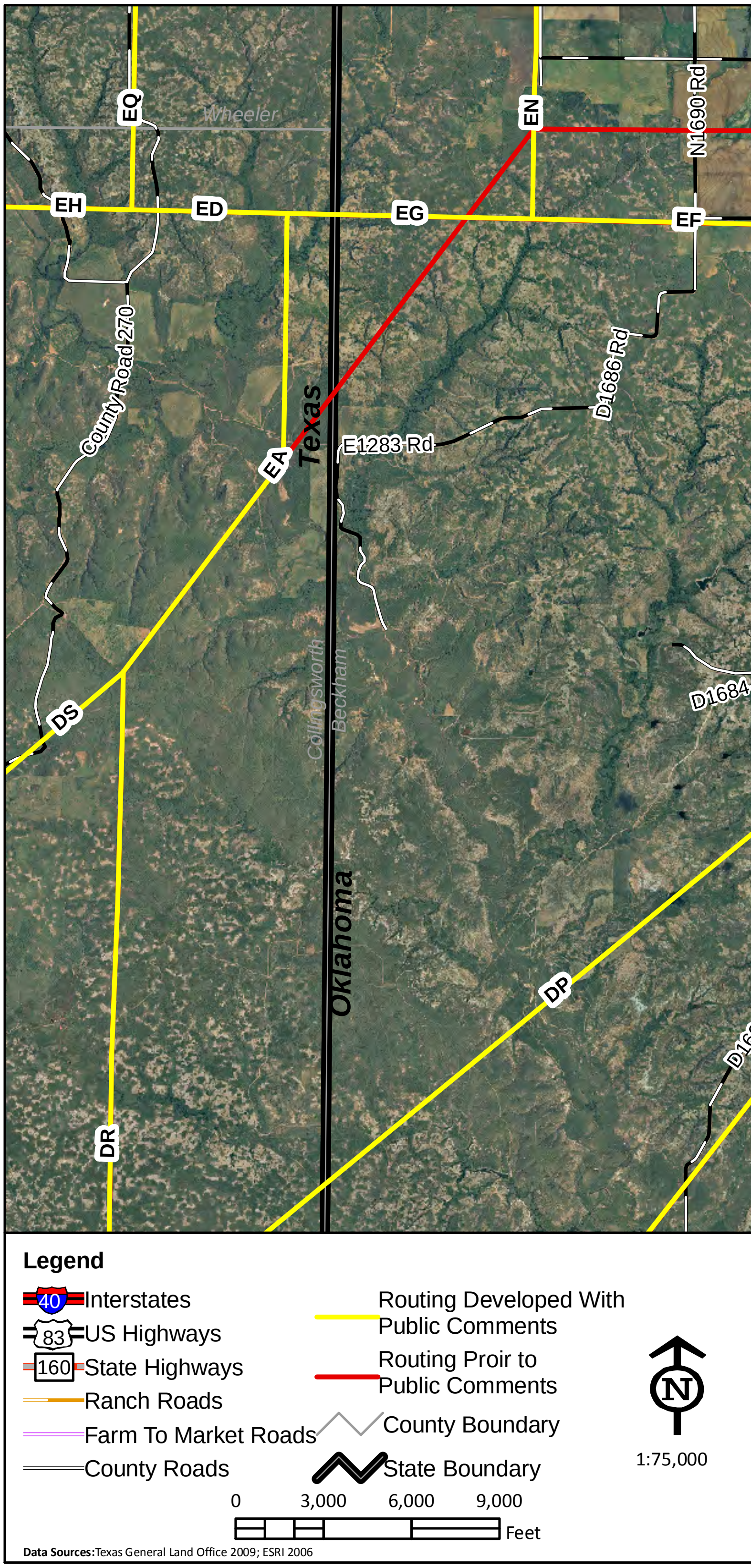

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345 kV Transmission Line Project

Figure 2-19
PRELIMINARY ALTERNATIVE ROUTE SEGMENT REMOVED FROM CONSIDERATION EA MAP

Prepared by: R Frazier February 2011

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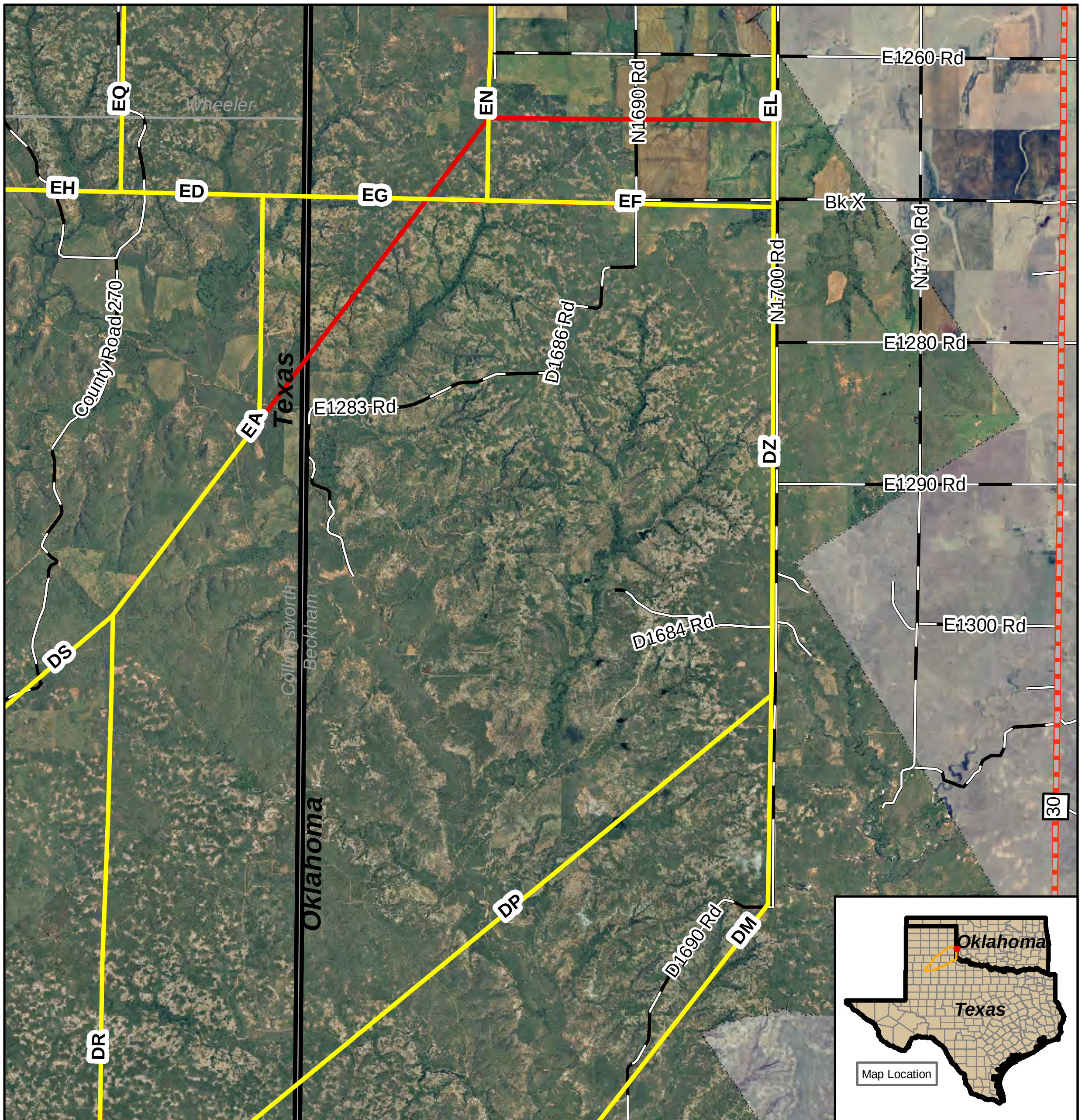

Legend

40 Interstates
83 US Highways
160 State Highways
Ranch Roads
Farm To Market Roads
County Roads
Routing Developed With Public Comments
Routing Proir to Public Comments
County Boundary
State Boundary

0 3,000 6,000 9,000 Feet

N

1:75,000

Data Sources: Texas General Land Office 2009; ESRI 2006

Xcel Energy

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TUCO to Texas/Oklahoma Interconnect
345 kV Transmission Line Project

Figure 2-20
PRELIMINARY ALTERNATIVE ROUTE SEGMENT REMOVED FROM CONSIDERATION EN MAP

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3.0 IDENTIFICATION OF ALTERNATIVE ROUTES

After the Alternative Route Segments were determined following the public and agency comments and open house meetings (see Section 2.4), the Project Team reviewed the complete set of Alternative Route Segments and identified 20 complete Alternative Routes (including a Preferred Route) that would connect the TUCO Substation with the interconnection point selected in Oklahoma. These Alternative Routes were developed in accordance with PURA § 37.056(c)(4)(A)-(D), P.U.C. SUBST. R. 25.101, and the PUC's policy of "prudent avoidance."

Table 3-1 presents each Alternative Route and the Route Segments comprising that route - listed linearly from the southwest (TUCO Substation) to the northeast (Oklahoma interconnection point). Figure 3-1 presents the general location of all 20 Alternative Routes.

TABLE 3-1

Alternative Route and Route Segments

Alternative Route	Alternative Route Segments
1	G, K, P, X, AA, DD, OO, DA, DF, AI, AK, AU, AZ, BC, BD, BE, BG, BH, BO, BR, BZ, CD, CB, CJ, CN, CT, CX, DJ, DX, EH, EG, ED, EN, EV
2	G, K, P, X, AA, DD, OO, DA, DF, AI, AK, AU, AZ, BC, BD, BE, BG, BH, BO, BR, BZ, CD, CB, CJ, CO, CR, DG, DO, DX, EH, EQ, EW, EV
3	G, K, P, X, AA, DD, OO, DA, DF, AI, AK, AU, AZ, BC, BD, BE, BJ, BO, BR, BZ, CD, CB, CJ, CO, CR, DG, DO, DX, EH, EQ, EW, EV
4	G, K, P, X, AA, DD, OO, DA, DF, AI, AK, AU, AZ, BC, BD, BE, BJ, BO, BR, BZ, CD, CB, CJ, CO, CR, CU, CX, DH, DR, EA, EG, EN, EV
5	G, K, L, M, Q, X, AA, DD, OO, DA, DF, AI, AK, AO, AP, AQ, AT, BA, BE, BG, BH, BO, BR, BZ, CD, CB, CJ, CO, CR, CU, CX, DH, DR, EA, EG, EN, EV
6	G, K, P, R, S, U, Z, AA, DD, OO, DA, DF, AI, AK, AO, AP, AQ, AT, BA, BE, BG, BH, BO, BR, BZ, CD, CB, CJ, CO, CR, CU, CX, DH, DR, EA, EG, EN, EV
7	G, E, F, I, L, M, Q, R, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, XX, YY, AD, AL, AS, AY, BH, BO, BR, BZ, CD, CB, CJ, CN, CT, CX, DJ, DX, EH, EQ, EW, EV
8	G, E, F, I, L, M, Q, R, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, AB, AJ, AL, AS, AY, BH, BO, BR, BZ, CD, CB, CJ, CO, CR, DG, DO, DX, EH, ED, EG, EN, EV
9	G, K, L, M, O, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, XX, YY, AD, AL, AS, AY, BH, BO, BR, BZ, CD, CB, CJ, CN, CT, CX, DJ, DX, EH, EQ, EW, EV
10	G, E, F, I, L, M, O, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, AB, AJ, AL, AS, AY, BH, BO, BR, BZ, CD, CB, CJ, CN, CT, CX, DJ, DX, EH, EQ, EW, EV
11	G, K, L, M, O, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, XX, YY, AD, AL, AS, AY, BH, BO, BR, BZ, CD, CB, CJ, CO, CR, DG, DO, DX, EH, ED, EG, EN, EV
12	G, E, F, I, L, M, O, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, XX, YY, AD, AL, AS, AY, BH, BO, BR, BZ, CE, CH, EP, CM, CR, DG, DO, DX, EH, EQ, EW, EV

TABLE 3-1 Alternative Route and Route Segments	
Alternative Route	**Alternative Route Segments**
13	G, E, F, I, L, M, O, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, XX, YY, AD, AL, AS, AY, BH, BO, BR, BZ, CE, CH, EP, CP, DL, DQ, DX, EH, EQ, EW, EV
14	G, E, F, I, L, M, O, S, U, Z, AA, BB, CC, EE, GG, HH, NN, TT, XX, YY, AD, DY, AR, BF, CI, DI, DB, DR, EA, EG, , EN, EV
15	G, E, F, I, L, B, H, J, T, W, EE, GG, HH, NN, TT, XX, YY, AD, DY, AR, BF, CI, DI, DM, DZ, EL
16	G, E, F, I, P, X, AA, BB, CC, EE, II, EM, LL, QQ, MM, JJ, NN, TT, XX, YY, AD, AL, AS, AY, BH, BO, BR, BZ, CD, CB, CJ, CN, CT, CX, DJ, DX, EH, EQ, EW, EV
17	G, E, F, I, P, X, AA, BB, CC, EE, II, EM, LL, QQ, MM, JJ, NN, TT, XX, YY, AD, DY, AR, BF, CI, DI, DM, DZ, EL
18	G, E, F, I, P, R, S, U, Z, AA, BB, CC, EE, II, EM, LL, QQ, MM, JJ, NN, TT, XX, YY, AD, AL, AS, AY, BH, BO, BR, BZ, CD, CB, CJ, CN, CT, CX, DJ, DX, EH, EQ, EW, EV
19	G, K, P, R, S, U, Z, AA, BB, CC, EE, II, EM, LL, QQ, PP, WW, AP, AQ, AW, BA, BE, BJ, BO, BR, BZ, CD, CB, CJ, CN, CT, CX, DJ, DX, EH, ED, EG, EN, EV
20 (Preferred Route)	G, K, P, X, AA, BB, CC, EE, II, EM, LL, QQ, PP, UU, AM, AT, BA, BE, BJ, BO, BR, BZ, CD, CB, CJ, CO, CR, DG, DO, DX, ER, EU, EW, EV

All of the Alternative Routes start at the TUCO Substation and exit the substation in the north and east directions. A description of each Alternative Route Segment in Table 3-1 above is located in Appendix E. Figures 3-2 through 3-21 present the location of each Alternative Route separately.

Selection of the Preferred Route is discussed in Section 6.0.

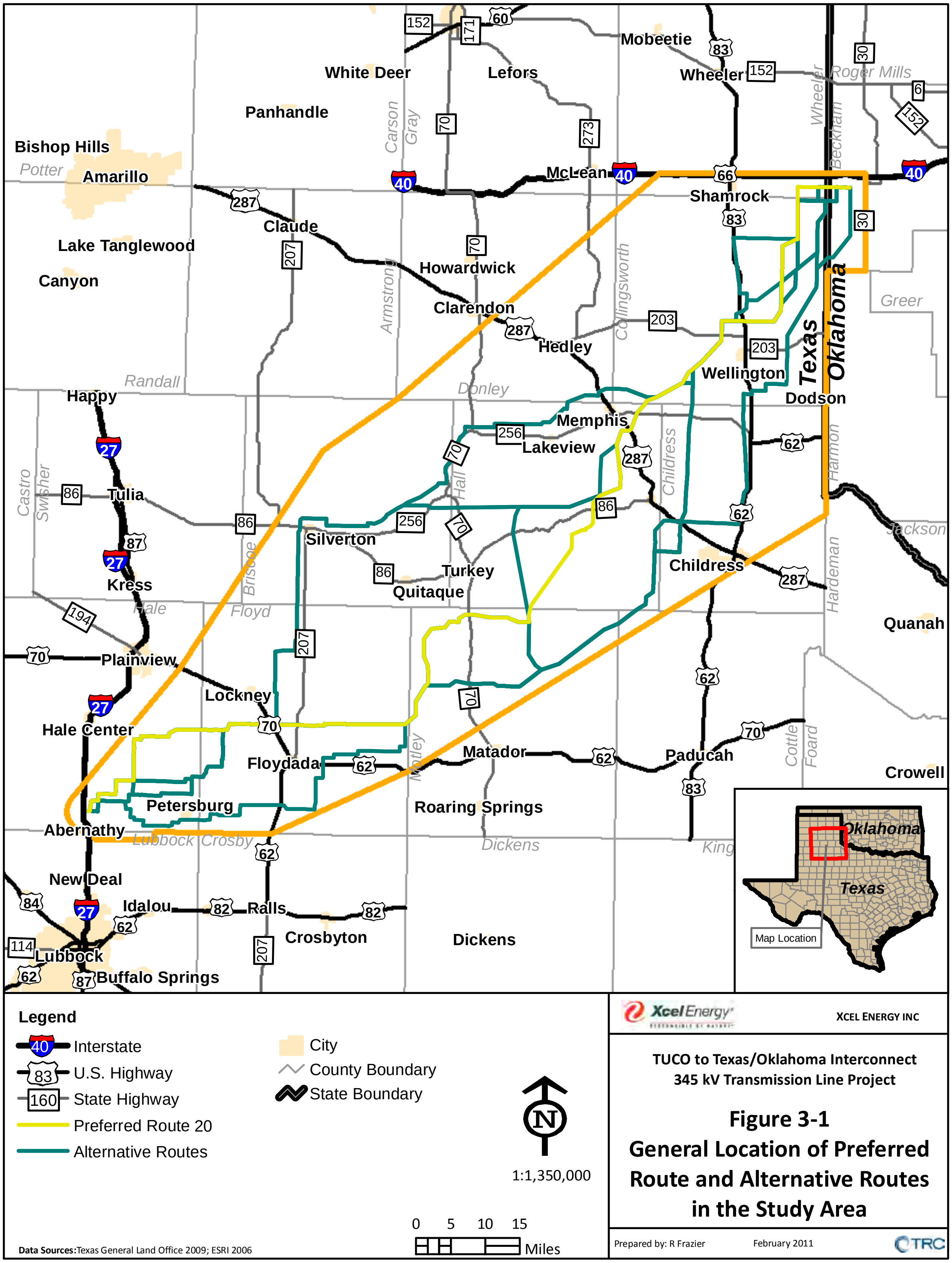

Figure 3-1
General Location of Preferred Route and Alternative Routes in the Study Area

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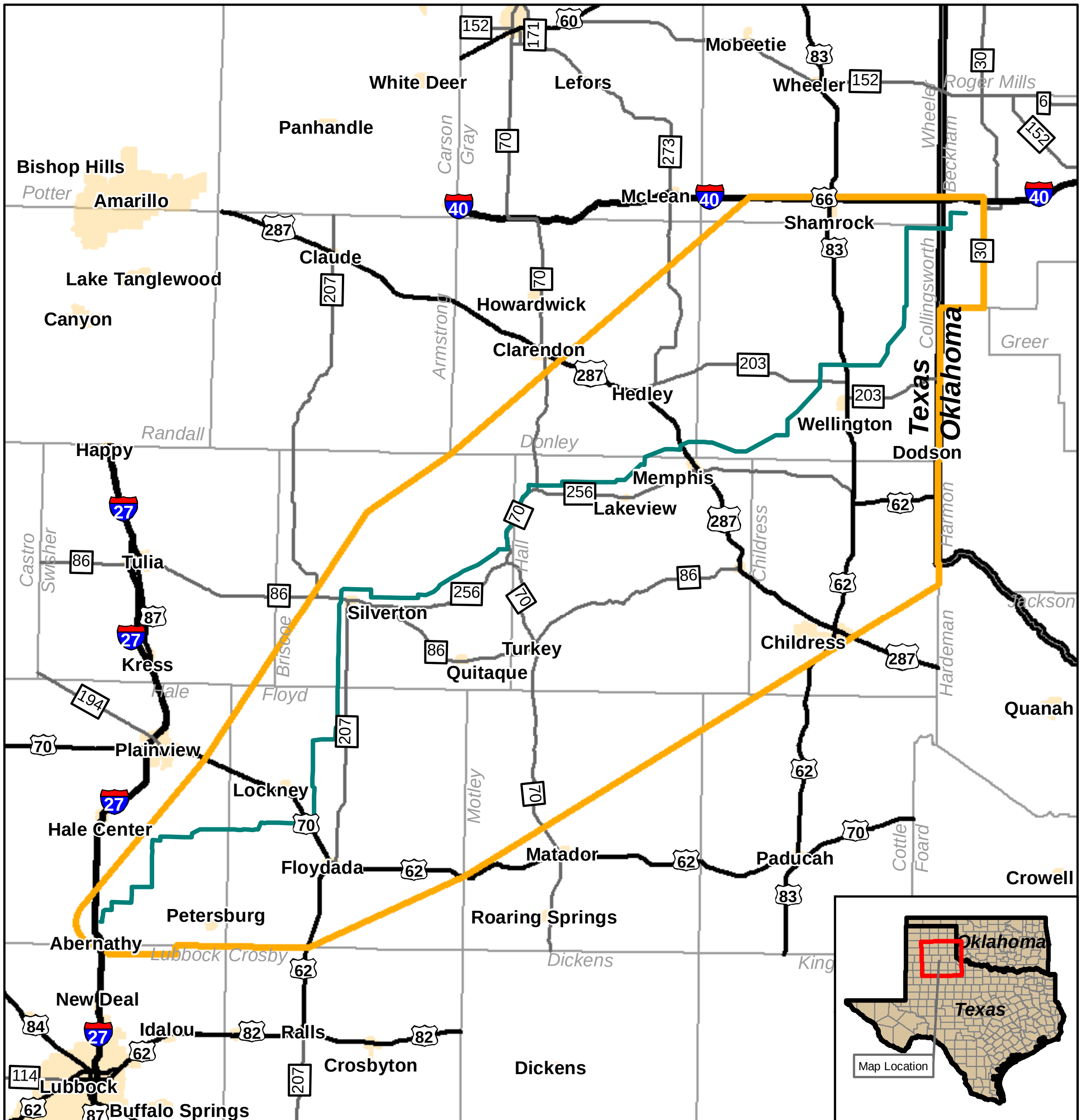

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 1
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

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Figure 3-2
General Location of Alternative Routes in the Study Area
Alternative Route 1

Data Sources: Texas General Land Office 2009; ESRI 2006

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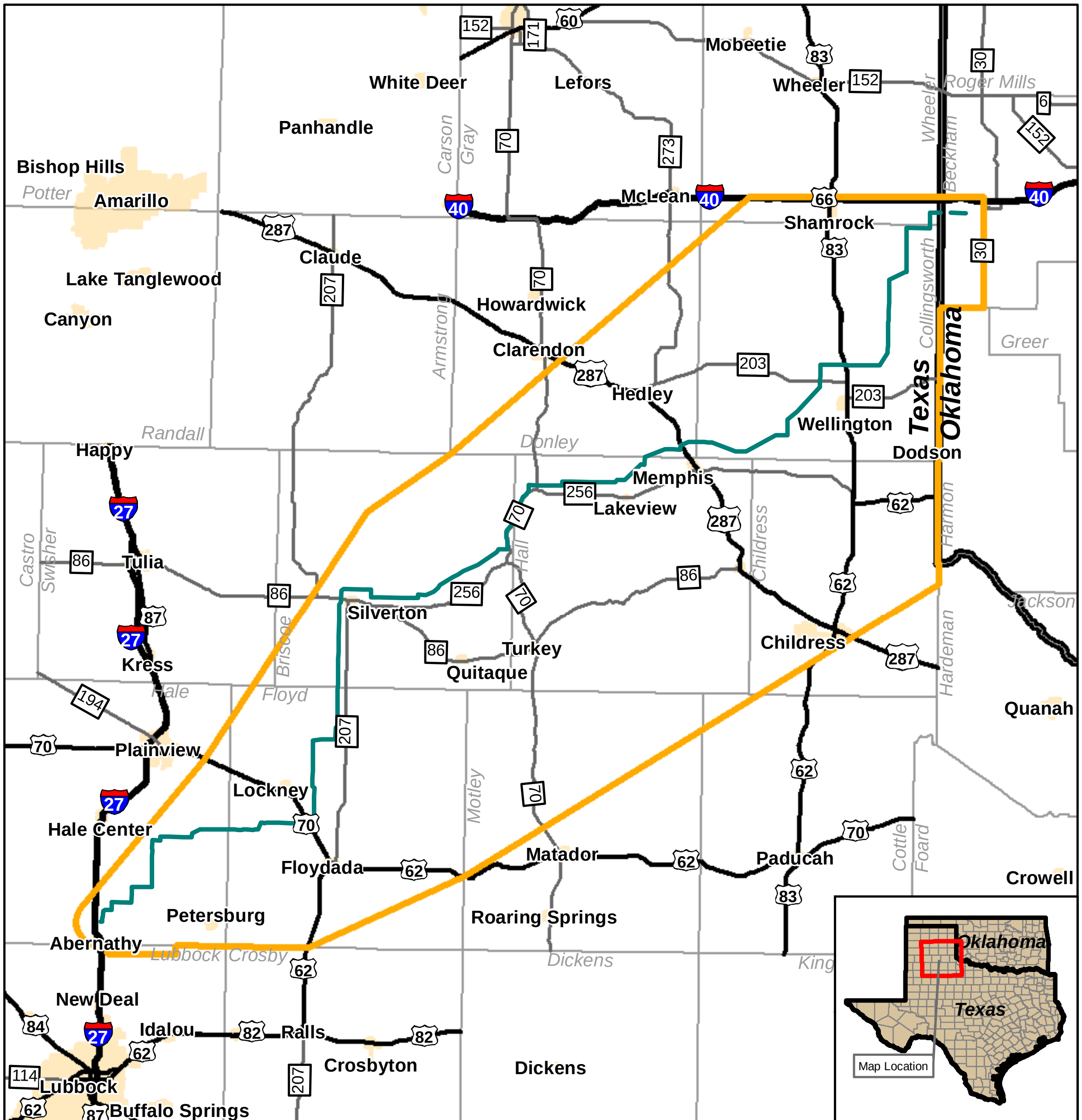

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Routes2
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-3
General Location of Alternative Routes in the Study Area
Alternative Route 2

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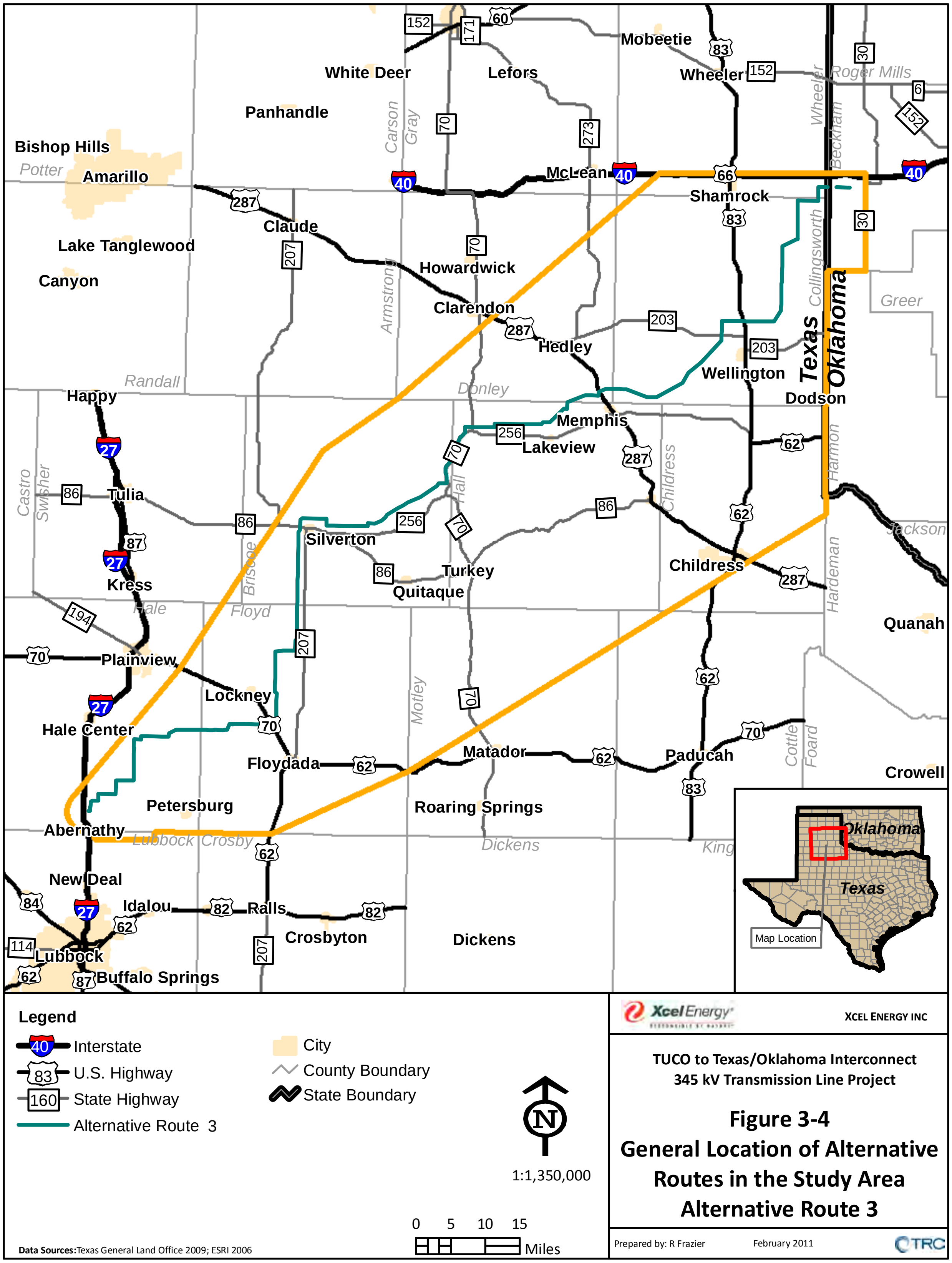

Figure 3-4
General Location of Alternative Routes in the Study Area
Alternative Route 3

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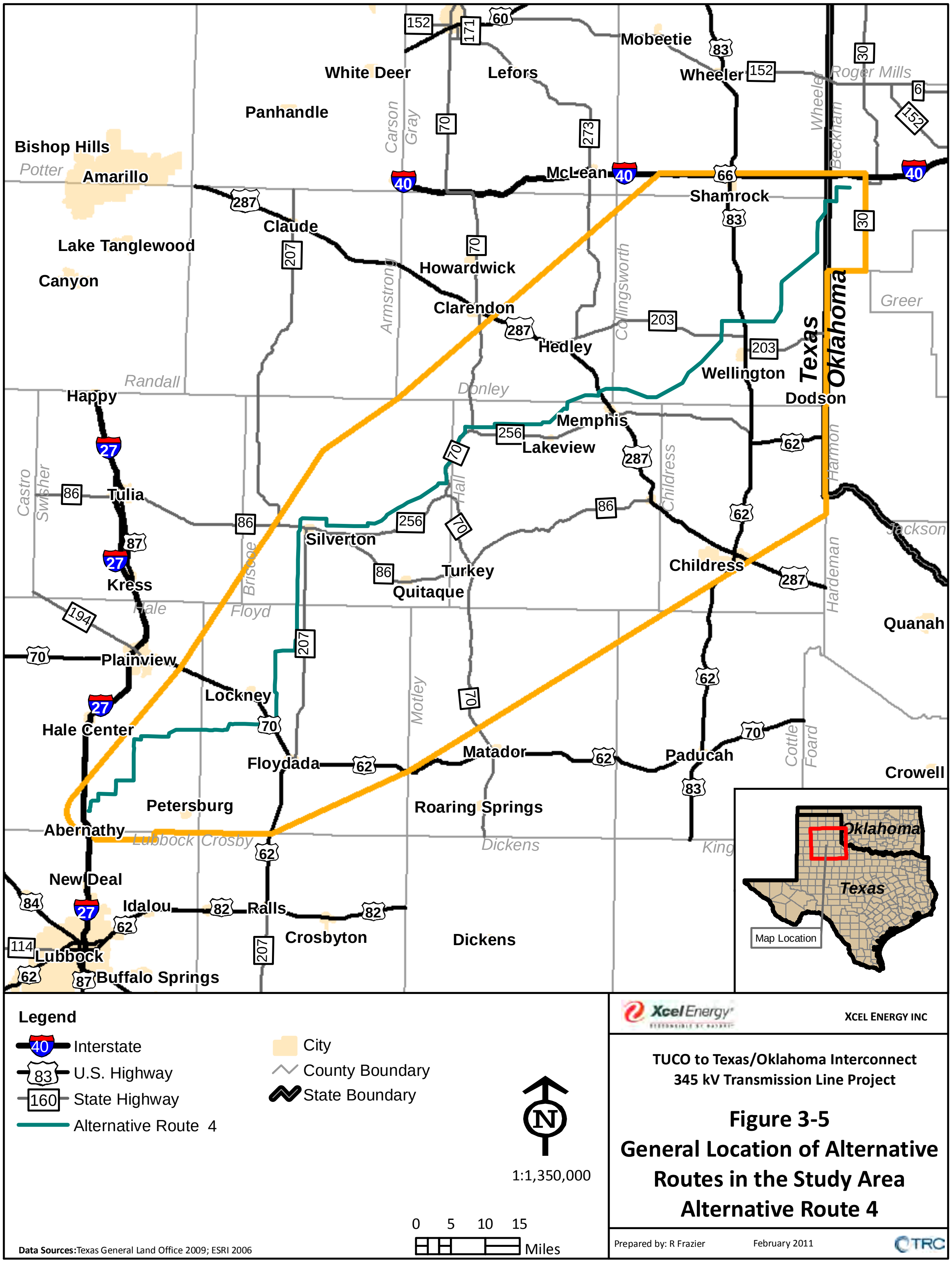

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Figure 3-5
General Location of Alternative Routes in the Study Area
Alternative Route 4

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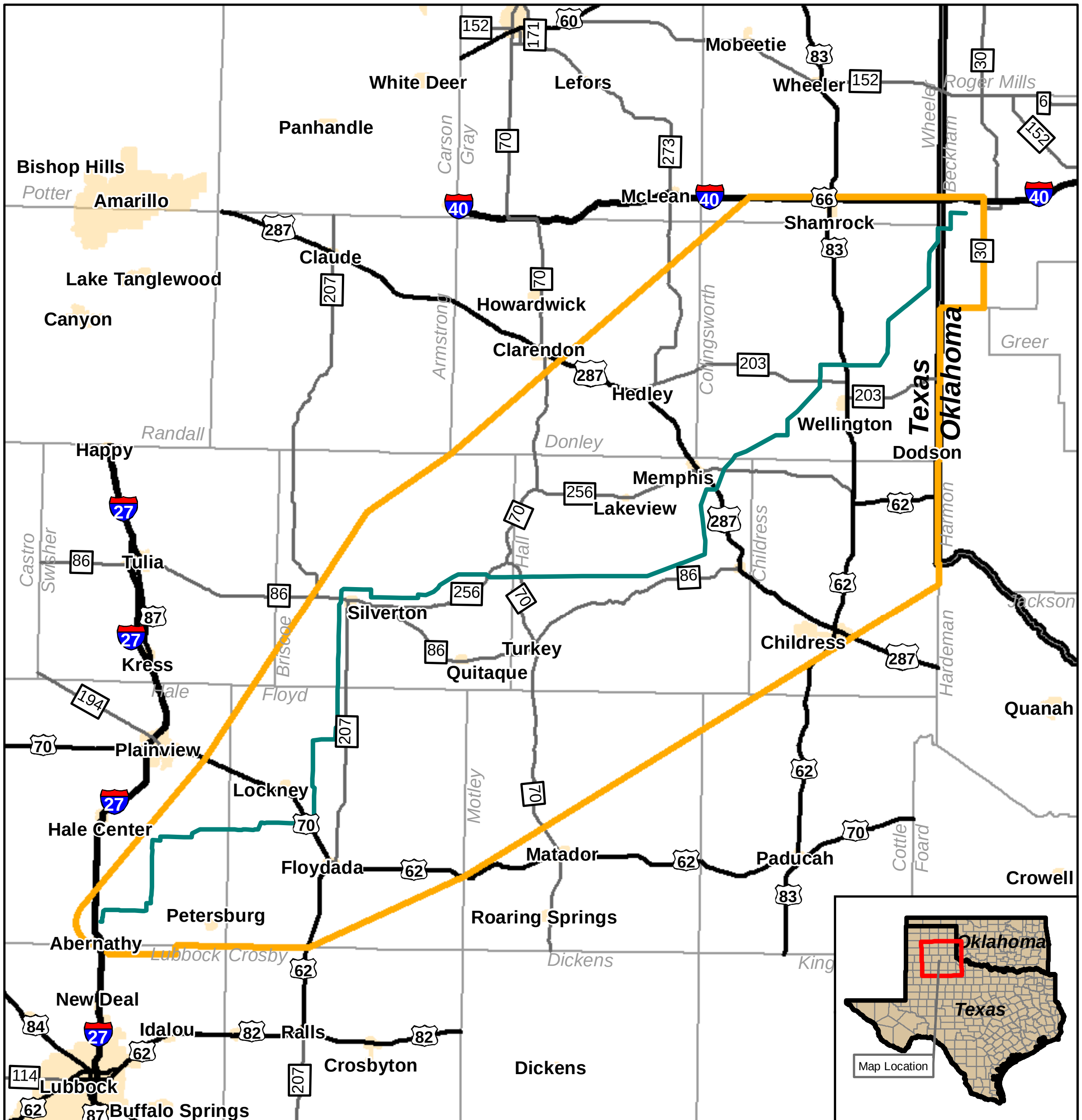

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 5
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

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Figure 3-6
General Location of Alternative Routes in the Study Area
Alternative Route 5

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Data Sources: Texas General Land Office 2009; ESRI 2006

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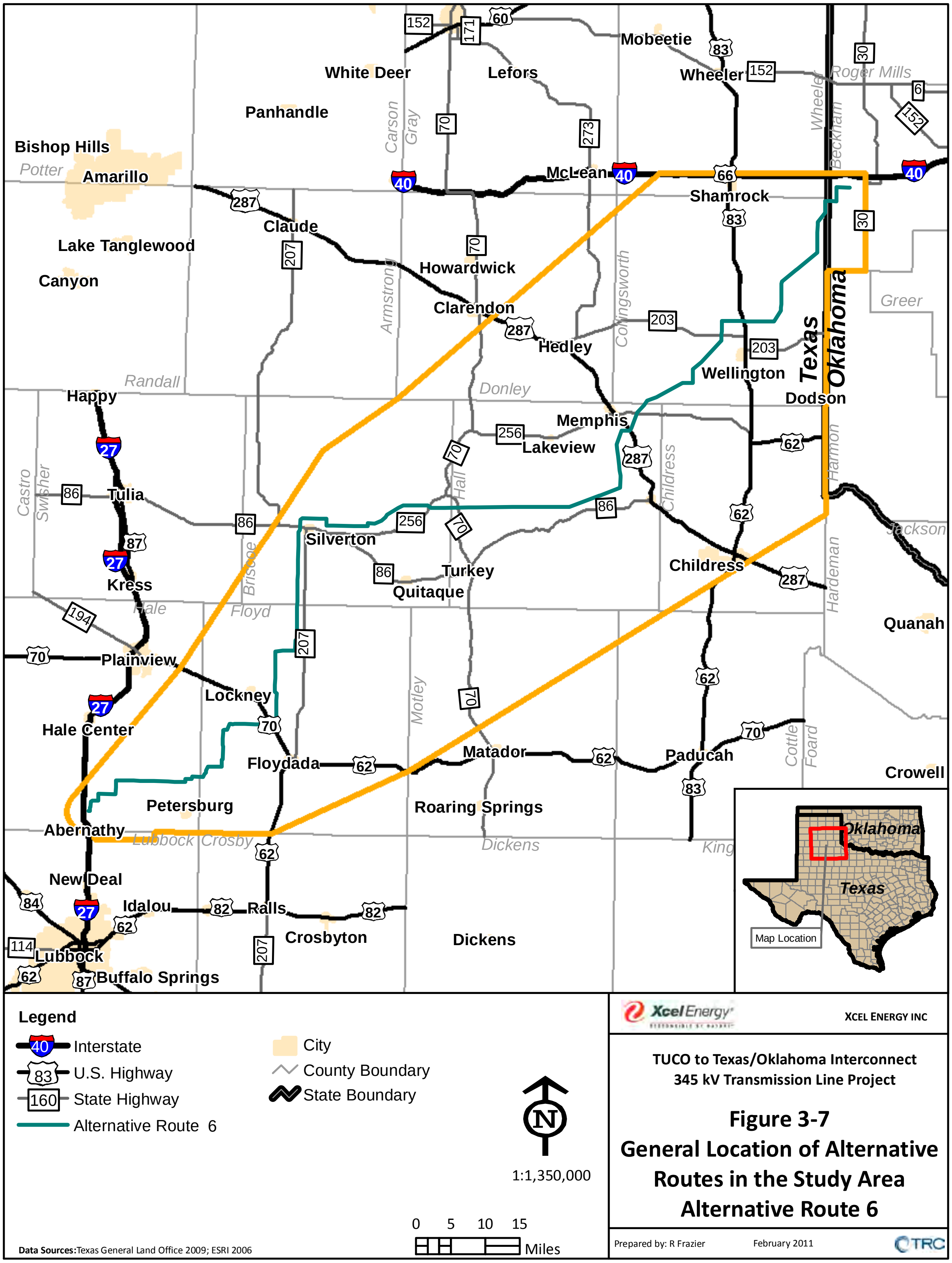

Figure 3-7
General Location of Alternative Routes in the Study Area
Alternative Route 6

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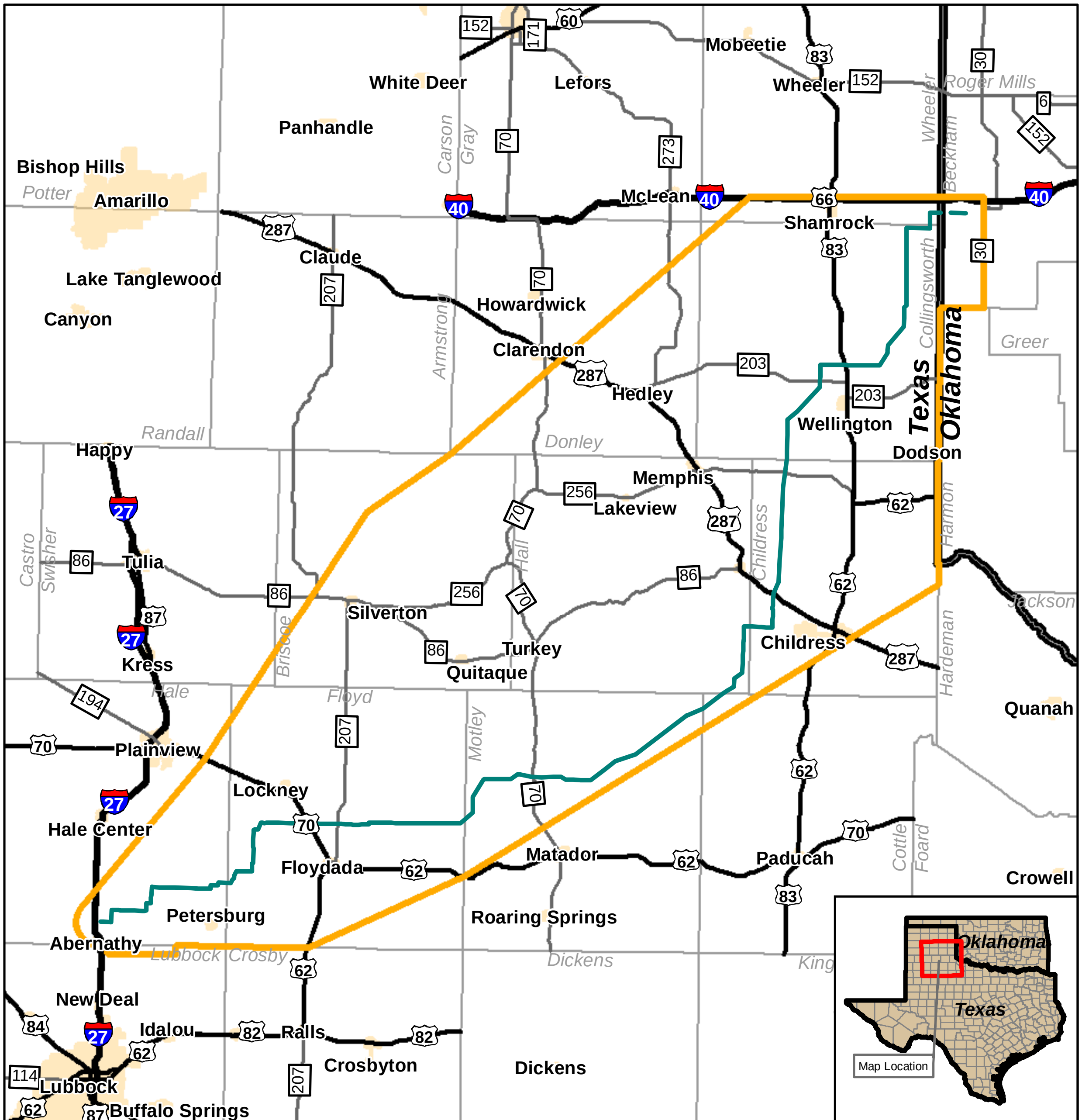

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 7
- City
- County Boundary
- State Boundary

N

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-8
General Location of Alternative Routes in the Study Area
Alternative Route 7

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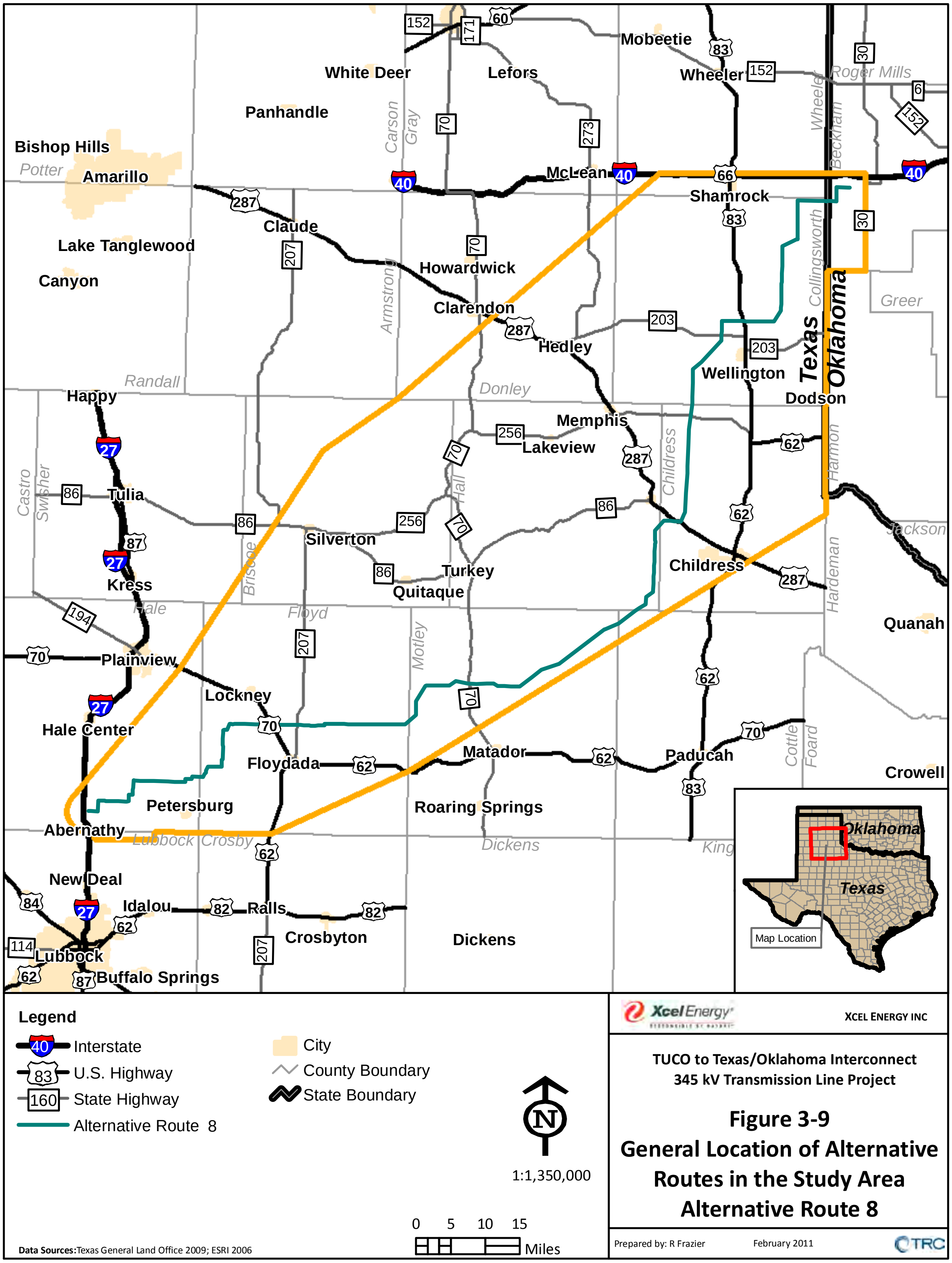

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Figure 3-9
General Location of Alternative Routes in the Study Area
Alternative Route 8

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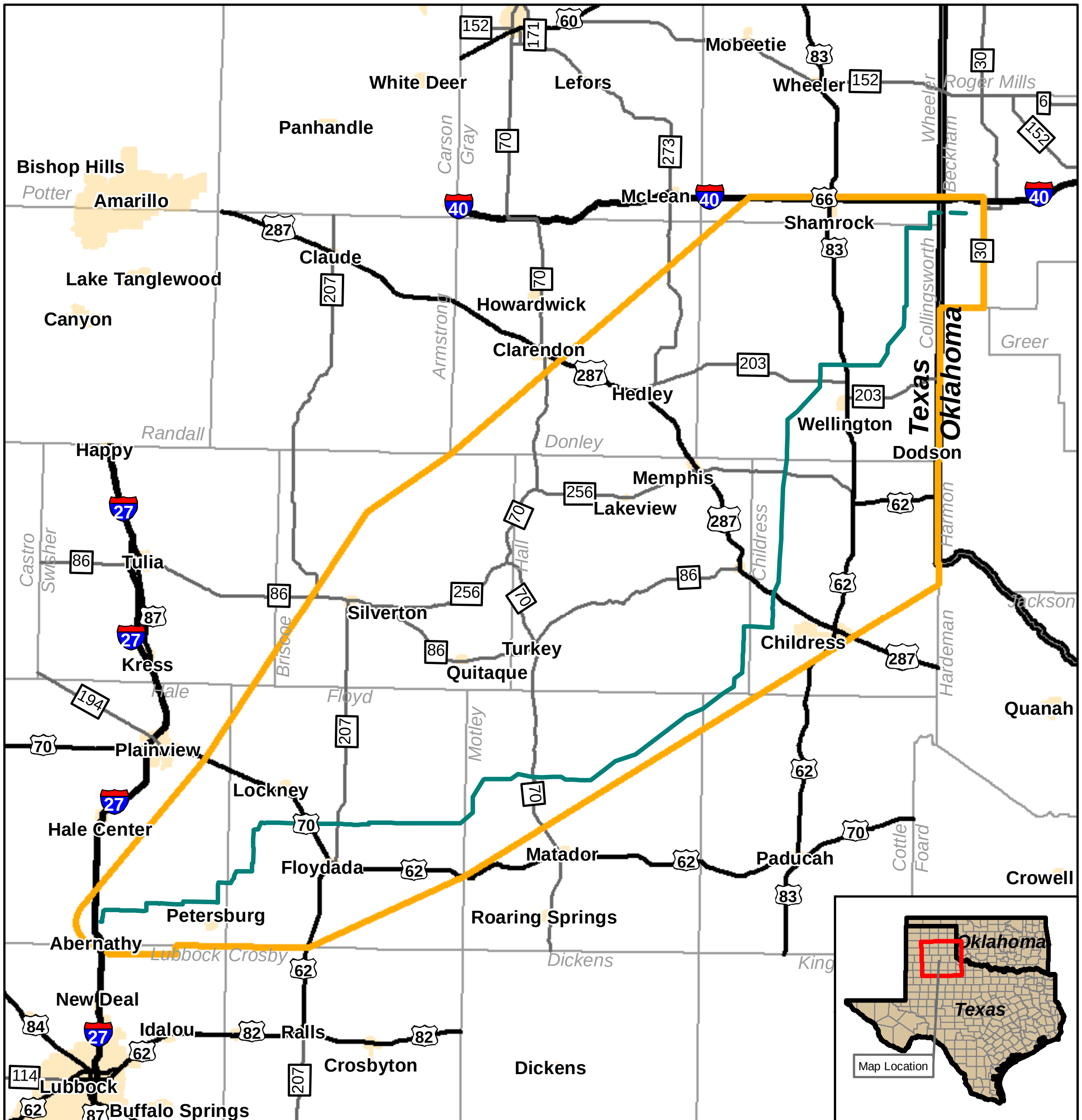

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 9
- City
- County Boundary
- State Boundary

N

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-10
General Location of Alternative Routes in the Study Area
Alternative Route 9

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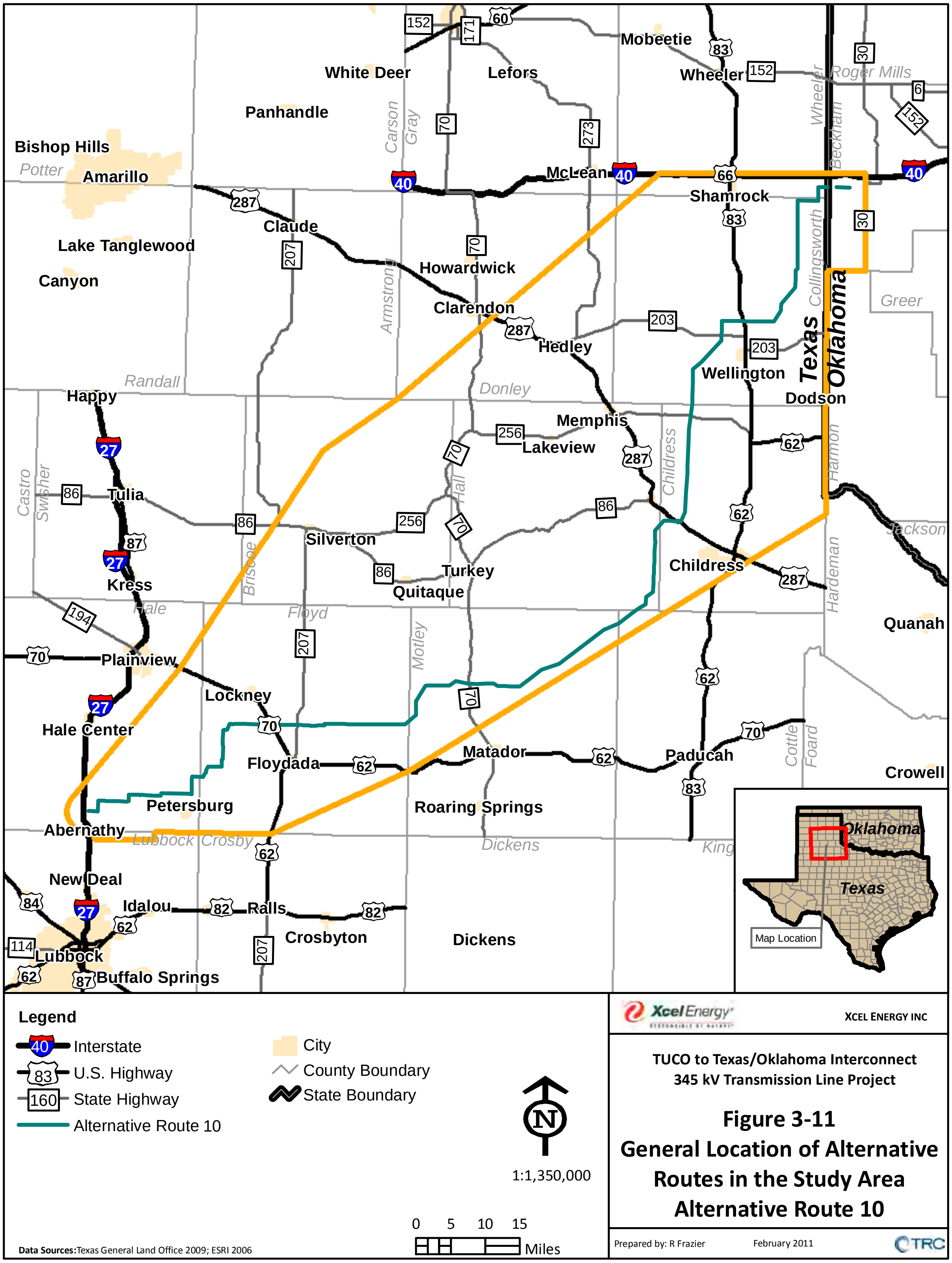
White Deer
Lefors
Mobeetie
Wheeler
Roger Mills
Panhandle
Carson
Gray
Bishop Hills
Potter
Amarillo
McLean
Shamrock
Claude
Lake Tanglewood
Howardwick
Canyon
Armstrong
Collingsworth
Beckham
Clarendon
Greer
Hedley
Wellington
Texas
Oklahoma
Randall
Donley
Dodson
Happy
Memphis
Lakeview
Childress
Harmon
Castro
Swisher
Tulia
Hall
Silverton
Briscoe
Jackson
Turkey
Quitaque
Childress
Kress
Hale
Floyd
Quanah
Plainview
Motley
Hardeman
Lockney
Hale Center
Floydada
Matador
Paducah
Cottle
Foard
Crowell
Petersburg
Roaring Springs
Abernathy
Lubbock
Crosby
Dickens
King
New Deal
Idalou
Ralls
Crosbyton
Dickens
Lubbock
Buffalo Springs
Oklahoma
Texas
Map Location
Legend
Interstate
U.S. Highway
State Highway
Alternative Route 10
City
County Boundary
State Boundary
1:1,350,000
0 5 10 15
Miles
Data Sources: Texas General Land Office 2009; ESRI 2006
Xcel Energy
XCEL ENERGY INC
TUCO to Texas/Oklahoma Interconnect
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Figure 3-11
General Location of Alternative
Routes in the Study Area
Alternative Route 10
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February 2011
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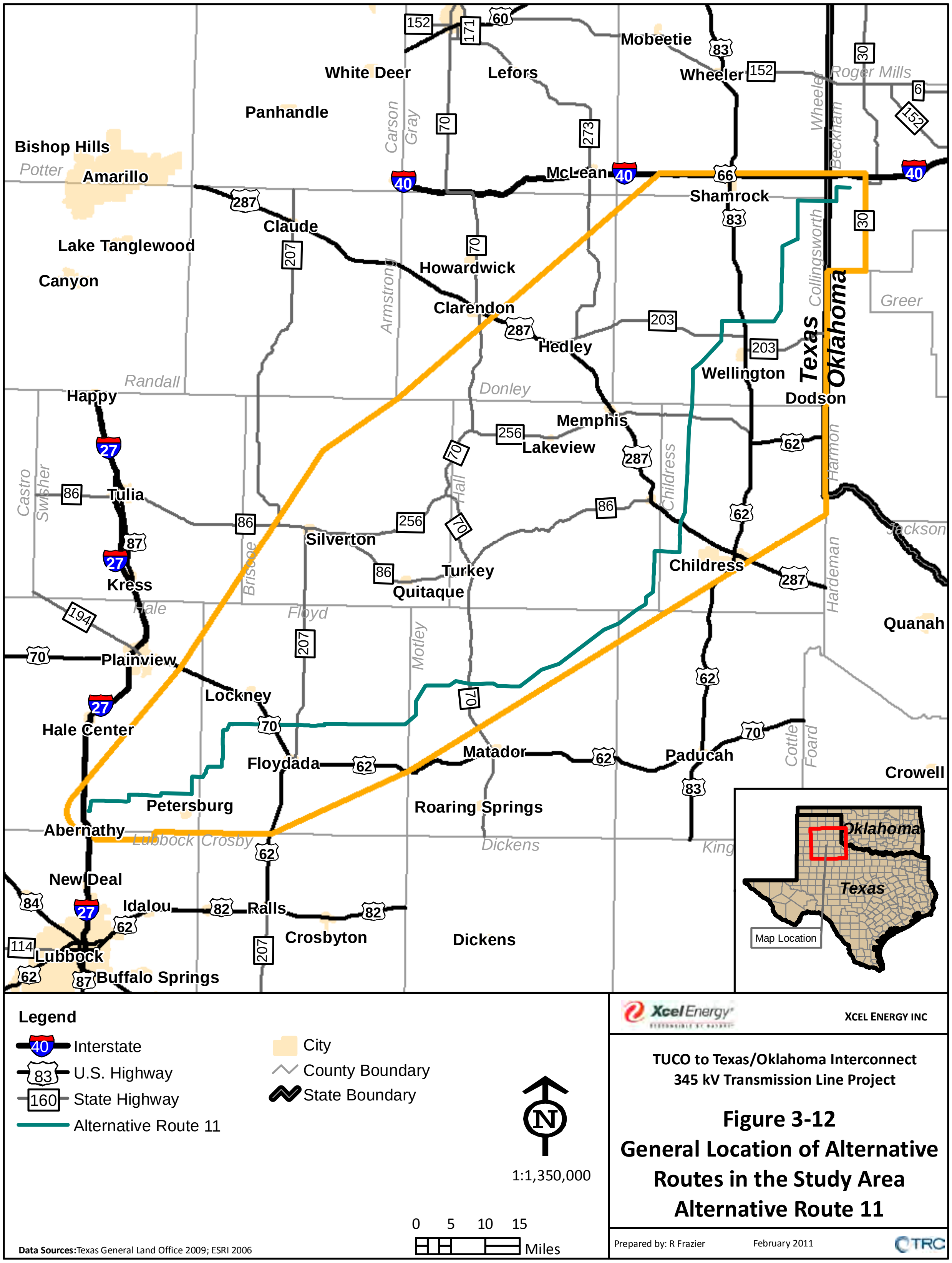

Figure 3-12
General Location of Alternative Routes in the Study Area
Alternative Route 11

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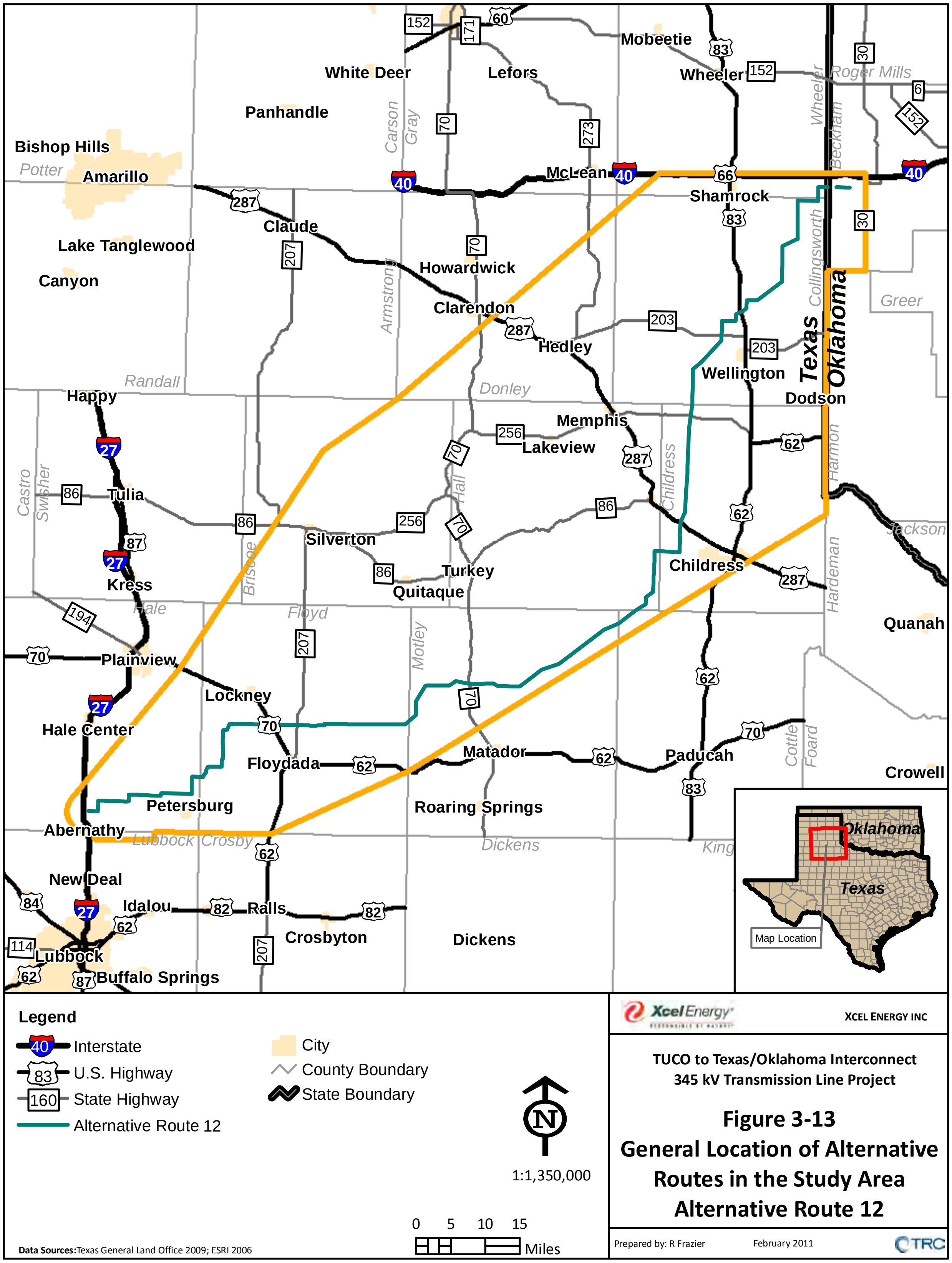

Figure 3-13
General Location of Alternative Routes in the Study Area
Alternative Route 12

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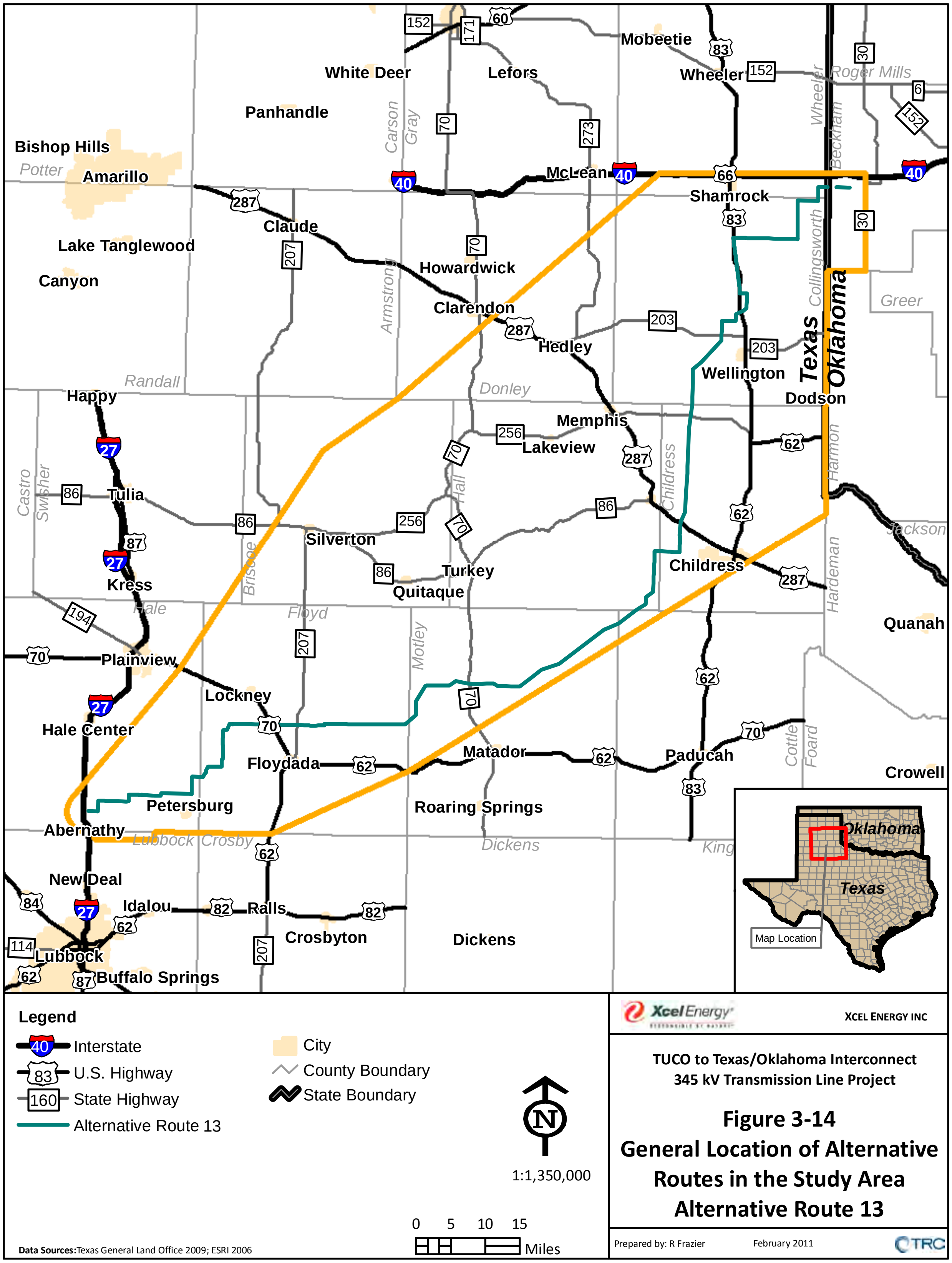

Figure 3-14
General Location of Alternative Routes in the Study Area
Alternative Route 13

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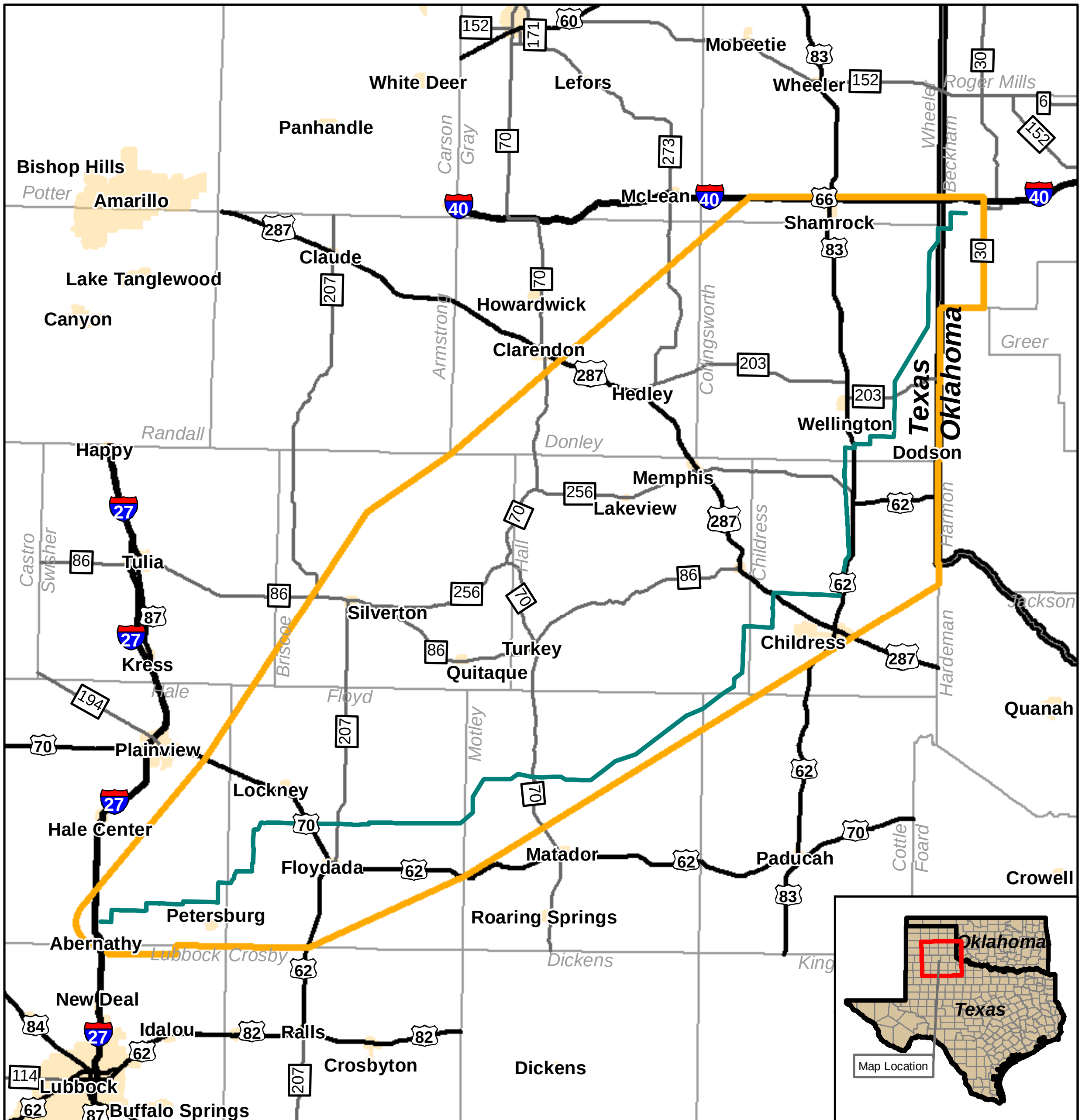

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 14
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-15
General Location of Alternative Routes in the Study Area
Alternative Route 14

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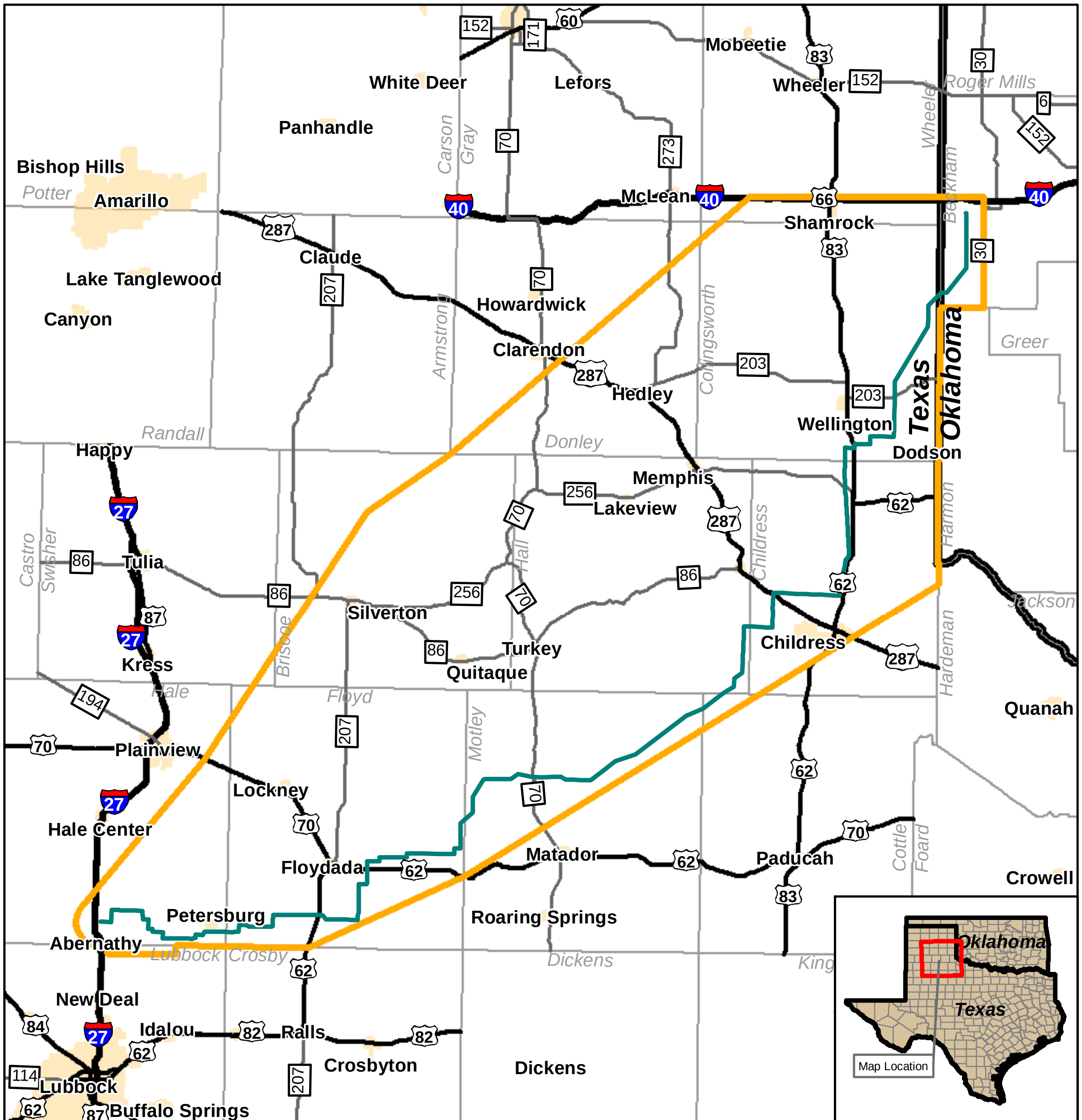

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 15
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-16
General Location of Alternative Routes in the Study Area
Alternative Route 15

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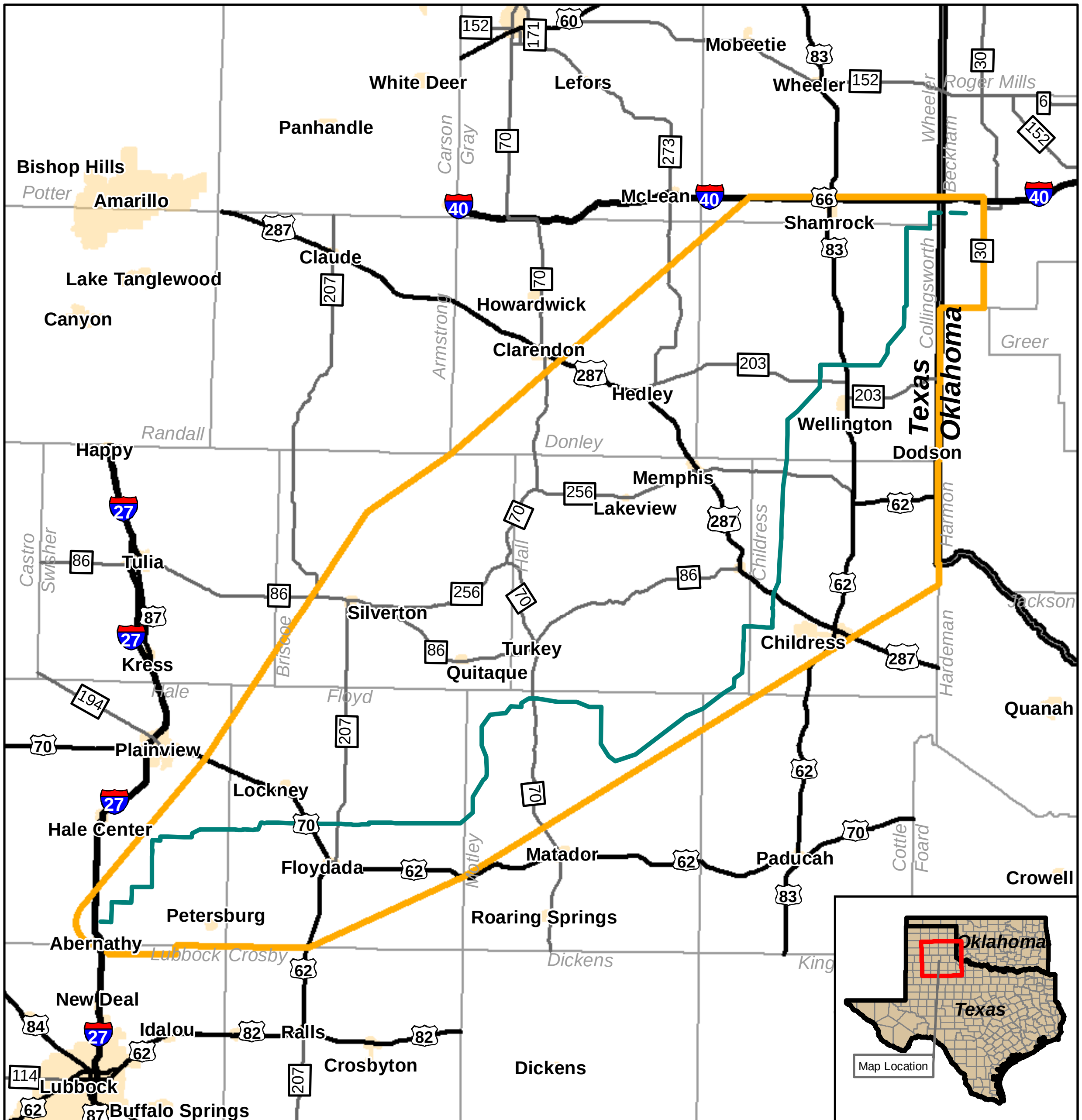

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Routes16
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-17
General Location of Alternative Routes in the Study Area
Alternative Route 16

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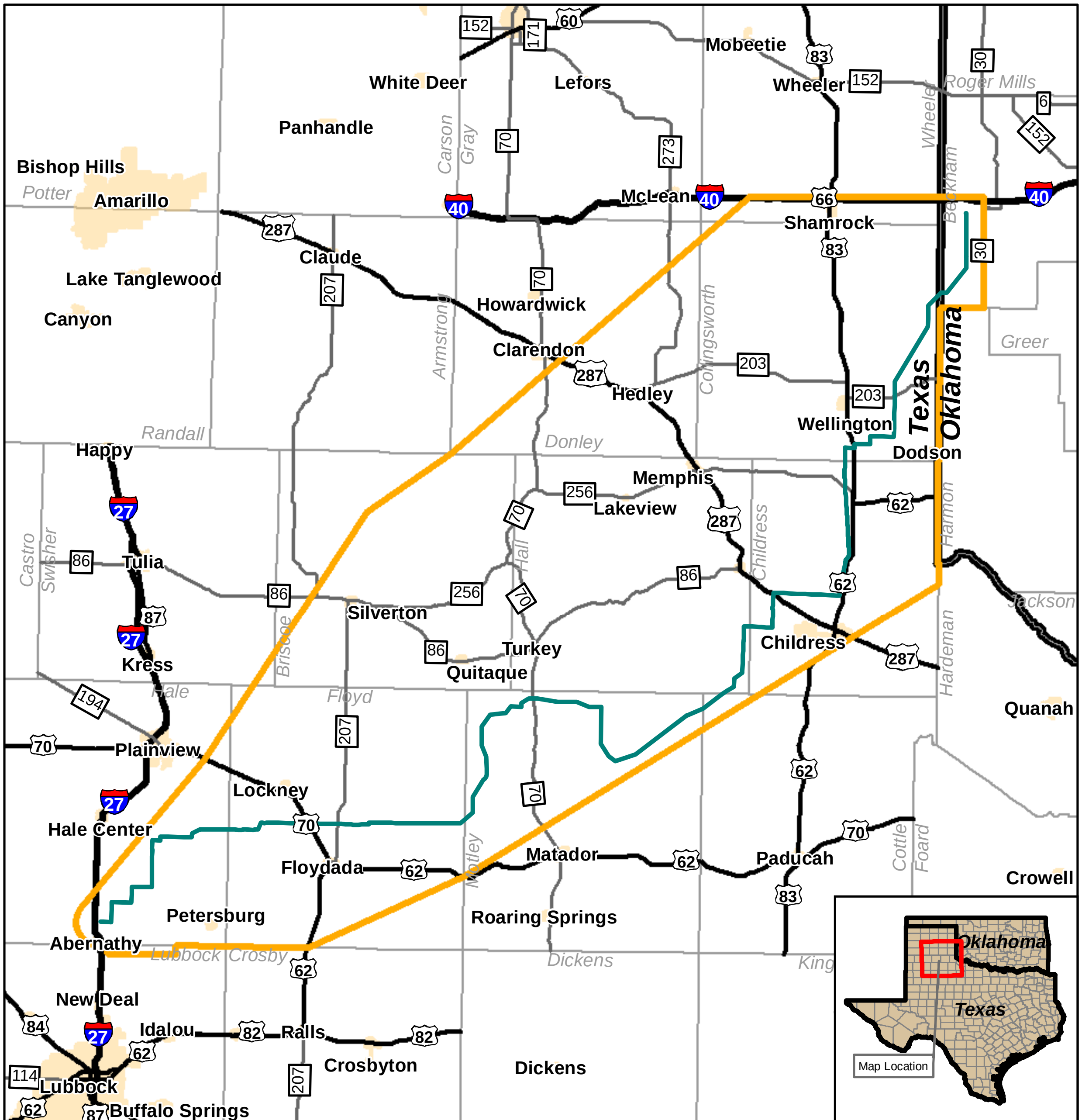

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 17
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-18
General Location of Alternative Routes in the Study Area
Alternative Route 17

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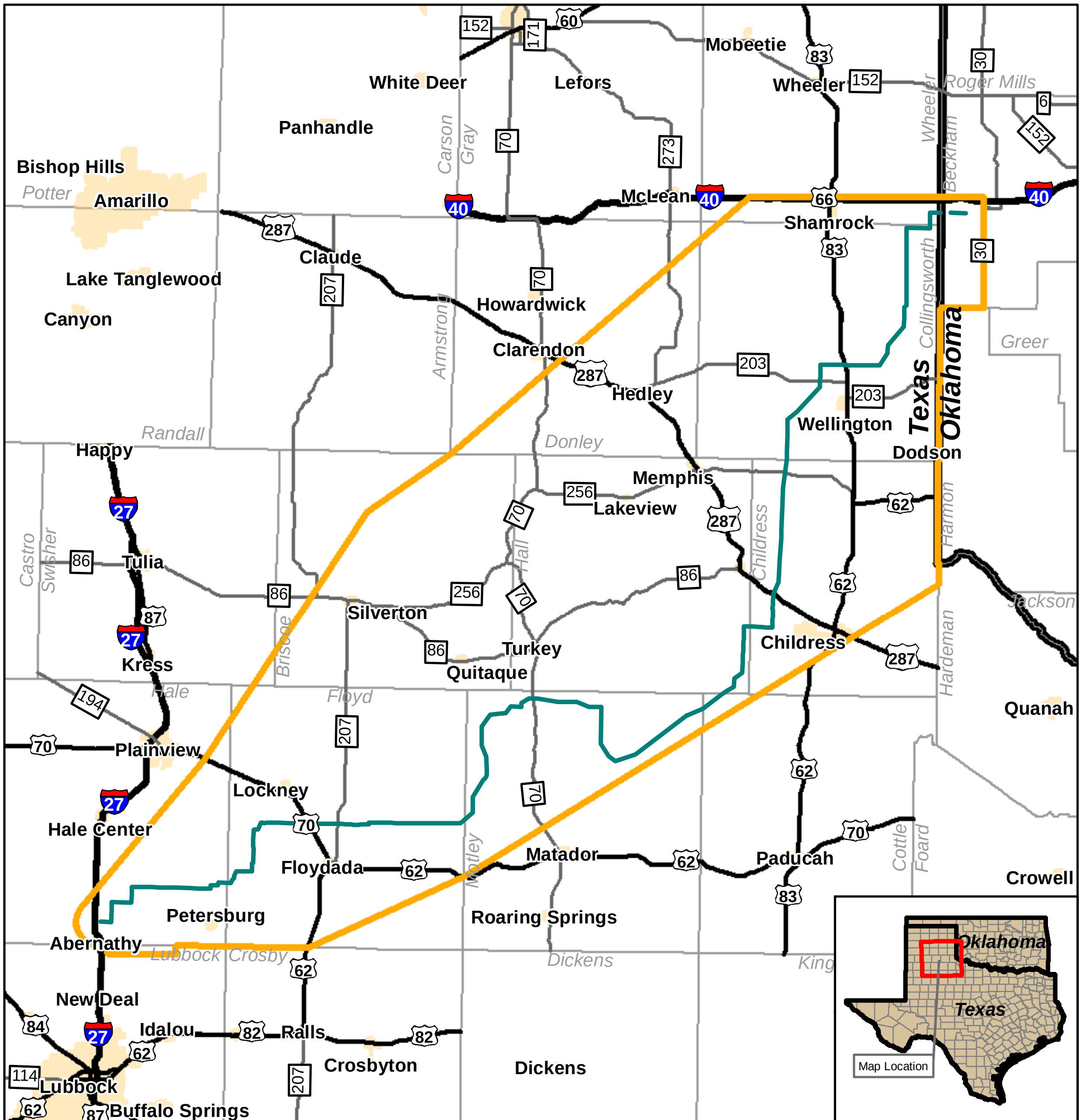

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 18
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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Figure 3-19
General Location of Alternative Routes in the Study Area
Alternative Route 18

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February 2011

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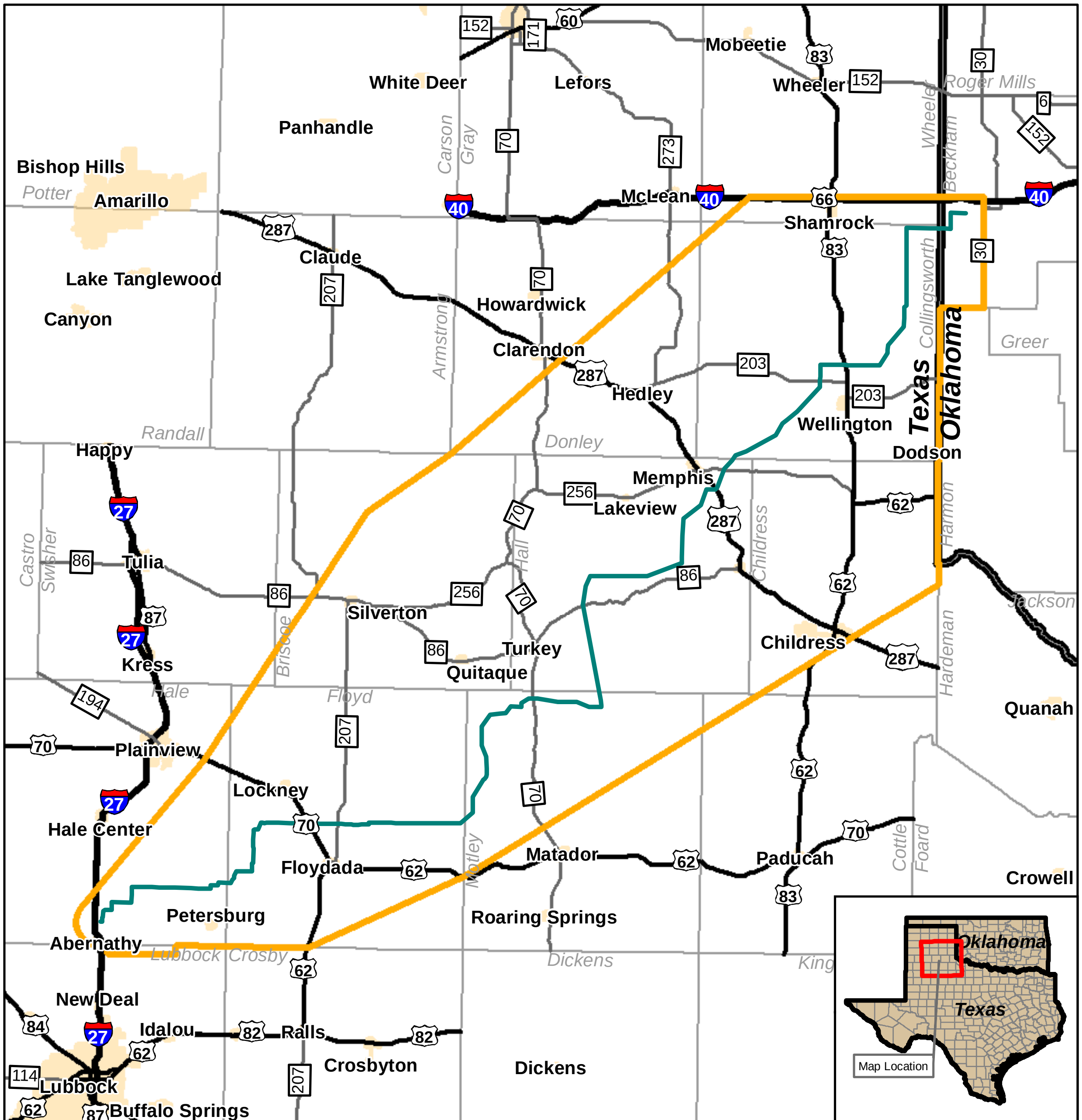

Legend

- Interstate
- U.S. Highway
- State Highway
- Alternative Route 19
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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345 kV Transmission Line Project

Figure 3-20
General Location of Alternative Routes in the Study Area
Alternative Route 19

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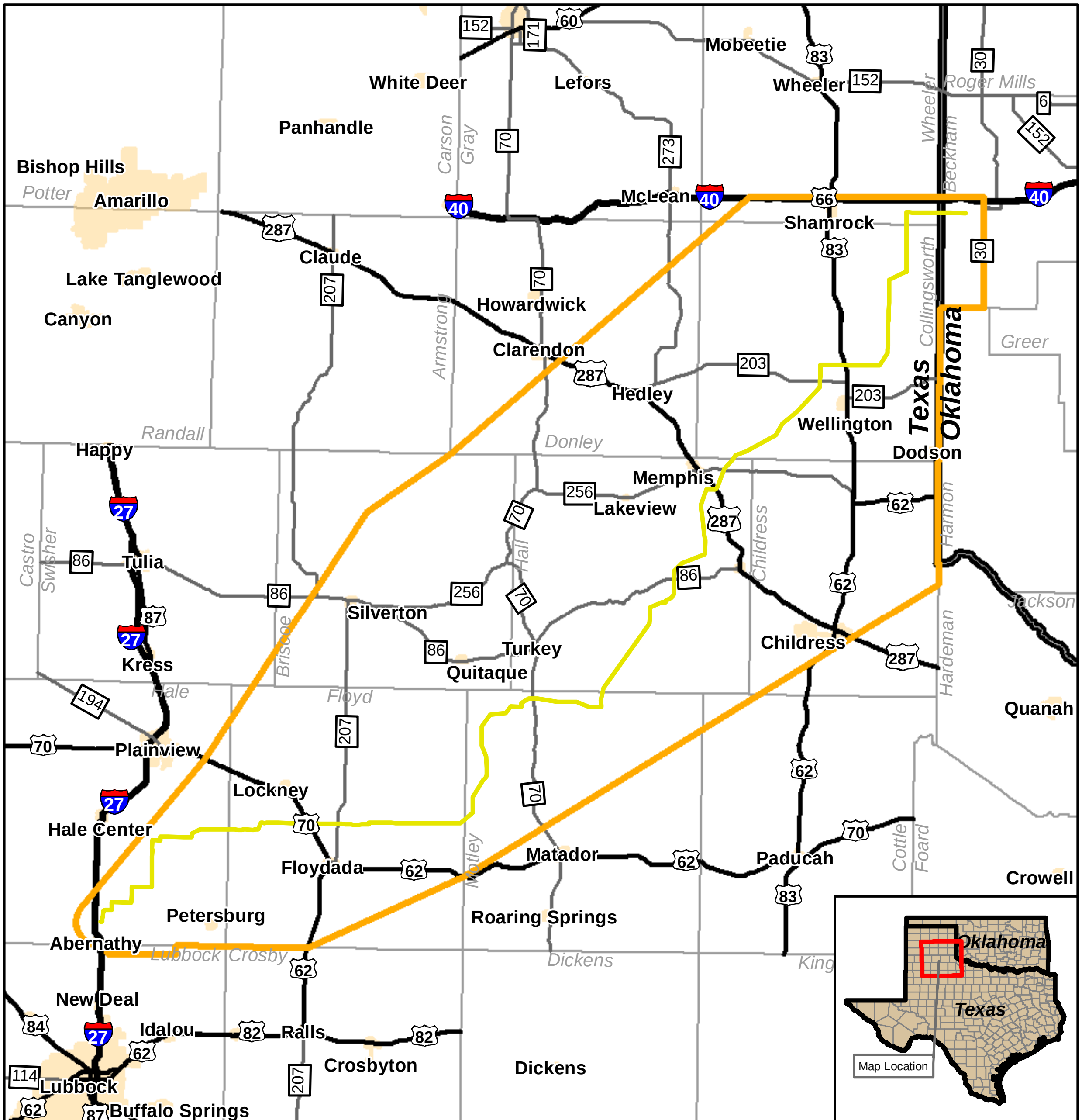

Legend

- Interstate
- U.S. Highway
- State Highway
- Preferred Route 20
- City
- County Boundary
- State Boundary

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006

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345 kV Transmission Line Project

Figure 3-21
General Location of Alternative Routes in the Study Area
Alternative Route 20

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4.0 ENVIRONMENTAL SETTING

The subsections below provide information on resources throughout the entire Study Area; Section 5.0 discusses these resources in relation to the 20 Alternative Routes and per CCN application guidance and requirements.

4.1 Physiography and Geology

The Study Area ranges up to 70 miles in width and covers approximately 5,300 square miles (see Figure 1-1). The Study Area is located in two physiographic sections, the High Plains (southern) and the North-Central Plains. These sections are located within the Great Plains Physiographic Province (BEG 1996; USGS 2010a).

4.1.1 High Plains

The High Plains region of Texas is located in the southern end of the Great Plains. The High Plains were formed by deposition of sediment eroded from the uplifting Rocky Mountains in Early Tertiary time, beginning about 65 million years ago. This physiographic region consists of approximately 20 million acres of a relatively high plateau. Topographic elevations range from 2,000 to 3,800 feet, sloping gently toward the southeast (BEG 1996; USGS 2010a). The Study Area is located in the southern section of this physiographic region. It is a distinct area of the section due to its flat topography, many playas, and local dune fields (BEG 1996).

Playa lakes are shallow, round depressions, ephemeral wetlands, characterized by clay soils. In the region, playas cover 2 percent of the land surface and average 15 acres in size. Most (87 percent) are less than 30 acres in size although some may exceed 800 acres (TPWD 2010a). These playa lakes may originate wherever water periodically can collect in a surficial depression. They expand by hydrologic and geomorphic processes that include: dissolution of lithologic carbonates; downward movement of fine grained clastics and organics by infiltrating groundwater, leading to additional carbonate dissolution; and, eolian (wind) removal of clastics from the floor of the lakes when dry (Osterkamp and Moon 1987).

Local dune fields are comprised of sand. Where vegetation is present, the dunes are stable. In dry locations with minimal ground cover, the dunes are active. Active sand dunes grow and change shape in response to seasonal, prevailing winds, resulting in a dynamic geomorphic region. Most dunes are longer on the windward side where sand migrates up by wind action and shorter on the slip face of the dune in the lee side.

The Blackwater Draw Formation occurs throughout most of the western portion of the Study Area. This formation consists of a grayish-red, massive textured sandstone with fine- to medium-grained quartz. The thickness is as much as 25 feet, but the formation feathers out locally due to the wind-blown (eolian) nature of the deposition.

In the High Plains, much of the near-surface layers are comprised of caliche, a caprock. Caliche is formed by the leaching of carbonate and silica from surface soils and the re-deposition of the dissolved mineral layers below the surface. The caliche ranges from crumbly to very hard (NPGCD 2010).

As described above, this caprock is covered with sheets of extensive eolian sediment.

Underlying the Blackwater Draw Formation is the Ogallala Formation, which contains buried sediments similar to Blackwater Draw except that the sediments are only exposed in the erosional features of the North-Central Plains.

4.1.2 North-Central Plains

The North-Central Plains of Texas and Oklahoma are distinct from the High Plains physiography due to low north-south ridges present. The ridges were formed from natural erosion of weaker caprock. The transition from the harder caprock of the High Plains to the North-Central Plains is a steep erosional slope known as the Caprock Escarpment. The erosion of this region resulted in some of the lowest elevations in the Study Area, with the lowest in Childress County (AEGTX 2010). Topographic elevations in the North-Central Plains range from 900 to 3,000 feet (BEG 1996).

The region is dissected by rivers resulting in varying topographic relief. In the northeastern portion of the Study Area, the topography is characterized by numerous sinkholes, caves, solution valleys and other karst topography features common in some limestone regions.

The geology of the region is variable with alluvium and eolian deposits to various types of bedrock with varying ages, dependent on the amount of erosion that has occurred. Geologic formations present in the Study Area include (USGS 1970; USGS 1998; AEGTX 2010):

- Alluvium and eolian deposits: Alluvium, stream-laid sediments, include terrace and channel deposits and alluvial plain deposits. Grain size ranges from silt to gravel. Eolian deposits, wind-blown sediments, include silt, clay, sand, and volcanic ash.
- Ogallala Formation: The Ogallala formation is a sandstone consisting of sand, silt, clay, gravel, and caliche. Sand is fine- to coarse-grain quartz with some silt and caliche nodules, cemented locally by calcite and silica. The formation is also cross-bedded. Gravel portions consist of quartz, quartzite, minor chert, igneous rock, metamorphic rock, and limestone. Clay balls are present in lower portions of the formation, as well as abraded Gryphaea in intra-formational channel deposits and in basal conglomerate. This formation forms ledges and caprock with a maximum thickness of 550 feet.
- Whitehorse Group: This formation consists of sandstone, shale, gypsum, and dolomite. The sandstone is a silty, fine-grain quartz that contains thin beds of anhydrite, gypsum, and dolomite. The shale is sandy and red with a massive texture. The gypsum is white and pink with a thin bedded to massive texture. The dolomite is grey and present in thin, discontinuous beds associated with gypsum. The thickness of the formation varies from approximately 300 to 700 feet.
- Quartermaster Formation: This formation consists of interbedded shale, siltstone, sandstone, gypsum, and dolomite. The shale is present as shades of red, reddish-brown and reddish-orange with massive texture. The sandy portions are red to reddish-orange with fine-grain quartz. The gypsum and dolomite are discontinuous and thin-bedded. The Quartermaster formation has a thickness of more than 300 feet. Dog Creek Shale and Blaine Formation: This formation consists of shale, silt, gypsum, anhydrite, salt, and dolomite. Karst topography is present at the surface in this formation.
- Flowerpot Shale: This formation contains shale and gypsum. The formation is exposed

in the deepest dissolution valleys of the Dog Creek Shale and Blaine Formation.

4.2 Soils

County soil survey data available from the USDA NRCS (USDA 2008a; USDA 2008b; and USDA 2009a through USDA 2009m) was used to identify soil resources found in the Study Area. Appendix F presents the characteristics for each soil type including the map unit identifier, soil type, slope, acreage within the Study Area, hydric soil classification, prime farmland classification, and soil corrosivity to concrete.

4.2.1 Prime Farmland Soils

As defined in 7 Code of Federal Regulations [CFR] § 657.5, Prime Farmland soils are soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and are also available for these uses (use could be cropland, pasture, forest land, or other land, but not urban built-up or water). These soils have the quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, Prime Farmland soils have adequate and dependable precipitation, a favorable temperature and growing season, acceptable acidity or alkalinity, permeability to water and air, and few or no surface stones. Prime Farmland soils are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

As summarized Appendix F, approximately 36 percent of the soils in the Study Area meet Prime Farmland criteria, an additional 11 percent meet Prime Farmland criteria if irrigated, and an additional 0.3 percent would meet Prime Farmland criteria if protected from flooding (USDA 2010). Figure 4-1 depicts the Prime Farmland soils in the Study Area. The NRCS does not consider electric transmission line installation to be a conversion of Prime Farmlands as the lines do not significantly restrict the use of the land for agriculture (Kiniry 2009; Benton 2010).

4.3 Water Resources

4.3.1 Surface Water/Floodplains

The Study Area is crossed by a drainage basin divide with the Red River Basin to the north and the Brazos River Basin to the south. Most of the surface waters within the Study Area are located in the Red River Basin, in the Middle North Fork of the Red River, Elm Fork of the Red River, Lower Salt Fork of the Red River, Groesbeck-Sandy Creeks, Lower Prairie Dog Town Fork of the Red River, North Pease River and Middle Pease River Watersheds. Watersheds crossed in the Brazos River Basin include Running Water Draw, White River, and Blackwater Draw Watersheds.

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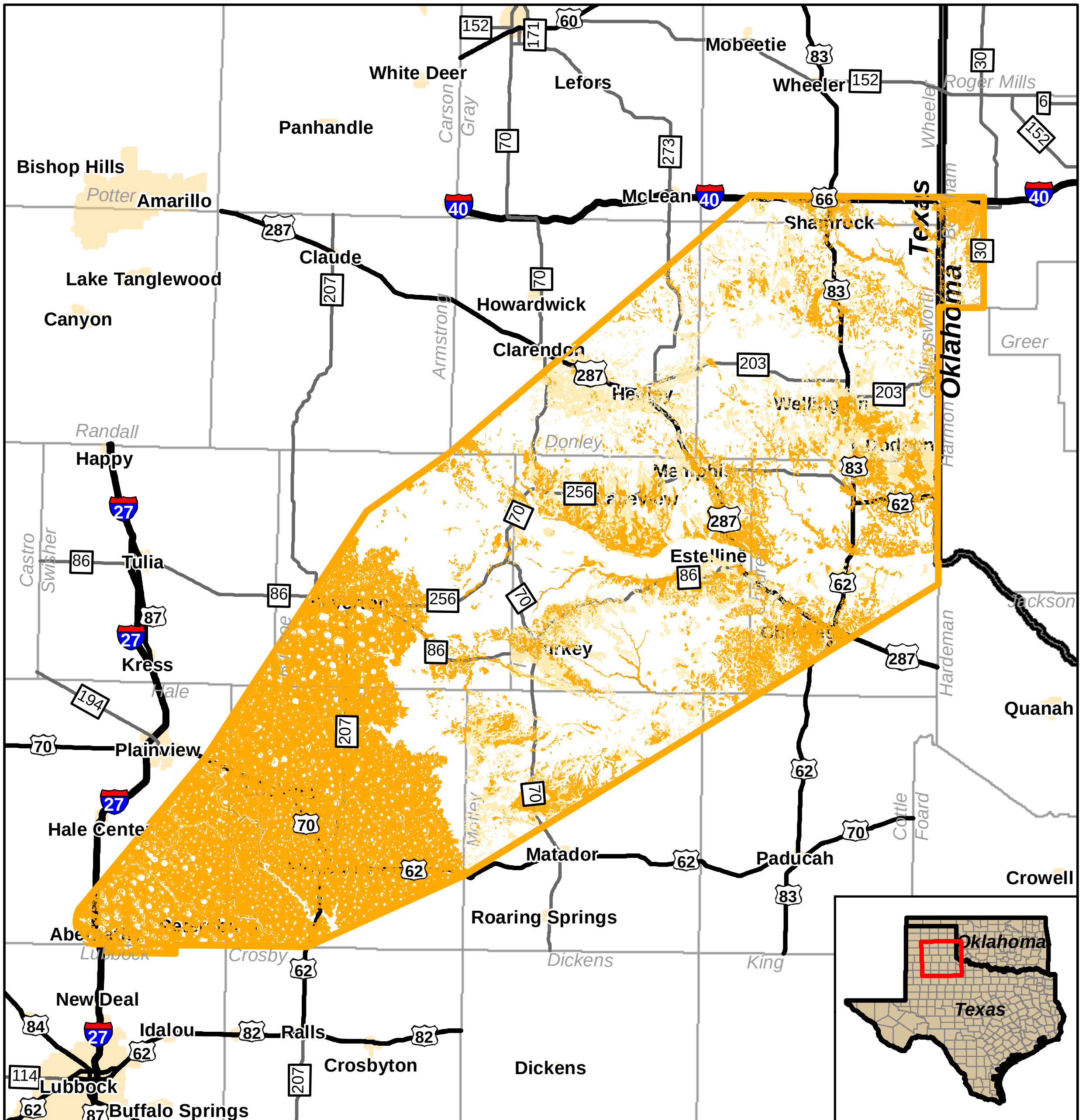

Legend

- Study Area
- Interstate
- U.S. Highway
- State Highway
- City
- County Boundary
- State Boundary
- All areas are prime farmland
- Prime farmland if irrigated
- Prime farmland if protected from flooding or not frequently flooded during the growing season
- Prime farmland if drained

1:1,350,000

0 5 10 15 Miles

Data Sources: Texas General Land Office 2009; ESRI 2006; Center for Spatial Analysis 2010; USDA 2010b.

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TUCO to Texas/Oklahoma Interconnect
345 kV Transmission Line Project

Figure 4-1
Prime Farmland Soils
in the Study Area

Prepared by: R Frazier February 2011

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