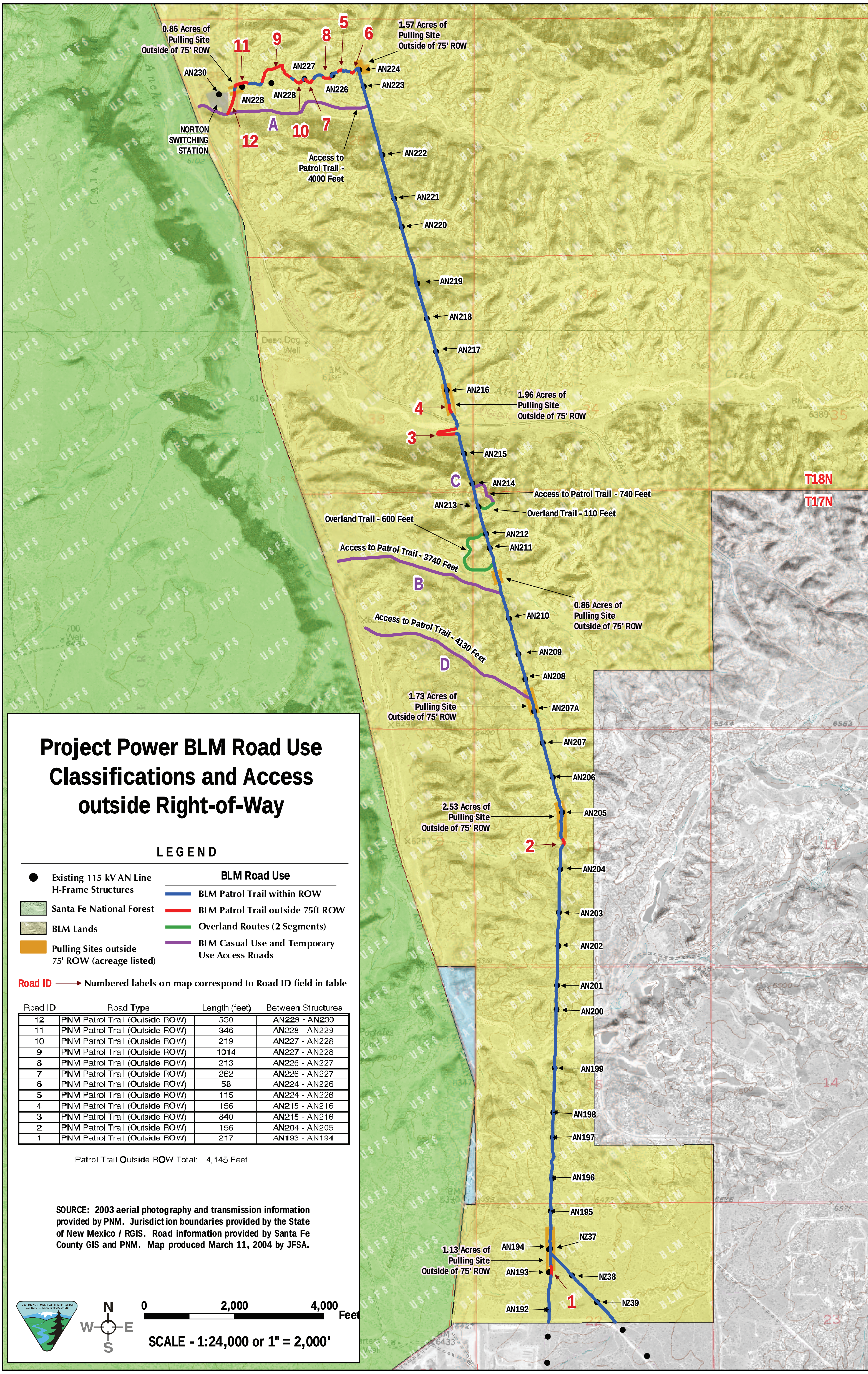
Appendix A. Transmission Line Access and Structure Maps

The following pages contain an index map of the project area and windows of each segment of the transmission lines for all project alternatives. These window maps show details along the lines, including pole and pulling sites and access roads.



Project Power BLM Road Use Classifications and Access outside Right-of-Way

LEGEND

- Existing 115 kV AN Line H-Frame Structures
- Santa Fe National Forest
- BLM Lands
- Pulling Sites outside 75' ROW (acreage listed)

BLM Road Use

- BLM Patrol Trail within ROW
- BLM Patrol Trail outside 75ft ROW
- Overland Routes (2 Segments)
- BLM Casual Use and Temporary Use Access Roads

Road ID → Numbered labels on map correspond to Road ID field in table

Road ID	Road Type	Length (feet)	Between Structures
12	PNM Patrol Trail (Outside ROW)	550	AN229 - AN230
11	PNM Patrol Trail (Outside ROW)	346	AN228 - AN229
10	PNM Patrol Trail (Outside ROW)	219	AN227 - AN228
9	PNM Patrol Trail (Outside ROW)	1014	AN227 - AN228
8	PNM Patrol Trail (Outside ROW)	213	AN226 - AN227
7	PNM Patrol Trail (Outside ROW)	262	AN226 - AN227
6	PNM Patrol Trail (Outside ROW)	58	AN224 - AN226
5	PNM Patrol Trail (Outside ROW)	115	AN224 - AN226
4	PNM Patrol Trail (Outside ROW)	156	AN215 - AN216
3	PNM Patrol Trail (Outside ROW)	840	AN215 - AN216
2	PNM Patrol Trail (Outside ROW)	156	AN204 - AN205
1	PNM Patrol Trail (Outside ROW)	217	AN193 - AN194

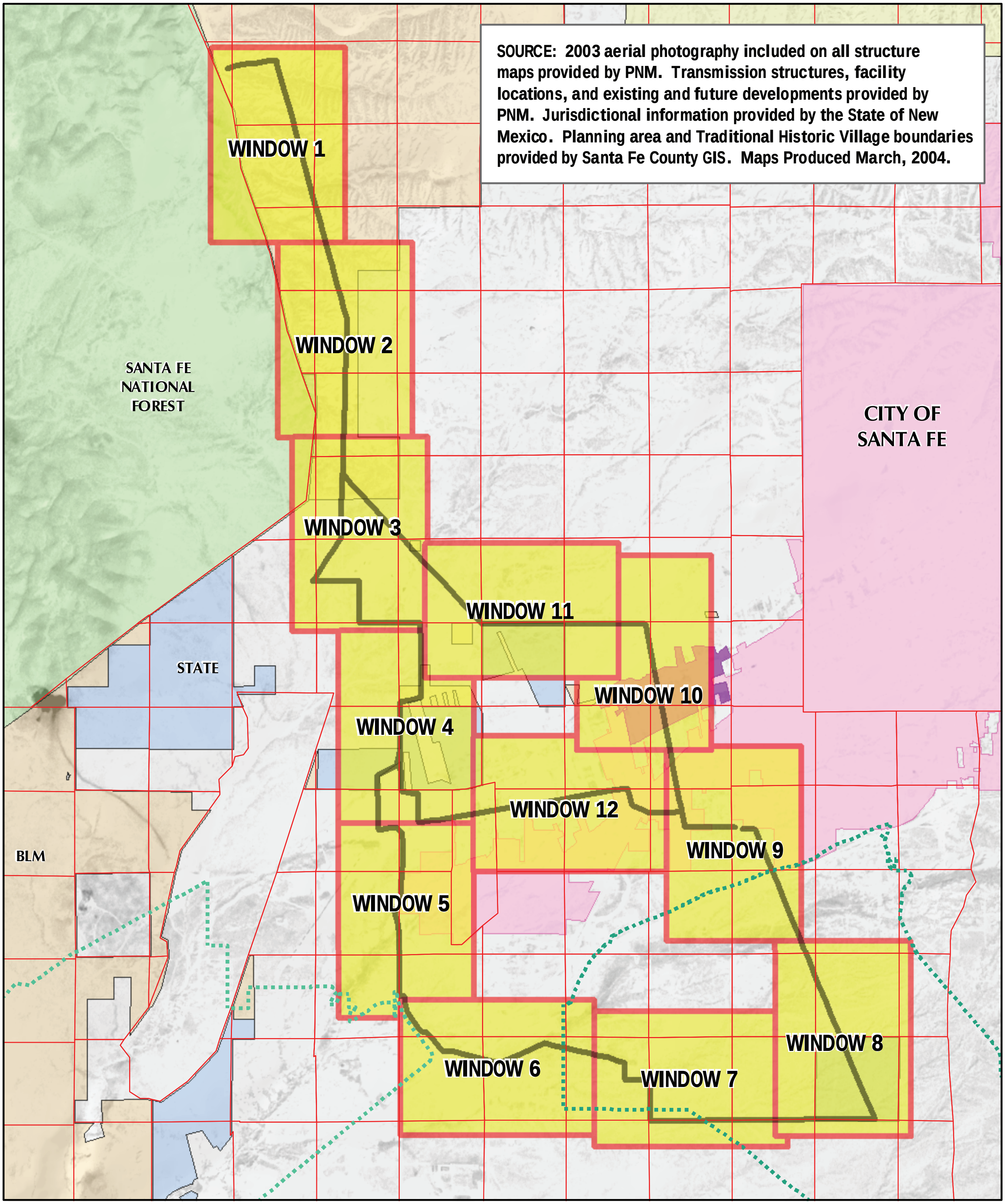
Patrol Trail Outside ROW Total: 4,145 Feet

SOURCE: 2003 aerial photography and transmission information provided by PNM. Jurisdiction boundaries provided by the State of New Mexico / RGIS. Road information provided by Santa Fe County GIS and PNM. Map produced March 11, 2004 by JFSA.

N W E S

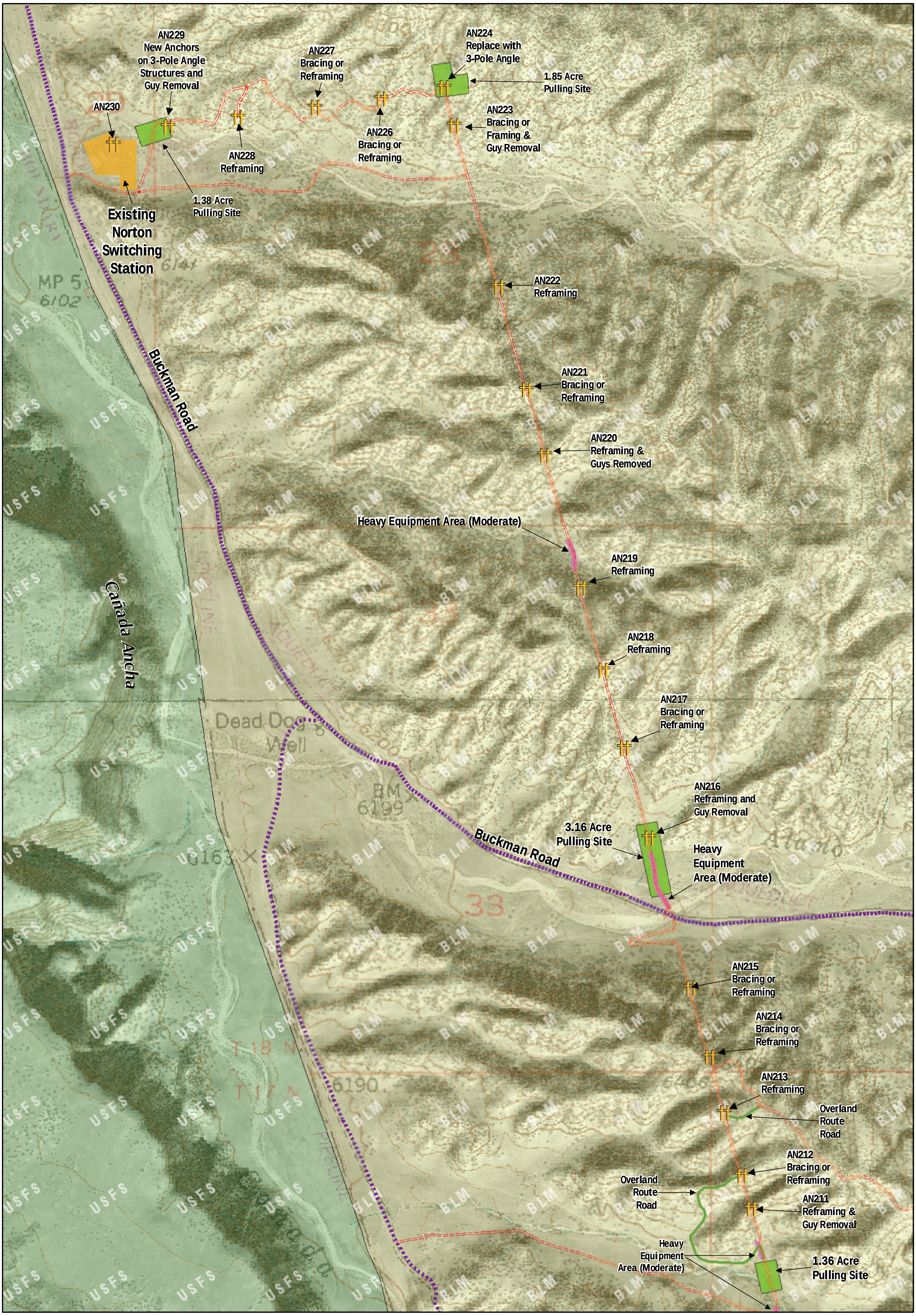
0 2,000 4,000 Feet

SCALE - 1:24,000 or 1" = 2,000'



Window Index for Transmission Line Access and Structure Maps

All structure locations included on the following maps are approximations for environmental analysis purposes and may not represent exact locations for future facilities



LEGEND

- Existing 115 kV AN Line H-Frame Structures
- Santa Fe National Forest
- BLM Lands
- Pulling Sites
- Switching Station

Access Routes

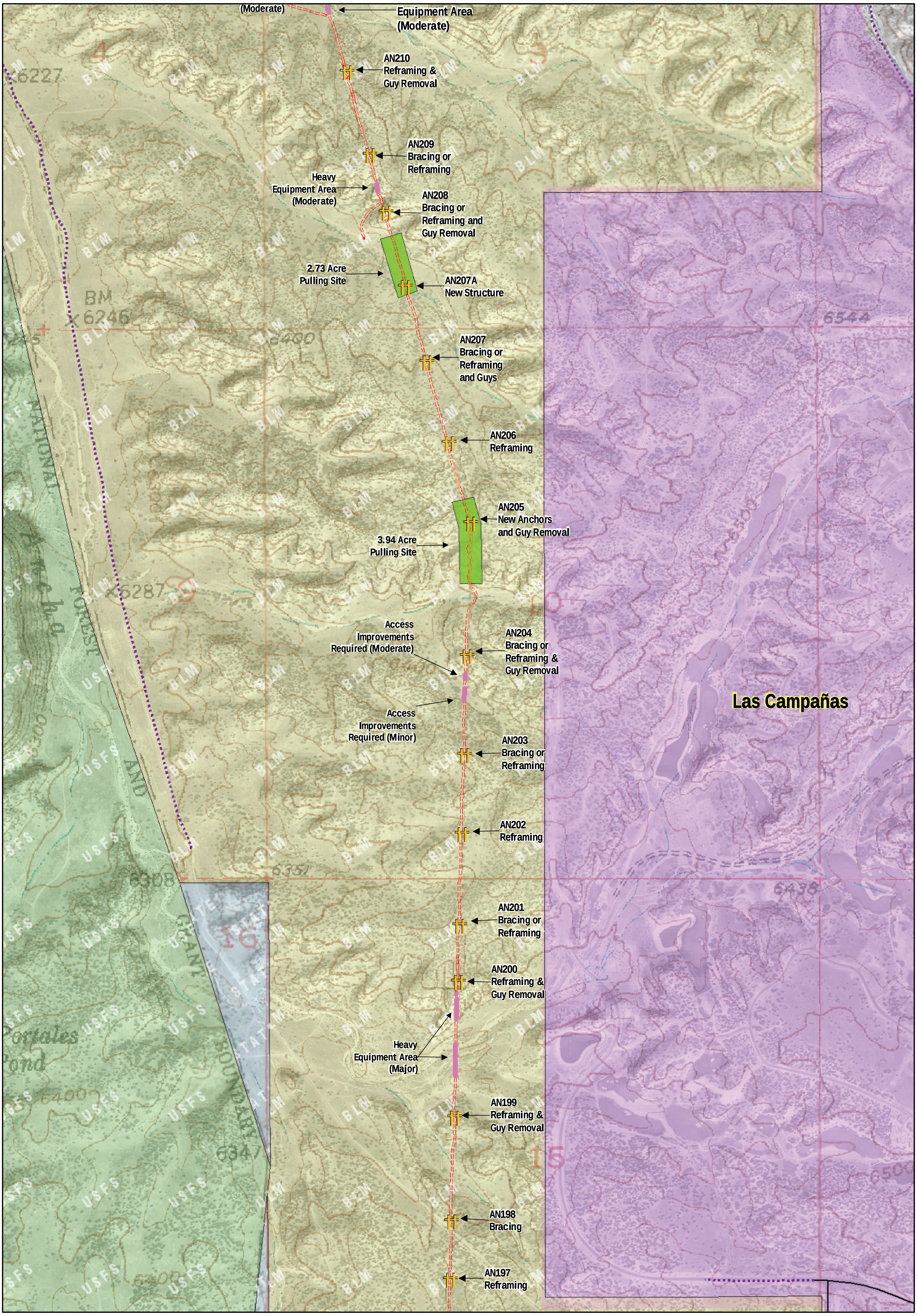
- Existing 2-Track Roads
- Gravel 1-Lane Roads
- Overland Route Roads
- Gravel 2+ Lane Roads
- Heavy Equipment Areas (Severity Listed at Sites)

N W E S

Transmission Line Access & Structures Window 1 of 12

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'



LEGEND

- Existing 115 kV AN Line H-Frame Structures (One New)
- Santa Fe National Forest
- BLM Lands
- State Lands
- Pulling Sites
- Approved & Recent Developments

Access Routes

- Existing 2-Track Roads
- Gravel 1-Lane Roads
- Overland Route Roads
- Gravel 2+ Lane Roads
- Heavy Equipment Areas

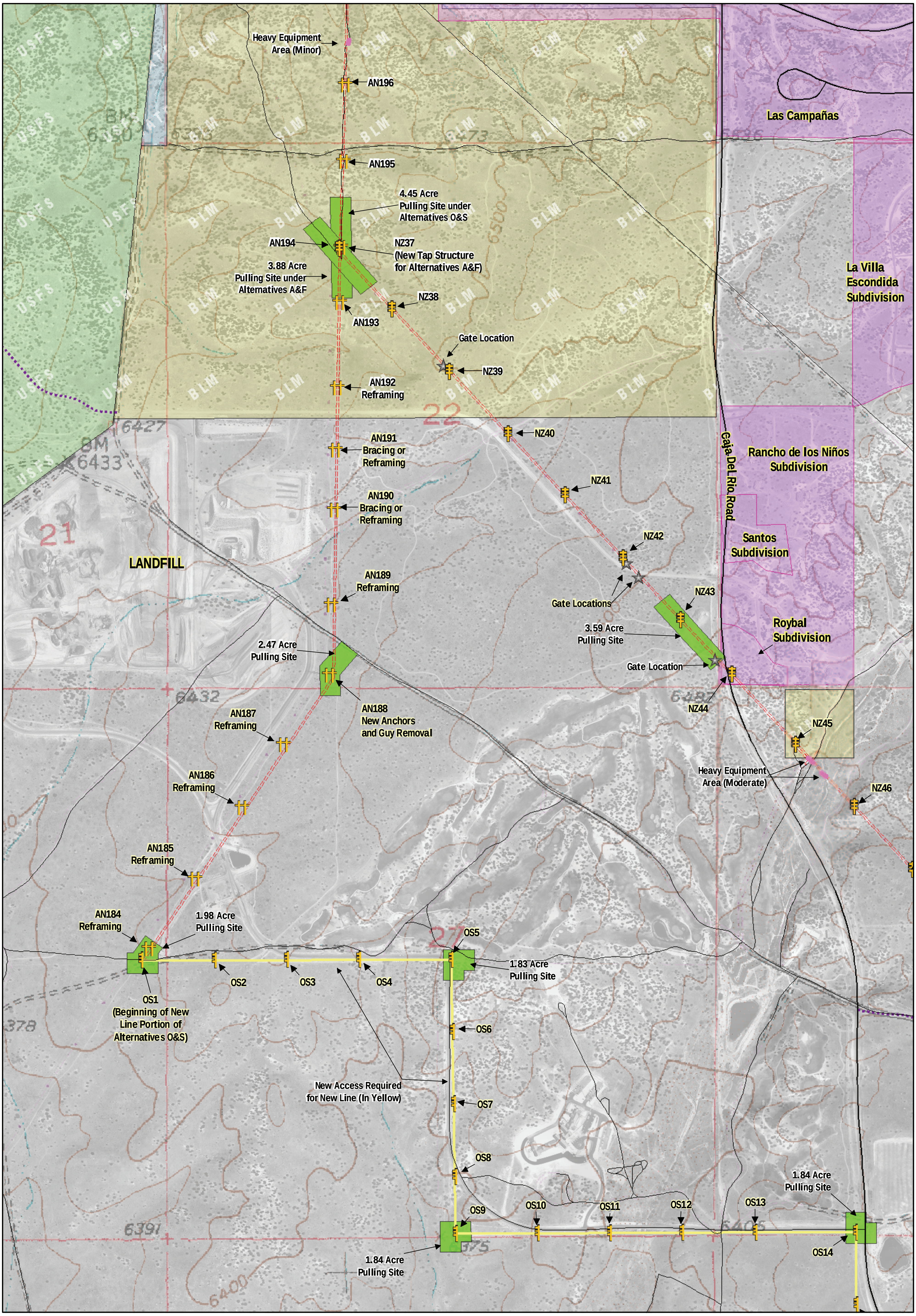
N W E S

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'

Transmission Line Access & Structures

Window 2 of 12



LEGEND

- Existing 115 kV AN Line H-Frame Structures
- Double Circuit NZ under Alt's A&F (Currently H-Frame)
- Single-Circuit New Line under Alt's O&S
- Santa Fe N.F.
- BLM Lands
- State Lands
- Pulling Sites
- Approved & Recent Developments

Access Routes

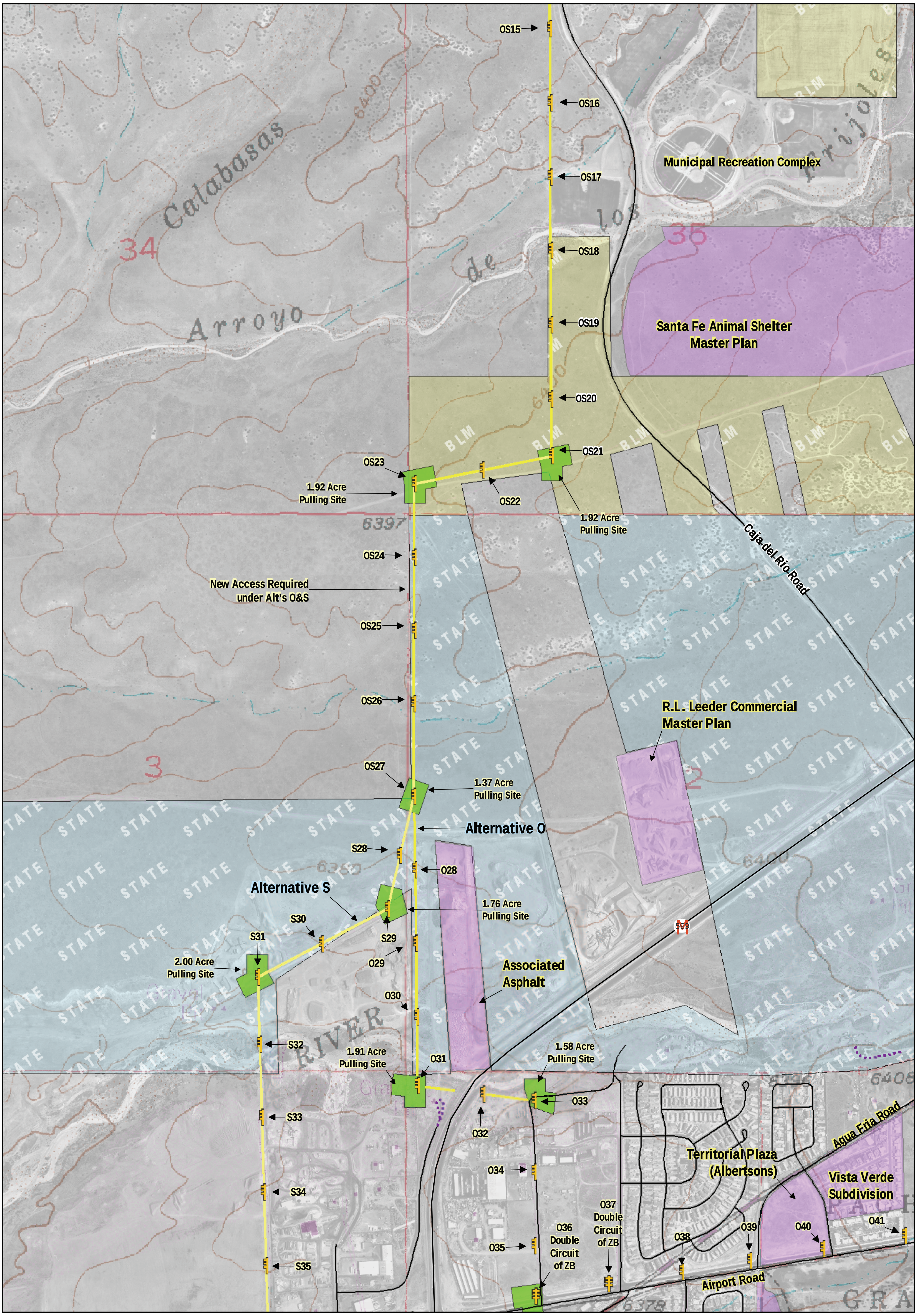
- Existing 2-Track Roads
- Gravel 1-Lane Roads
- Overland Route Roads
- Gravel 2+ Lane Roads
- Heavy Equipment Areas

N W E S

Transmission Line Access & Structures Window 3 of 12

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'



LEGEND

- BLM Lands
- State Lands
- Pulling Sites
- Approved and Recent Developments

Access Routes

- Gravel 2+ Lane Roads
- Area Requiring New Power Line Access Road
- Paved Roads and Highways
- Single-Circuit New Line under Alt's O&S
- Double-Circuit of ZB Line under Alt O (2 Poles)

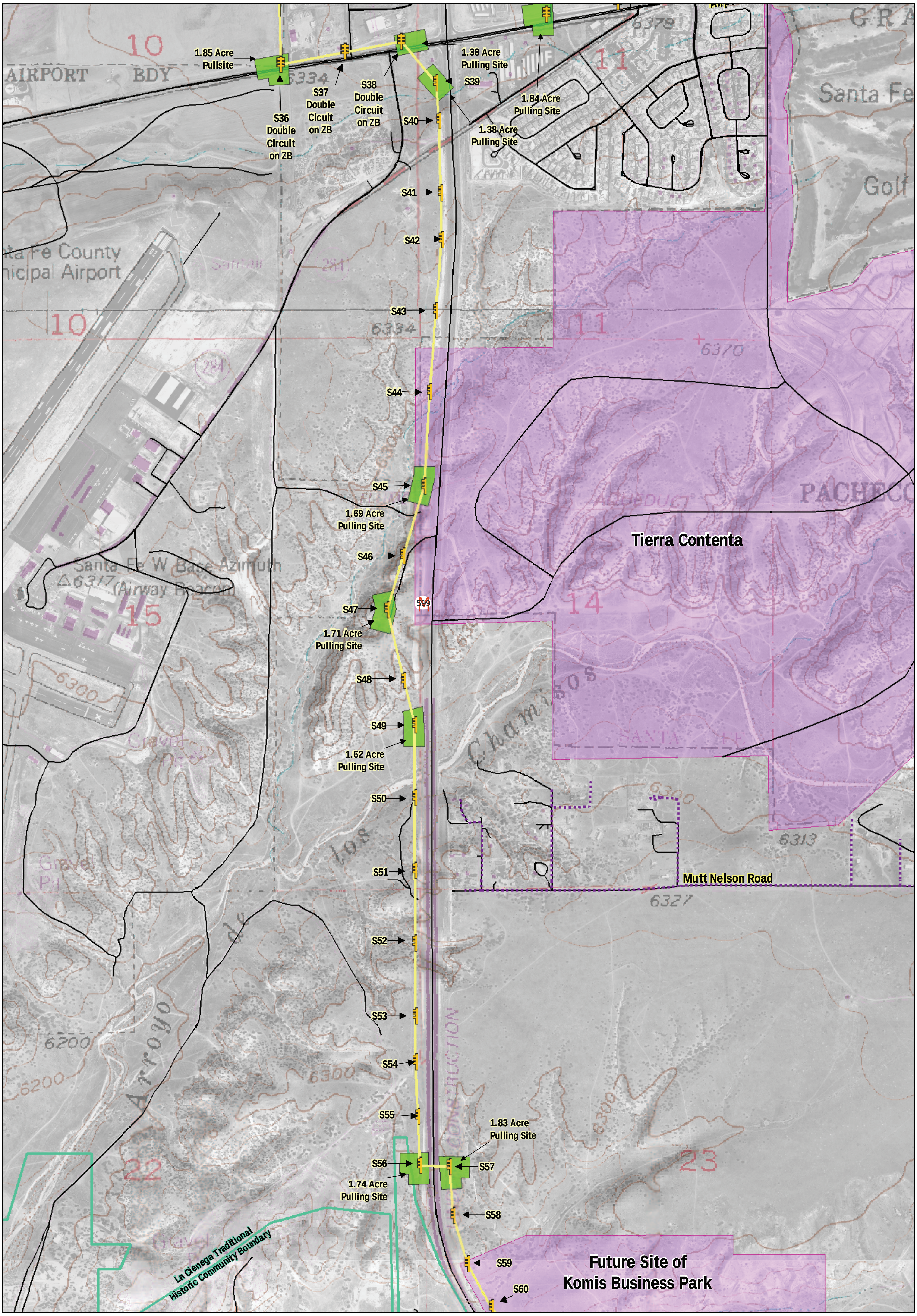
N W E S

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'

Transmission Line Access & Structures

Window 4 of 12



LEGEND

Access Routes

- Existing Paved Roads and Highways
- Area Requiring New Power Line Access Road Under Alternative
- Gravel 2+ Lane Roads
- Pulling Sites
- Approved and Recent Developments
- Single-Circuit New Line under Alt's O&S
- Double-Circuit of ZB Line under Alt's O&S (3 for Alt S, 2 for Alt O)

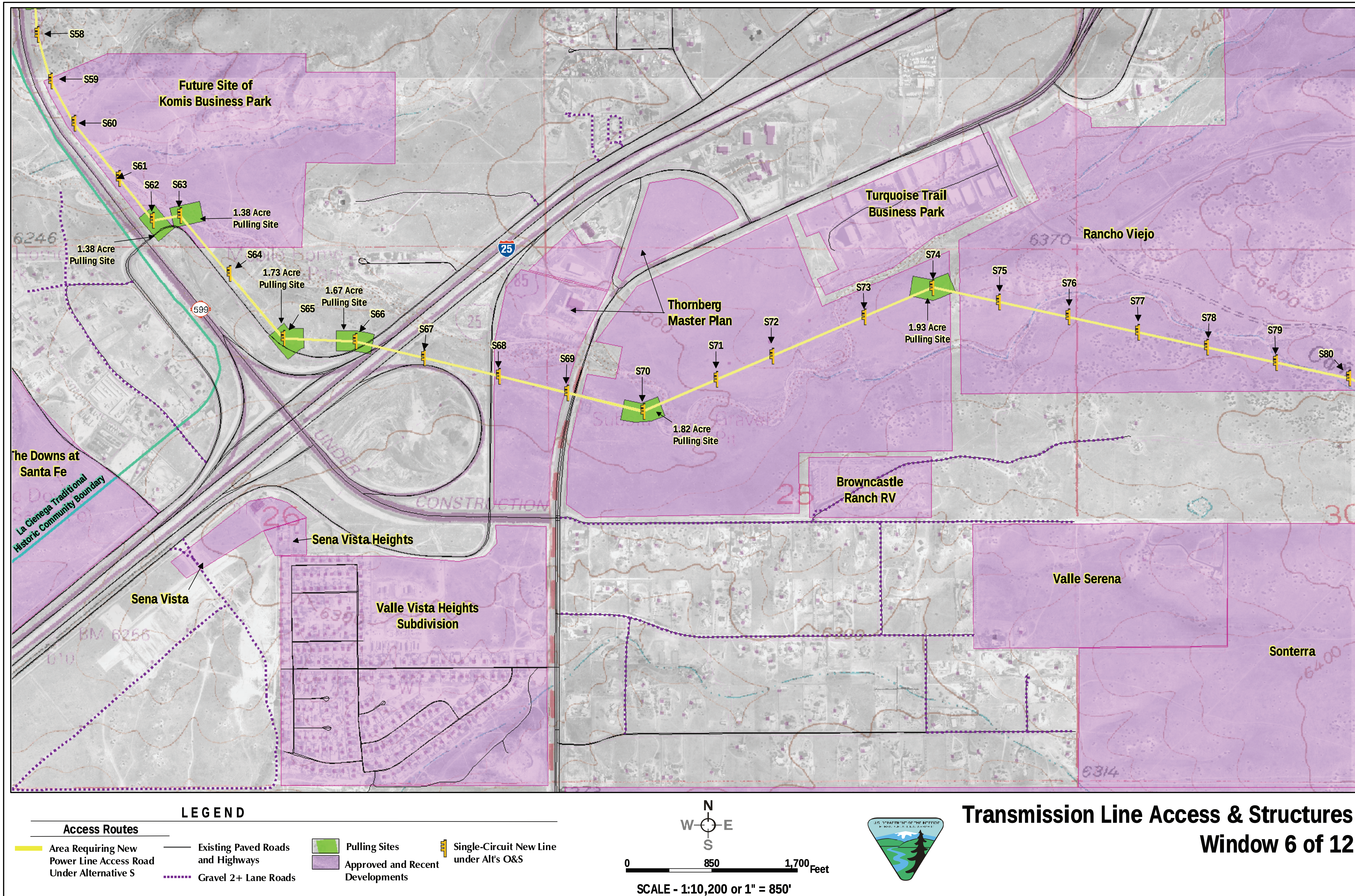
N
W E
S

Transmission Line Access & Structures

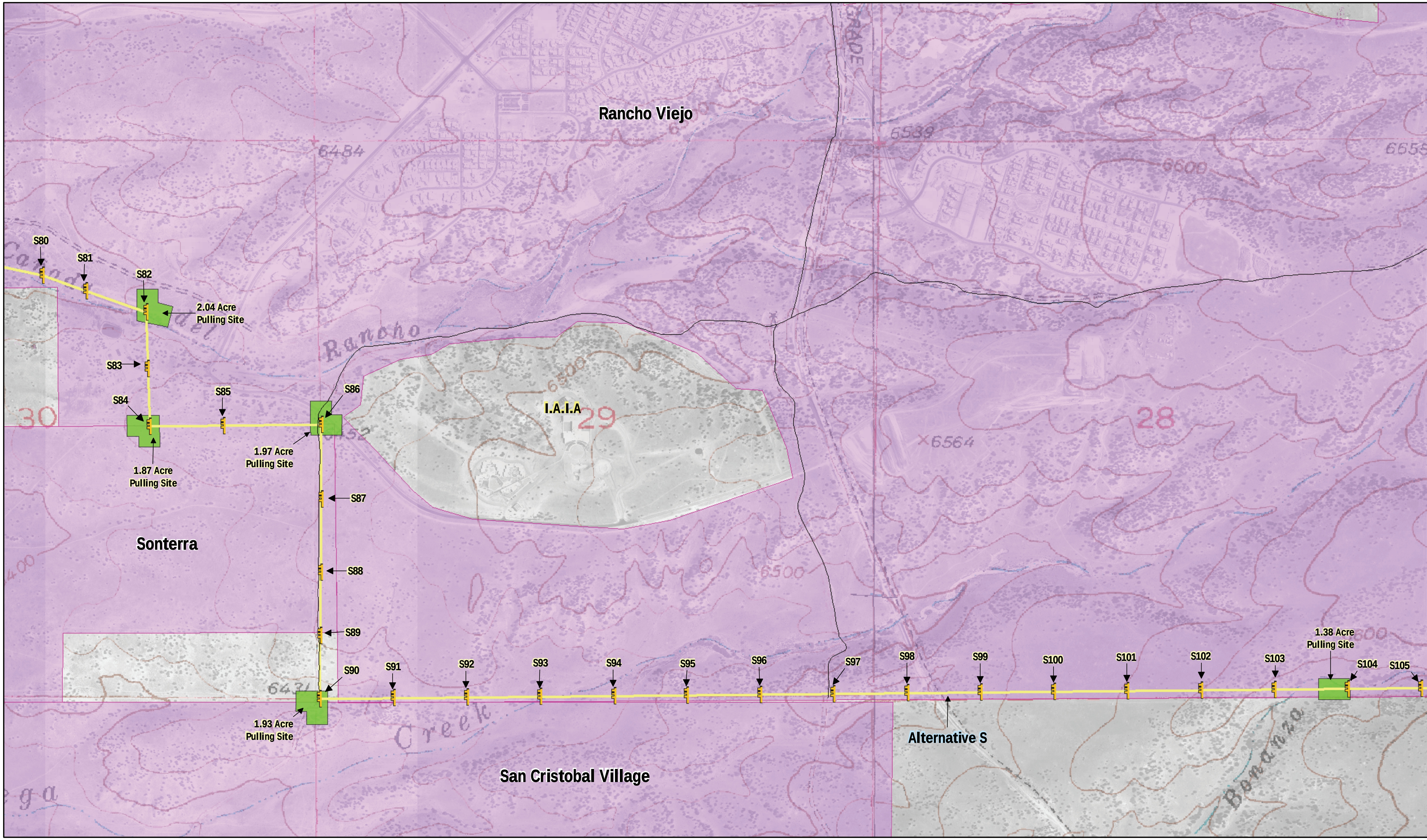
Window 5 of 12

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'



Transmission Line Access & Structures
Window 6 of 12



LEGEND

Access Routes

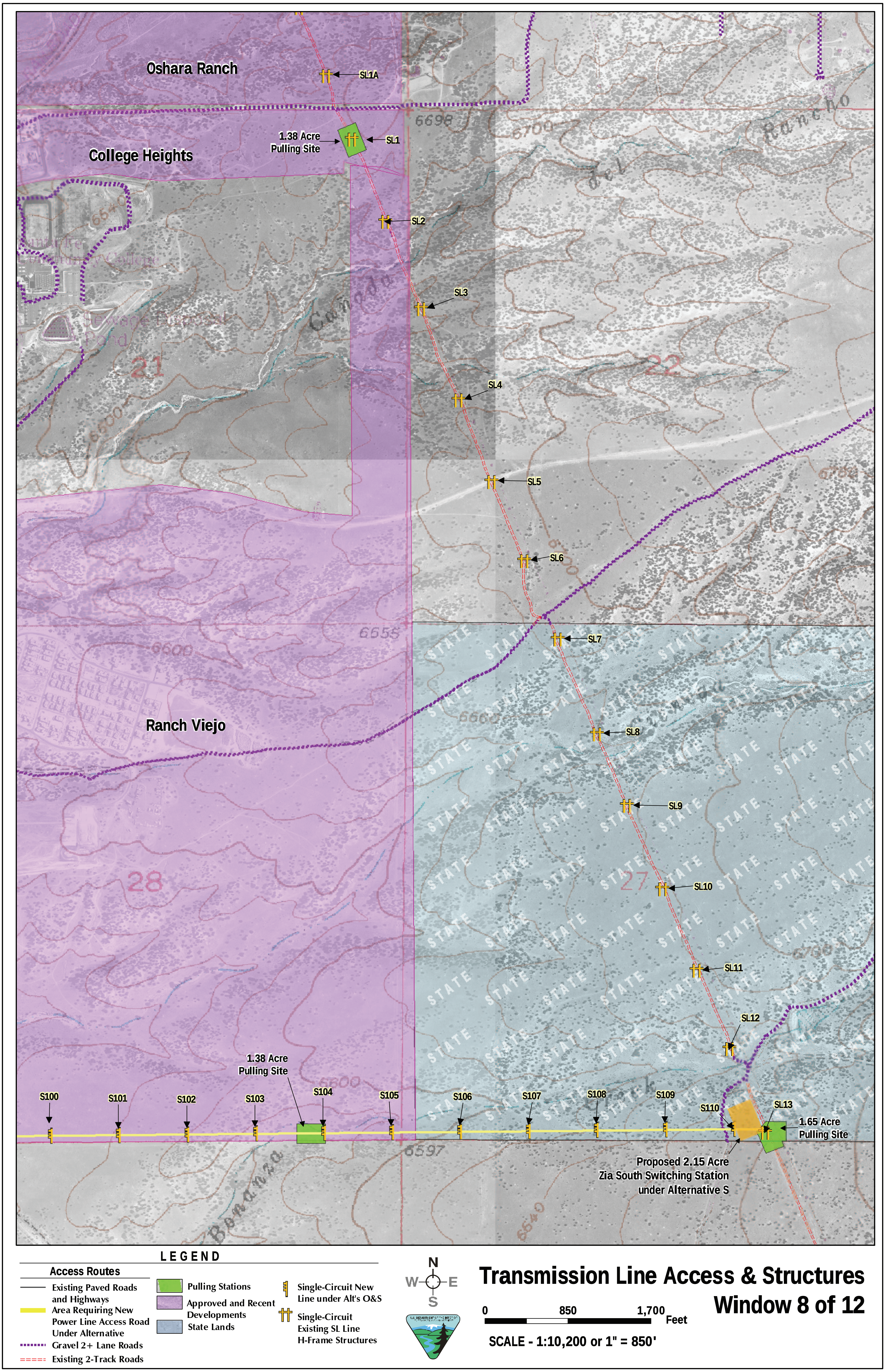
- Area Requiring New Power Line Access Road Under Alternative S
- Existing Paved Roads and Highways
- Gravel 2+ Lane Roads
- Pulling Sites
- Approved and Recent Developments
- Single-Circuit New Line under Alternative S

N W E S

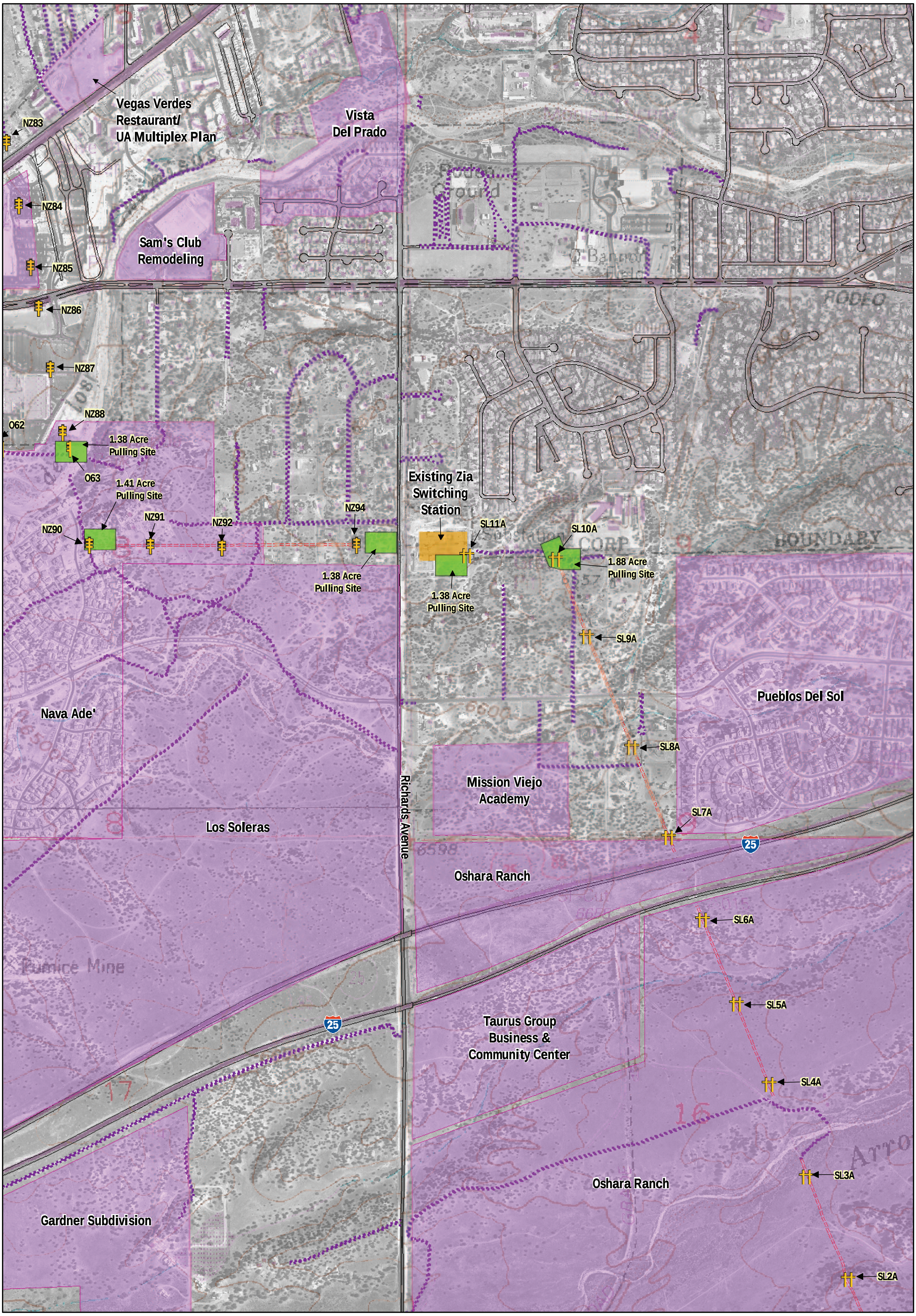
0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'

Transmission Line Access & Structures Window 7 of 12



Transmission Line Access & Structures
Window 8 of 12



LEGEND

Access Routes

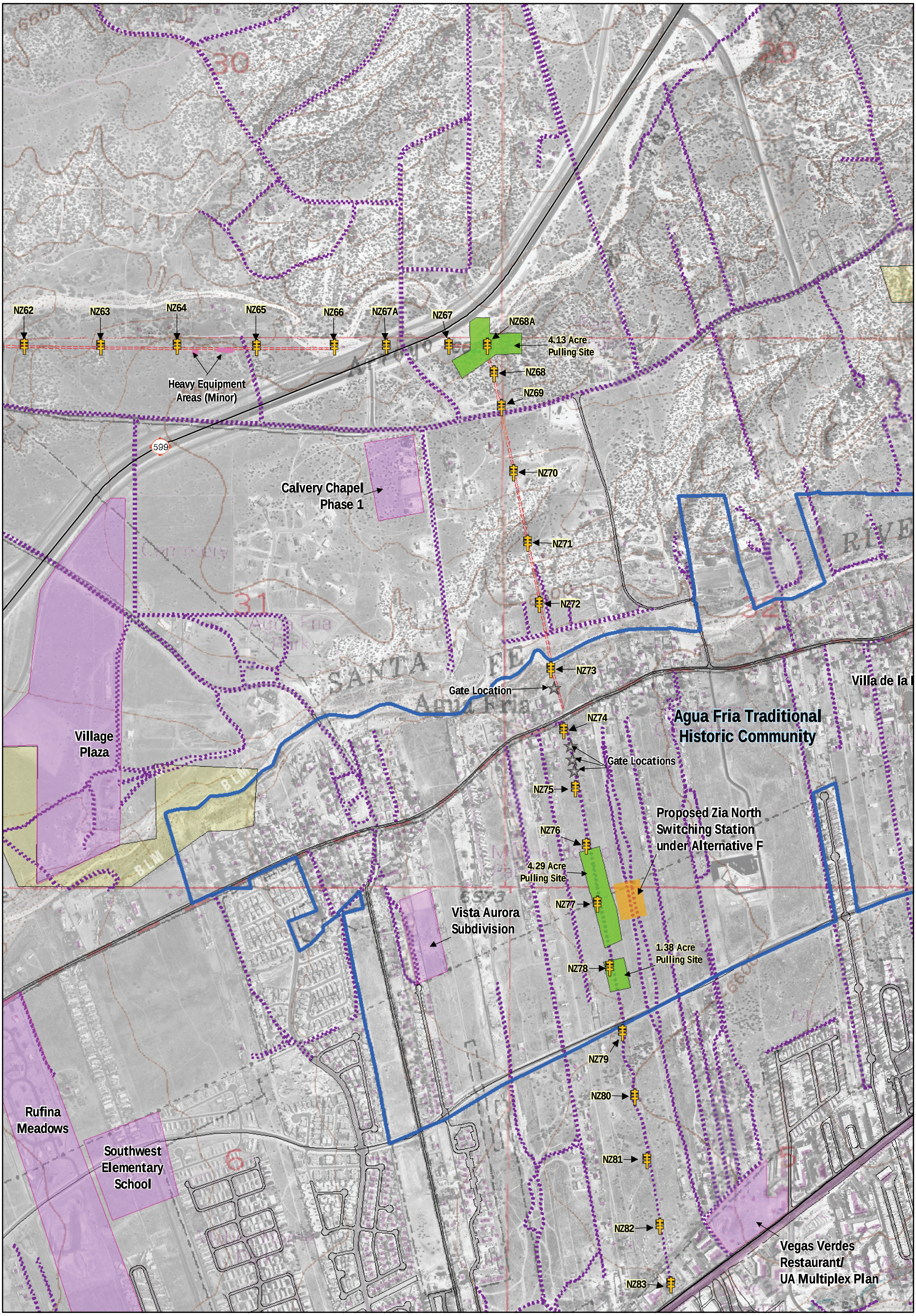
- Existing Paved Roads and Highways
- Gravel 2+ Lane Roads
- Existing 2-Track Roads
- Pulling Sites
- Approved and Recent Developments
- Existing Zia Switching Station
- Single-Circuit New Line under Alternative O
- Double Circuit NZ Line (Currently H-Frame)
- Single-Circuit Existing SL Line H-Frame Structures

N W E S

Transmission Line Access & Structures
Window 9 of 12

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'



LEGEND

Access Routes

- Existing Paved Roads and Highways
- Gravel 2+ Lane Roads
- Existing 2-Track Roads
- Heavy Equipment Areas
- Pulling Sites
- Approved and Recent Developments
- BLM Lands
- Double Circuit NZ Line (Currently H-Frame)
- Proposed Zia North Switching Station under Alternative F

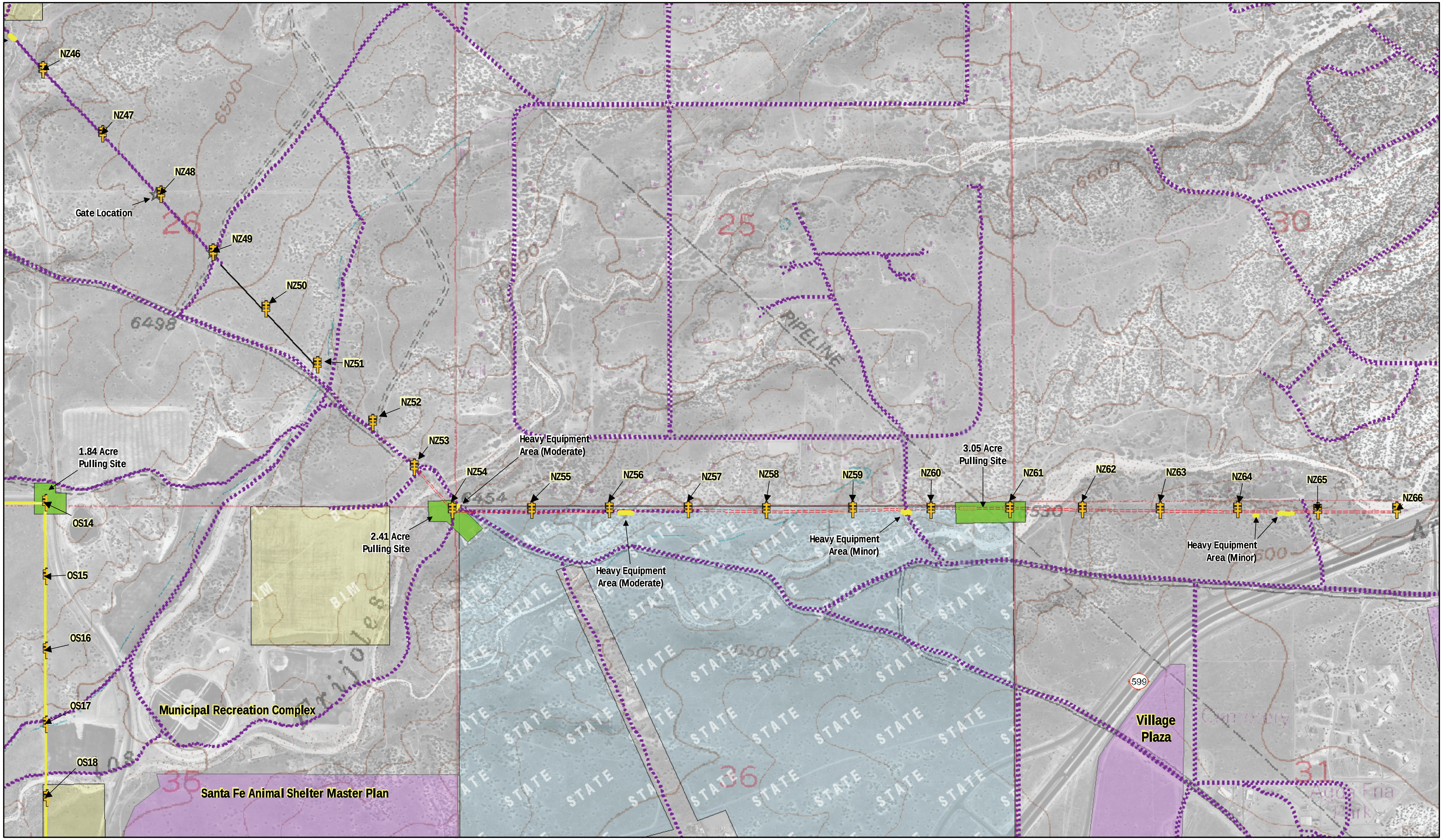
N
W E
S

Transmission Line Access & Structures

Window 10 of 12

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'



LEGEND

Access Routes

- Heavy Equipment Areas
- Existing Paved Roads and Highways
- Gravel 2+ Lane Roads
- Existing 2-Track Roads
- Pulling Stations
- Approved and Recent Developments
- State Lands
- BLM Lands
- Single-Circuit New Line under Alternatives O&S
- Double-Circuit of Existing NZ Line under Alternatives A&F

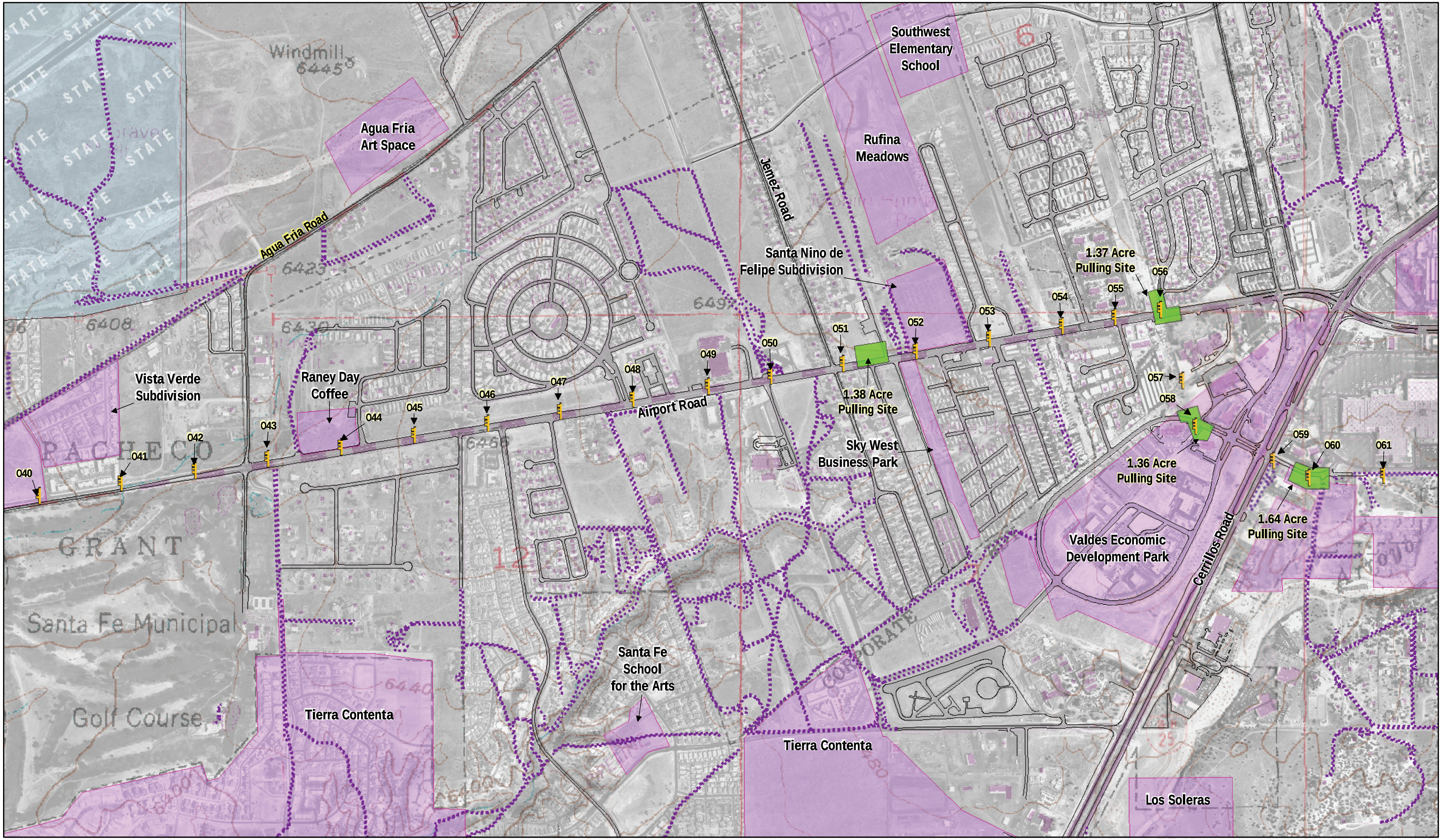
N W E S

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'

Transmission Line Access & Structures

Window 11 of 12



Transmission Line Access & Structures
Window 12 of 12

LEGEND

Access Routes

- Existing Paved Roads and Highways
- Gravel 2+ Lane Roads
- Existing 2-Track Roads
- Pulling Sites
- Approved and Recent Developments
- State Lands
- Single-Circuit New Line under Alternative O

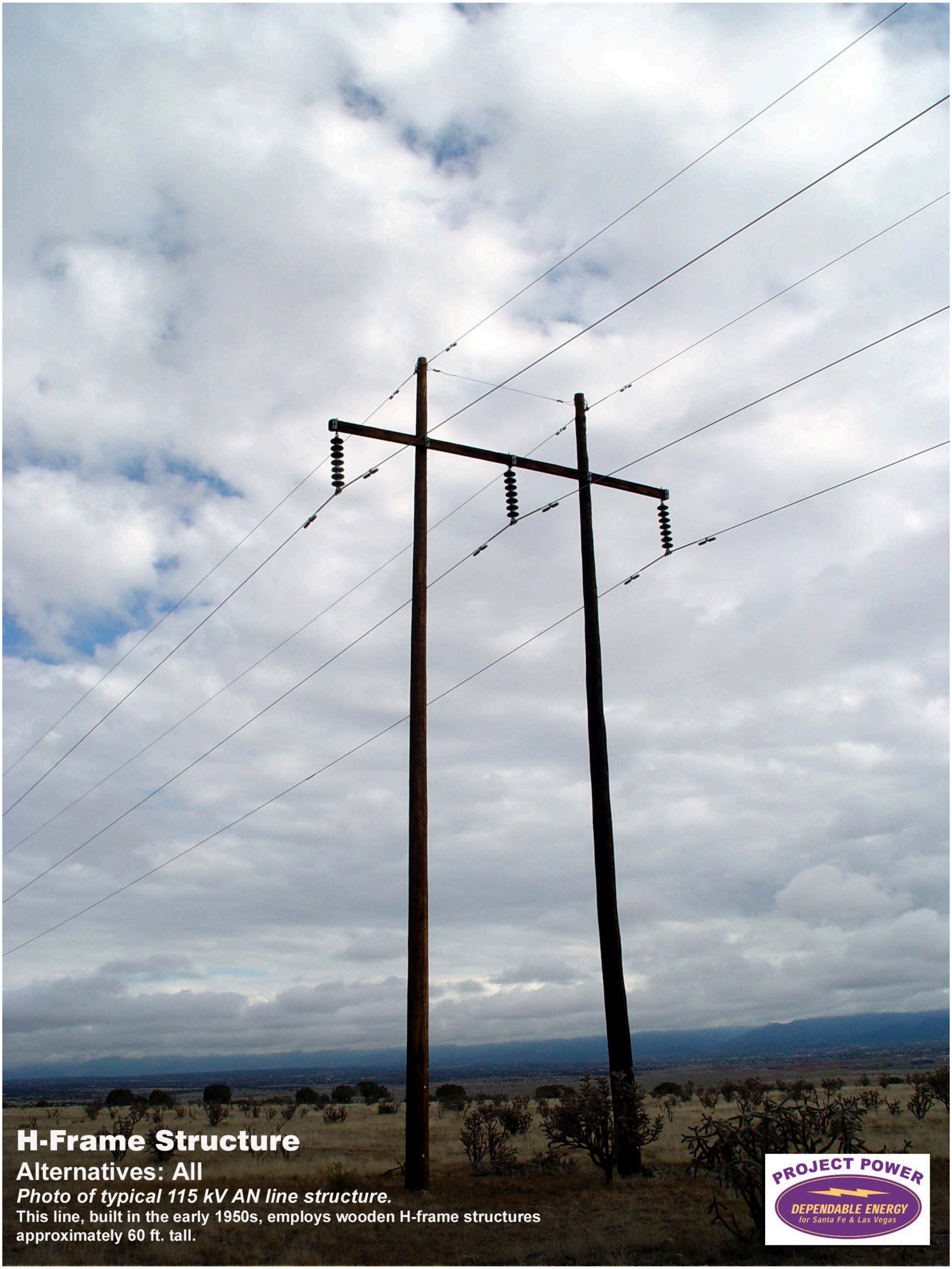
N W E S

0 850 1,700 Feet

SCALE - 1:10,200 or 1" = 850'

Appendix B. Visual Simulations

The following pages contain photo simulations of each proposed alternative.



H-Frame Structure

Alternatives: All

Photo of typical 115 kV AN line structure.

This line, built in the early 1950s, employs wooden H-frame structures approximately 60 ft. tall.

H-Frame Structure Modification

Alternatives: All

Photo simulation of proposed 115 kV AN line upgrades.

Cross arms to be raised to the top of the existing H-frame structure and added knee and vee bracing at the top of the poles and cross brace between poles. Added top bracing will increase the structure height by six feet yielding a total structure height of approximately 63 ft.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

H-Frame Structure Modification

Alternatives: All

Photo simulation of proposed 115 kV AN line upgrades.

Cross arms to be extended beyond the height of the existing H-frame structure with added knee and vee bracing at the top of the extension and cross bracing between poles. The extension will increase the structure height by approximately 12 ft. yielding a total structure height of approximately 69 ft.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

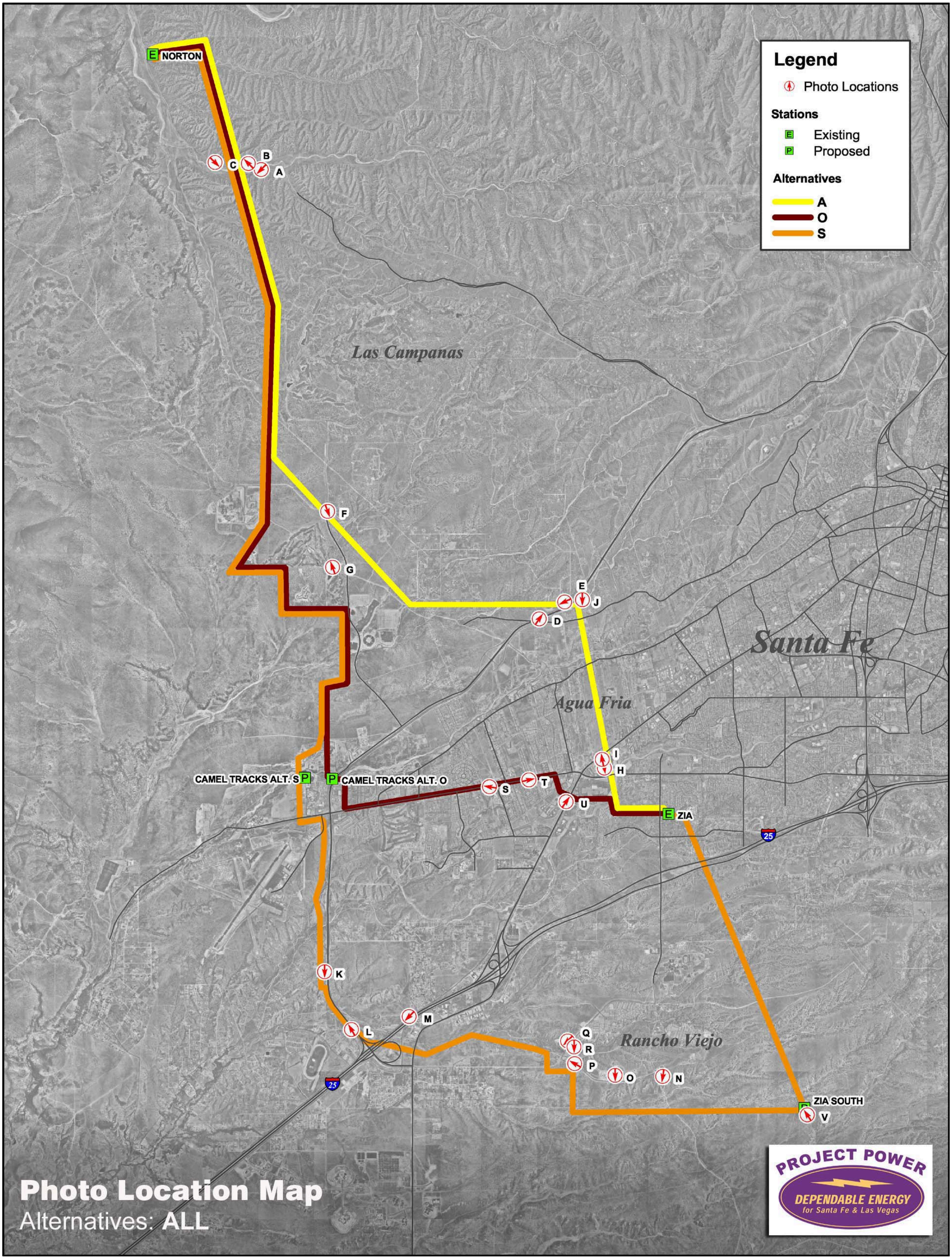


Photo Location Map

Alternatives: **ALL**

Photo Location A

Alternatives: All

Photo of existing Algodones-Norton 115kV transmission line.

This line, built in the early 1950s, employs structures that are approximately 55-60 ft. tall.
Photo from Buckman Road and Alamo Arroyo, facing southwest.

Photo Location A

Alternatives: All

Photo simulation of proposed 115 kV AN line upgrades.

Cross arms to be raised to the top of the existing H-frame structures and added knee and vee bracing at the top of the poles and cross brace between poles. Added top bracing will increase the structure height by approximately 6 ft. at this location. Photo from Buckman Road and Alamo Arroyo, facing southwest.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera 4A

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Photo Location B

Alternatives: All

Photo of existing Algodones-Norton 115kV transmission line.

This line, built in the early 1950s, employs structures that are approximately 55-60 ft. tall.
Photo from Buckman Road and Alamo Arroyo, facing northwest.

Camera 4B

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Photo Location B

Alternatives: All

Photo simulation of proposed 115 kV AN line upgrades.

Cross arms to be raised to the top of the existing H-frame structures and added knee and vee bracing at the top of the poles and cross brace between poles. Added top bracing will increase the structure height by approximately 6 ft. Photo from Buckman Road and Alamo Arroyo, facing northwest.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera 4B

Photo Location C

Alternatives: All

Photo of existing Algodones-Norton 115kV transmission line.

This line, built in the early 1950s, employs structures that are approximately 55-60 ft. tall.
Photo from Buckman Road and Alamo Arroyo, facing southeast..

Photo Location C

Alternatives: All

Photo simulation of proposed 115 kV AN line upgrades.

Cross arms to be raised to the top of the existing H-frame structures and added knee and vee bracing at the top of the poles and cross brace between poles. Added top bracing will increase the structure height by an average of 6 ft. yielding a total structure height of approximately 63 ft. Photo from Buckman Road and Alamo Arroyo, facing southeast.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera 6

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Photo Location D

Alternatives: A

Photo of existing Norton to Zia 115kV transmission line.

This line was built in 1958, it's structures are approximately 65 ft. tall.
Photo from NM599, facing northeast.

Camera 8

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Photo Location D

Alternatives: A

Photo simulation of proposed 115 kV NZ line rebuild.

Rebuild would include replacement of H-frame structures with single, self-weathering steel poles, about 70 ft. tall and double circuiting the line.

Photo from NM599 facing northeast.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera 8

Photo Location E

Alternatives: A

Photo of existing Norton to Zia 115kV transmission line.

This line was built in 1958; its structures are approximately 65 ft. tall.
Photo from NM599, facing southwest.

Camera 15

Photo Location E

Alternatives: A

Photo simulation of proposed 115 kV NZ line rebuild.

Rebuild would include structure for structure replacement of H-frame structures with single, self-weathering steel poles, about 70 ft. tall and double circuiting the line. Photo from NM599 facing southwest.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera 15

Photo Location F

Alternatives: A

Photo of existing Norton to Zia 115kV transmission line.

This line was built in 1958; its structures are approximately 65 ft. tall.
Photo from Caja del Rio Road, near the Marty Sanchez Golf Complex, facing southeast.

Camera 16

Photo Location F

Alternatives: A

Photo simulation of proposed 115 kV NZ line rebuild.

Rebuild would include structure for structure replacement of H-frame structures with single, self-weathering steel poles, about 70 ft. tall and double circuiting of the line. Photo from Caja del Rio Road near Marty Sanchez Golf Complex facing southeast.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera 16

Photo Location G

Alternatives: A

Photo of existing Norton to Zia 115kV transmission line.

This line was built in 1958; its structures are approximately 65 ft. tall.
Photo from the putting green at the Marty Sanchez Golf Complex, facing northwest.

Camera 18

Photo Location G

Alternatives: A

Photo simulation of proposed 115 kV NZ line rebuild.

Rebuild would include structure for structure replacement of H-frame structures with single, self-weathering steel poles, about 70 ft. tall and double circuiting of the line. Photo from putting green at the Marty Sanchez Golf Complex facing northwest.

Reasonable efforts to provide an accurate visual simulation have been made.
However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera 18

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Photo Location H

Alternatives: A

Photo of existing Norton to Zia 115kV transmission line

Existing structures are about 60 ft. high.

Image from shopping center on Zafarano Dr.. Between Cerrillos and Rodeo Roads, facing south.

Camera I

Photo Location H

Alternatives: A

Photo simulation of proposed 115 kV NZ line rebuild.

Single circuit wood H-frame structures to be replaced with double circuit self-weathering steel poles about 70 ft. high. Image from shopping center on Zafarano Dr.. Between Cerrillos and Rodeo Roads, facing south.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera J

Photo Location I

Alternatives: A

Photo of existing Norton to Zia 115kV transmission line.

Existing H-frame structures are about 60 ft. high.
Image from shopping center on Zafarano Dr.. Between Cerrillos and Rodeo Roads, facing northwest.

Camera J

Photo Location I

Alternatives: A

Photo simulation of proposed 115 kV NZ line rebuild.

Single circuit wood H-frame structures to be replaced with double circuit self-weathering steel poles about 70 ft. high. Image from shopping center on Zafarano Dr.. Between Cerrillos and Rodeo Roads, facing northwest.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Camera I

Photo Location J

Alternatives: A

Photo of existing Norton to Zia 115kV transmission line.

This line was built in 1958; its structures are approximately 65 ft. tall.
The near line, the Mejia Tap 115kV transmission line, will not be affected by Project Power.
Photo from NM599, facing south.


Photo Location J
Alternatives: A
Photo simulation of proposed 115 kV NZ line rebuild.
Rebuild would include replacement of H-frame structures with single, self-weathering steel poles, about 70 ft. tall and double circuiting the line. In addition, a new, higher switch structure would replace the existing switch structure.
The near line, the Mejia Tap 115kV transmission line, will not be affected by Project Power.
Photo from NM599 facing south.
Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.
Camera 7
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Photo Location K
Alternative: **S**
Photo of existing conditions.
Image faces south from NM 599, south of Airport Road.

Photo Location K
Alternative: S

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high. Pole locations shown are approximate. Image faces south from NM 599, south of Airport Road.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

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Photo Location L

Alternatives: S

Photo of existing conditions.

Image location is NM599, just north of I-25 facing northwest.


RACE TRACK
MUSEUM
Photo Location L
Alternatives: S
Photo simulation of proposed new line.
This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high.
Pole locations shown are approximate. Image location is NM599, just north of I-25, facing northwest.
Reasonable efforts to provide an accurate visual simulation have been made.
However, this computer-generated rendering should be considered an approximate
representation of how the proposed facilities will appear.
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Photo Location M

Alternatives: S

Photo of existing conditions.

Image location is Interstate 25, east of NM599 interchange, facing southwest.

Photo Location M

Alternatives: S

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high.
Pole locations shown are approximate. Image location is Interstate 25, east of NM599 interchange, facing southwest.

Reasonable efforts to provide an accurate visual simulation have been made.
However, this computer-generated rendering should be considered an approximate
representation of how the proposed facilities will appear.

Photo Location N

Alternatives: S

Photo of existing conditions.

Image faces south from the recreation trail near Mesa Pino Road, Rancho Viejo.


Photo Location N
Alternatives: S
Photo simulation of proposed new line.
This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high.
Pole locations shown are approximate. Image faces south from the recreation trail near Mesa Pino Road, Rancho Viejo.
Reasonable efforts to provide an accurate visual simulation have been made.
However, this computer-generated rendering should be considered an approximate
representation of how the proposed facilities will appear.
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Photo Location O

Alternatives: S

Photo of existing conditions.

Image faces south from the IAIA library building.

Photo Location O

Alternatives: S

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high.
Pole locations shown are approximate. Image faces south from the IAIA library building.

Reasonable efforts to provide an accurate visual simulation have been made.
However, this computer-generated rendering should be considered an approximate
representation of how the proposed facilities will appear.

Photo Location P

Alternatives: S

Photo of existing conditions.

Image faces northwest from A-Van-Nu-Po Road, just west of the IAIA.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Photo Location P

Alternatives: S

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high.
Pole locations shown are approximate. Image faces northwest from A-Van-Nu-Po Road, just west of the IAIA.

Reasonable efforts to provide an accurate visual simulation have been made.
However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Photo Location Q

Alternatives: S

Photo of existing conditions.

Image faces southwest from Avenida del Sur, Rancho Viejo.

Photo Location Q

Alternatives: S

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high.
Pole locations shown are approximate. Image faces southwest from Avenida del Sur, Rancho Viejo.

Reasonable efforts to provide an accurate visual simulation have been made.
However, this computer-generated rendering should be considered an approximate
representation of how the proposed facilities will appear.

Photo Location R
Alternatives: S
Photo of existing conditions.
Image faces south from the Sierra Dawn cul de sac, Rancho Viejo.

Photo Location R

Alternatives: S

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 75 ft. high. Pole locations shown are approximate. Image faces south from the Sierra Dawn cul de sac, Rancho Viejo.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.


Photo Location S
Alternatives: S
Existing conditions
Photo from Airport Road and Lucia Lane facing west.
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Photo Location S

Alternatives: S

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 80 ft. high. The structures would also support the existing distribution line. Existing wooden poles would be replaced with 35 ft. high self-weathering steel poles. Photo from Airport Road and Lucia Lane facing west.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

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Photo Location T
Alternatives: O
Existing conditions
Photo from Airport Road and Calle Inez facing east.

Photo Location T

Alternatives: O

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 80 ft. high. The structures would also support the existing distribution line. Existing wooden poles would be replaced with 35 ft. high self-weathering steel poles. Photo from Airport Road and Calle Inez facing east.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Photo Location U

Alternatives: O

Existing conditions

Photo from Cerrillos and Wagon Roads facing Northeast.

Photo Location U

Alternatives: O

Photo simulation of proposed new line.

This new single circuit 115kV line would employ single self-weathering steel poles about 80 ft. high.
Photo from Cerrillos and Wagon Roads facing northeast.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

Photo Location V

Alternatives: S

Photo of existing conditions.

Image faces northwest from a location on the SL line east of Rancho Viejo.

Photo Location V

Alternatives: S

Photo simulation of proposed new line and switching station.

A new single circuit 115kV line would intersect the existing 115kV SL line at this location where a new switching station would be constructed. Image faces northwest from a location on the SL line east of Rancho Viejo.

Reasonable efforts to provide an accurate visual simulation have been made. However, this computer-generated rendering should be considered an approximate representation of how the proposed facilities will appear.

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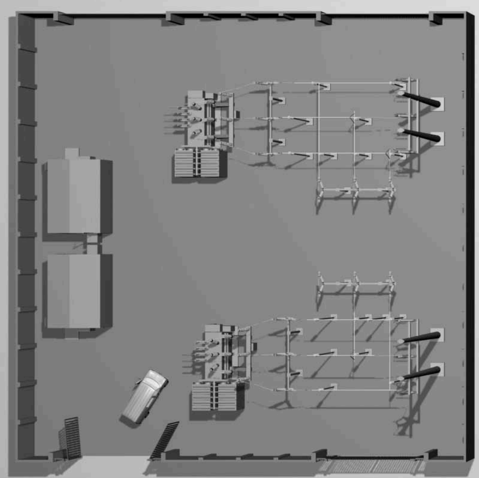
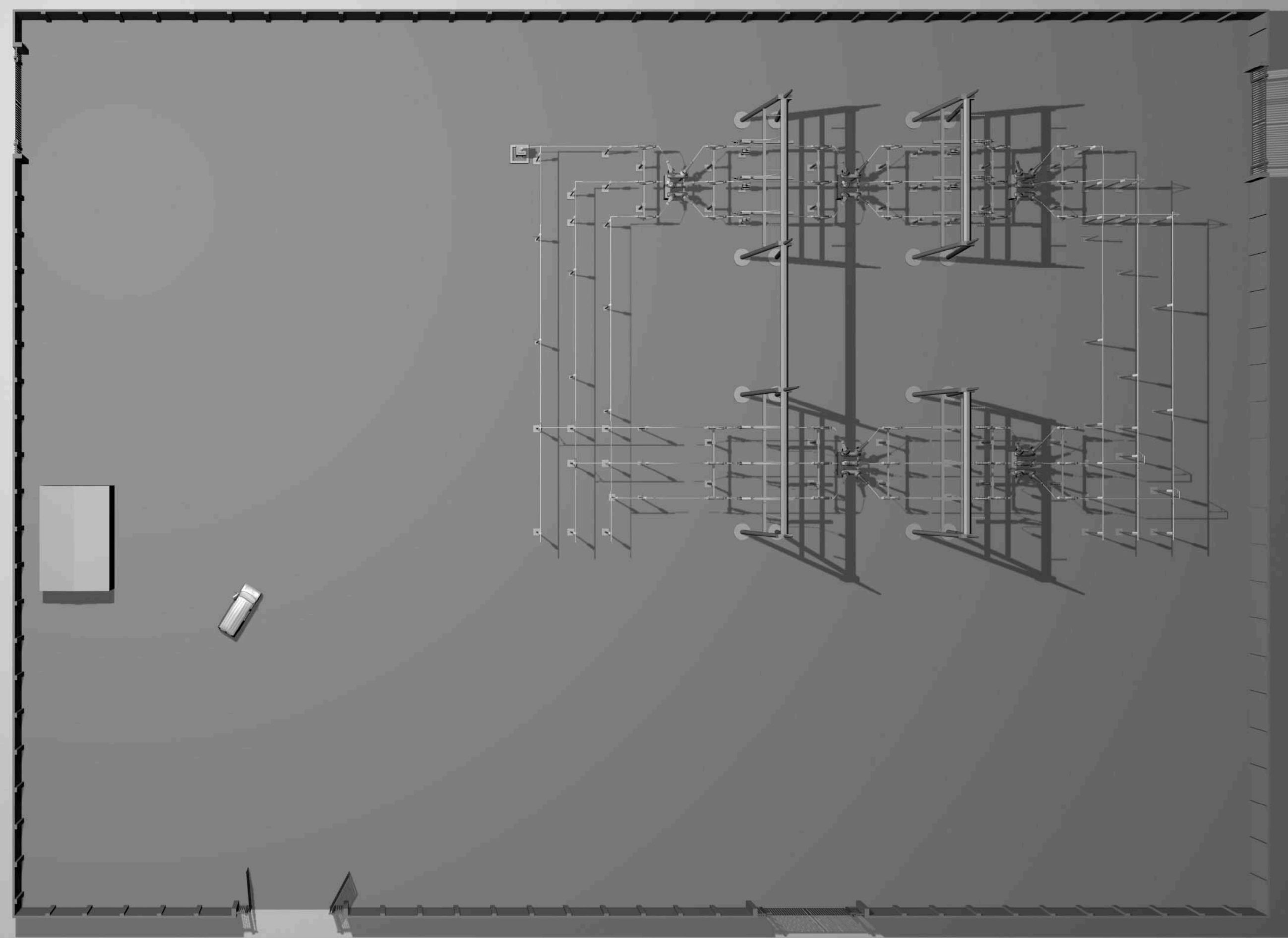
Station Size Comparison



Typical Distribution Substation
Two Unit, 115kV to 12.5kV
128' x 128'



Typical Switching Station
Based on Zia North Design
260' x 360'

PROJECT POWER
DEPENDABLE ENERGY
for Santa Fe & Las Vegas

Appendix C. EMF Data

SECTION 1: ELECTRO-MAGNETIC FIELDS FIELD COMPARISON STUDY

SECTION 2: ALTERNATIVE ANALYSIS

Prepared By

Public Service Company of New Mexico

February 2004

SECTION 1: ELECTRO-MAGNETIC FIELDS - FIELD COMPARISON STUDY

Introduction

As part of various public and community meetings held for Project Power, Public Service Company of New Mexico (PNM) presented computer models showing the electro-magnetic fields (EMF) that would be generated by various options of Project Power. A copy of the field measurement data is provided at the end of this discussion.

Of particular interest to some members of the public was the accuracy of the computer model when compared to field EMF conditions. As a result, PNM undertook a study to compare actual EMF field readings to the models produced by recognized computer programs

Background

To develop the information used at Public Meetings, PNM provided proposed transmission line configurations and projected circuit loadings to a consulting engineering firm, CH2MHill. This firm used a computer program called FIELDS to model the EMF fields that the proposed Project Power facilities would create.

PNM uses a computer program developed by the Electric Power Research Institute (EPRI) to model EMF fields. This program is called ACDCLINE.

Use of both the FIELDS program and the ACDCLINE program allows for a comparison between computer-generated models in addition to the comparison to field results

Field Comparison Study

PNM selected three different transmission line locations in the Santa Fe and Albuquerque areas for the comparison study. The line configurations at these sites is similar to the configurations in the Agua Fria area for both existing conditions and for proposed Project Power alternatives. Key issues that directly affect EMF levels include: distance of the conductor from ground, phase separation, arrangement of phasing on double-circuit structures, and line loadings.

Field studies

Field studies were conducted on October 2 and October 27, 2003. Line loadings collected as part of the study are considered to be average daily loads. Line loads and other conditions which affect EMF do vary over time. EMF measurements taken for this study should be considered a snapshot in time.

At all three field sites, PNM collected the following data:

1). physical configurations of the existing circuit(s) including

- phase-to-phase spacing
- phase to overhead groundwire spacing
- size and type of conductor
- height of conductors and overhead groundwire above ground
- structure configuration (h-frame or single pole)
- arrangement of phasing (A, B, C)
- physical information was collected from a combination of field measurements and PNM record drawings

2). Circuit loadings in megawatts, as reported by PNM's Power Operations Center, at the time EMF field measurements were taken.

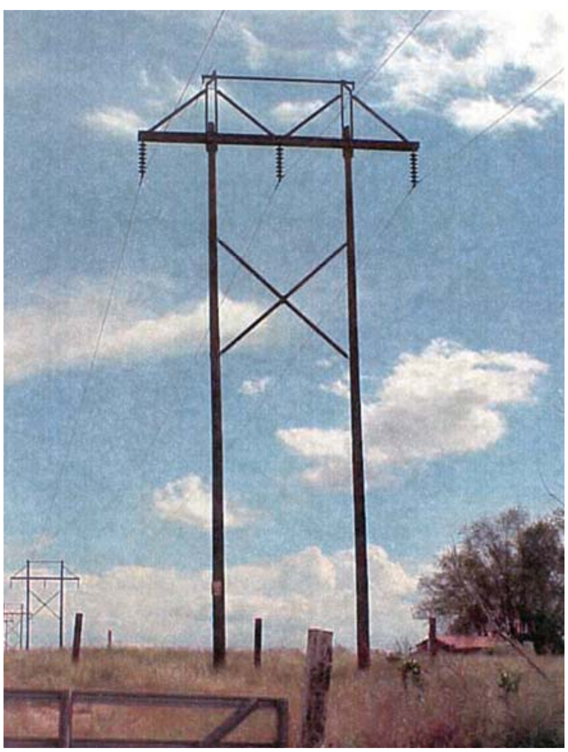
3). EMF measurements in milligauss were taken on a cross-section of the right-of-way using an EMDEX II gauge. Two gauges were used in order to verify readings. EMF measurements were jointly taken by members of the public and PNM staff.

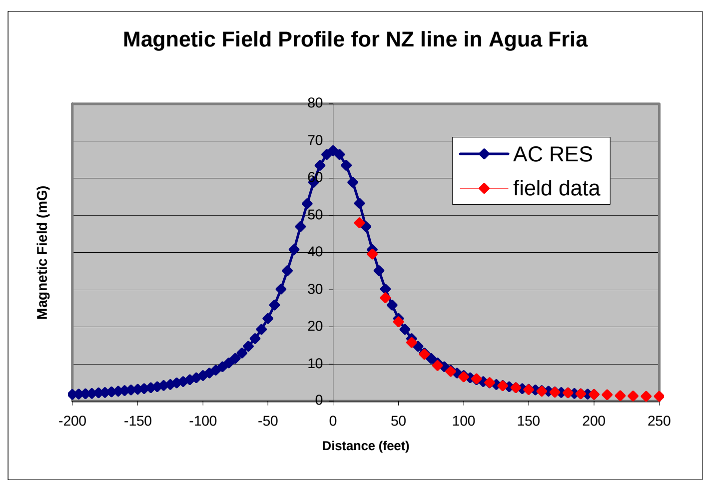
Computer Model
Using the physical configuration data and the circuit loading information, PNM used the ACDCLINE program to model EMF fields.

Results
Listed below are the results by site. Computer models use the ACDCLINE program unless otherwise noted.

Site 1. Comparison of EMF generated by PNM's "NZ" single circuit 115kV line just south of Agua Fria Road, Santa Fe, NM. This transmission line is typical wood pole h-frame construction. Field data was collected about 1:30 pm on Oct. 2, 2003. The figure titled "Magnetic Field Profile for NZ Line in Agua Fria" shows two EMF curves. One is the computer model of EMF and the other is the actual EMF field measurements. The computer model correlates well with field conditions. This data also correlates well with the computer EMF model generated by CH2MHill using the FIELDS program. This model is shown in the figure titled "NZ-1 Corridor" and is the curve labeled *Existing NZ Corridor*.

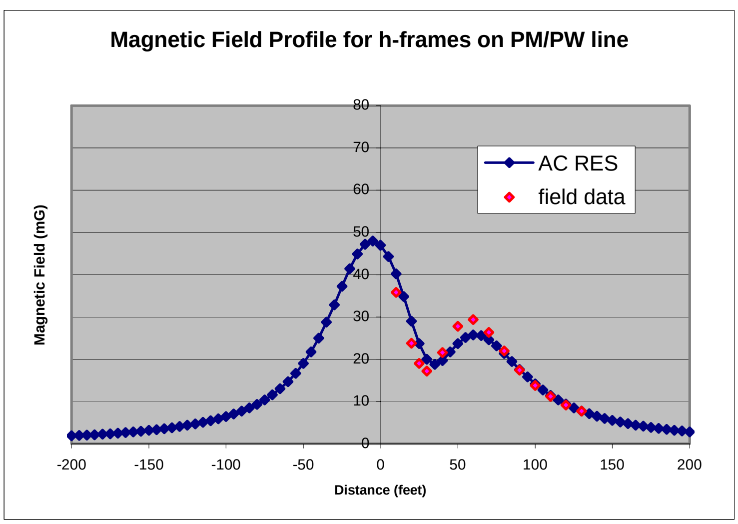
Figure C-1. Site 1





Site 2. H-frame comparison of EMF generated by PNM's PM and PW 115kV lines south of the intersection of Sage and Benavides, Albuquerque, NM. At this location, the transmission corridor is made up of two typical single circuit wood-pole H-frame structures. Field data was collected about 10:00 am on Oct. 27, 2003. The figure titled "Magnetic Field Profile for H-frames on the PM/PW" line shows EMF model and the actual EMF field measurements. These two curves compare well. The difference in the height of the two peaks on the curves is an indication that the two circuits lines are carrying different loads.

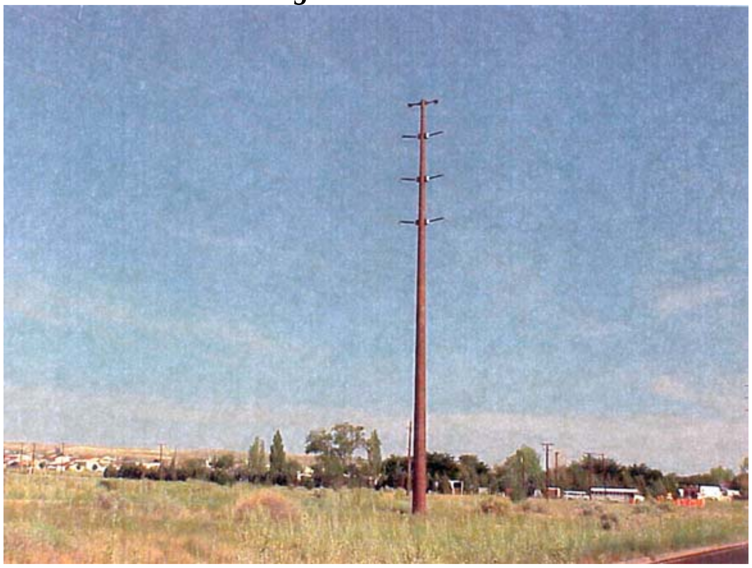
Figure C- 2. Site 2

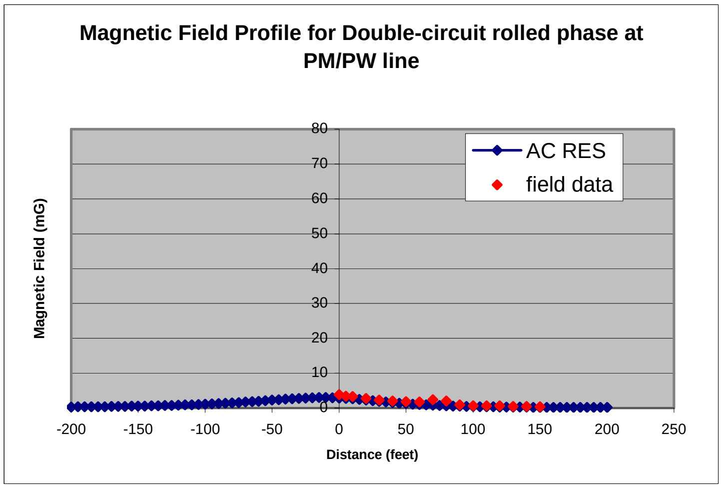


The computer programs make some assumptions such as the ground is level. If the actual ground is not level (as was the case in the field here), the computer model and the field readings will not match exactly.

Site 3. Double-circuit comparison of EMF generated by PNM's PM and PW 115kV lines south of the intersection of Sage and 98th, Albuquerque, NM. At this location, the transmission corridor is a single steel single pole structure that carries both circuits. This is a typical double-circuit design. At this location, phasing of the circuits is rolled. Field data was collected about 10:30 am on Oct. 27, 2003. The figure titled "Magnetic Field Profile for Double-circuit Rolled Phase at PM/PW Line" shows the two EMF curves, one is the computer model data and the other is actual EMF field test readings. These two curves compare well. The EMF field reading curve shows a small bump approximately 75 feet from the centerline. This is an indication of a low voltage underground circuit. This circuit was not included in the computer model. EMF readings at site 3 are significantly lower than Site 2. This is due to a combination of height of conductor above ground and the rolled phasing.

Figure C-3. Site 3





Conclusion
Both of the EMF computer programs, ACDCLINE and FIELDS, provide a reasonable model of the EMF that was measured at the three field locations.

SECTION 2: ALTERNATIVE ANALYSIS

Electric Fields

Electric field values were calculated for the proposed project. The most important parameters for determining the ground level electric field of a transmission line are conductor height above ground, line geometry, and line voltage. Because of practical considerations, measured values of the electric field can, and do, deviate from calculated values. It is therefore common practice to calculate the electric fields for a line under a specific extreme condition.

The NESC states the condition for evaluating electric-field-induced currents is with the conductors at 212 degree F (maximum operating temperature) and at a final unloaded sag. The computed electric field profiles at one meter (3.3 feet) above ground for typical spans are calculated at mid span where the conductors are at their lowest point (minimum ground clearance see FIGURE 1). Line loadings and MW are shown in Figures 2 through 5 respectively for the four alternatives.

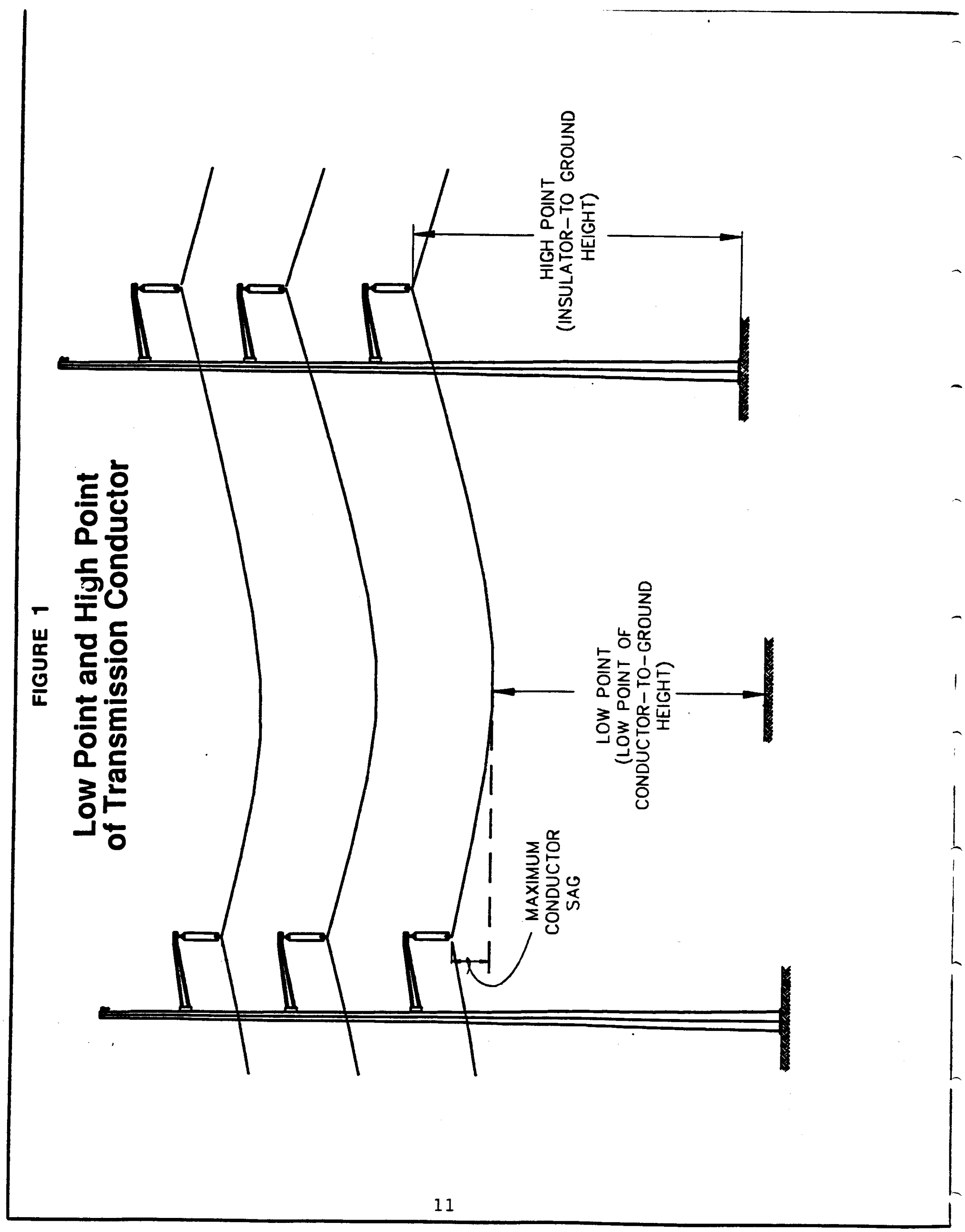
Field values calculated for the proposed project would vary from a high of approximately 1.25 kV/m directly under the conductor at mid span to about 0.7 kV/m at the ROW edge. On ROWs where the proposed project would be the only line in service, the 0.7 kV/m field would be expected at both ROW edges.

The maximum field strength for the electric field values occurs within a relatively small area of the ROW (about 5 percent of the total area) near the location where the conductors sag closest to the ground. Additional attenuation of fields would be realized as distance from the ROW edge is increased. Most states have not established maximum electric field levels within the ROW or at the ROW edge, nor have Federal standards been established. Table 1 gives a summary of existing and proposed standards from other states, and guidelines for transmission line electric field strength limits.

Table 1. Summary of Existing State Guidelines for Transmission Line Electric and Magnetic Fields

State/ Entity	Electric Fields		Magnetic Fields
	on ROW kV/m	edge of ROW kV/m	edge of ROW mG
Florida	8a, 10b	2	150 max -a; 200 max -b; 250 max -c;
Minnesota	8	none	none
Montana	7d	1	none
New Jersey	none	3	none
New York	11.8	1.6	200 max -e
North Dakota	9	none	none
Oregon	9	none	none
Bonneville Power Administration	9, 5d, 3.5f, 2.5g	5	none

a - 230 kV or smaller line
b - 500 kV lines
c - 500 kV double circuit lines
d - maximum for highway crossings
e - interim standard
f - maximum for shopping center parking lots
g - maximum for commercial/industrial parking lots



Electric fields for various alternatives are shown in Figure 2 through Figure 5. The electric field is shown on the y-axis and is labeled “E (kV/M). Refer to Appendix B for photo simulations of alternatives.

Figure 2. Electric field profile for AN Corridor (all alternatives)

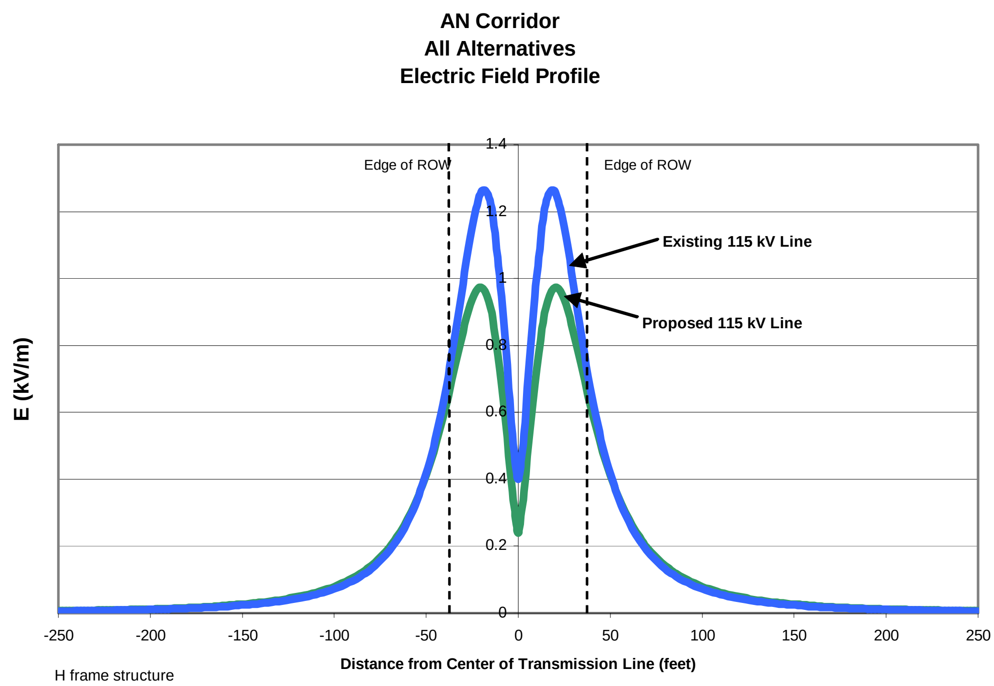


Figure 3. Electric Field Profile for NZ-1 Corridor (A and F alternatives)

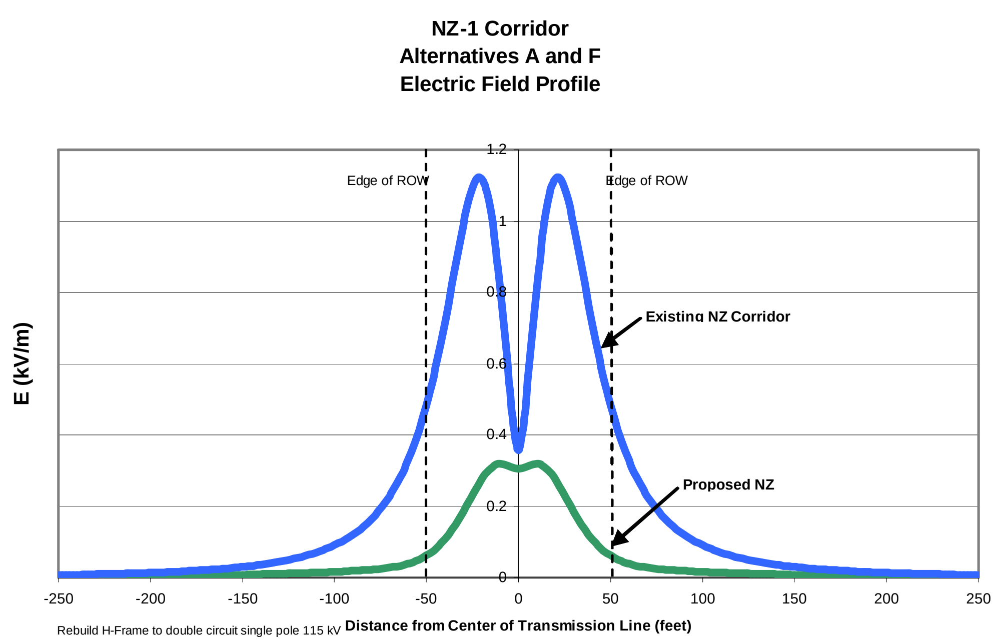


Figure 4. Electric Field profile for NZ-2 Corridor (A, F, and O alternatives)

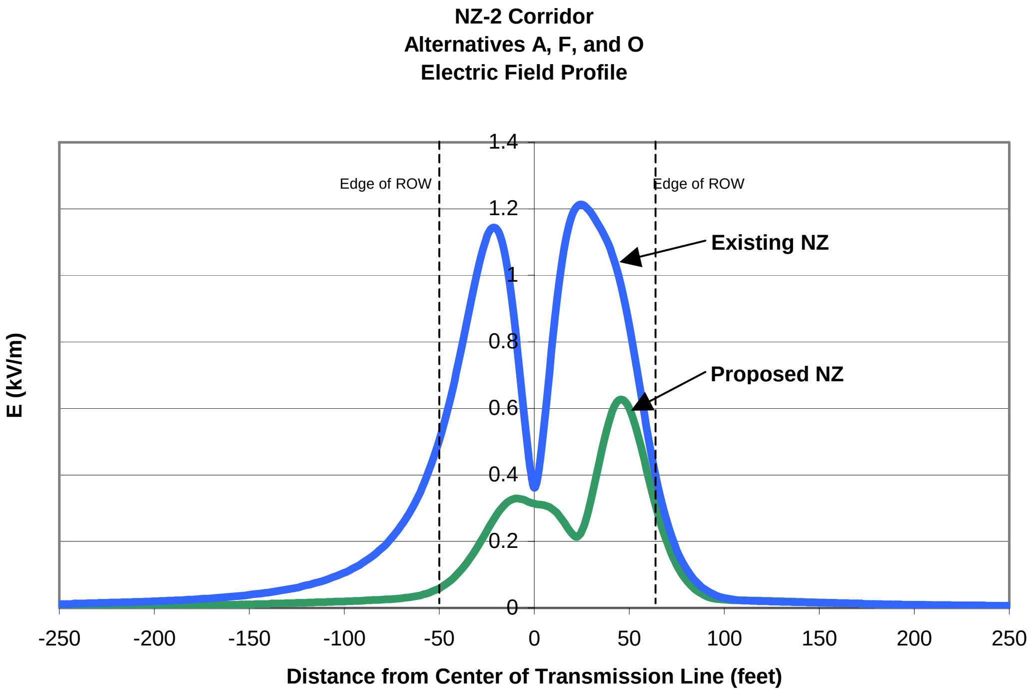
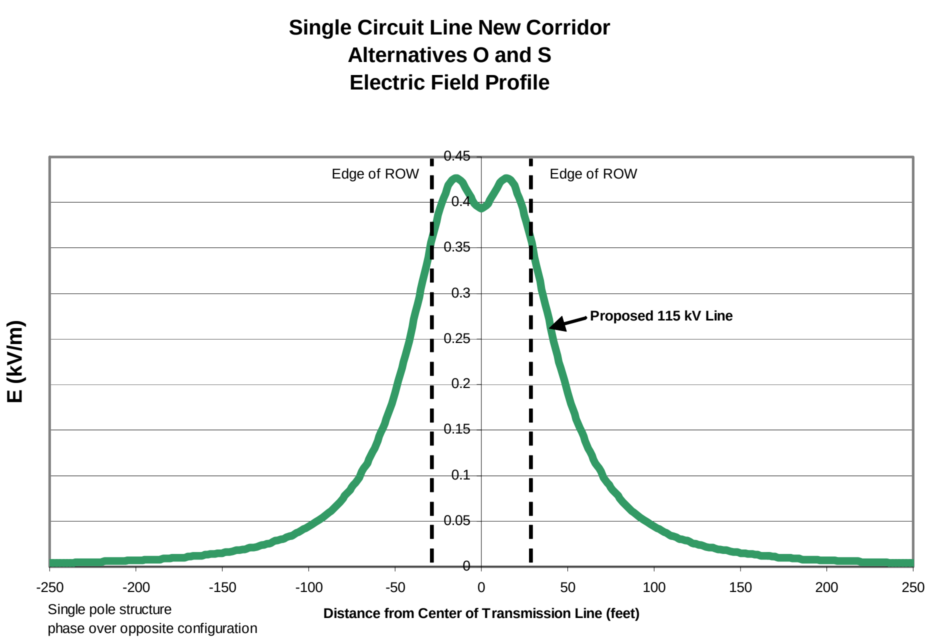


Figure 5. Electric field profile for single circuit line in new corridor (new line for O and S alternatives)



Magnetic Fields

Magnetic field values were calculated for the proposed project alternatives. Magnetic field strengths are directly related to, among other factors, the amount of current in the conductor; the

Magnetic Fields

Magnetic field values were calculated for the proposed project alternatives. Magnetic field strengths are directly related to, among other factors, the amount of current in the conductor; the greater the current flow, the greater the magnetic field. Therefore, unlike electric fields, magnetic fields can vary significantly over time, fluctuating with system loads. It is for this reason, the magnetic fields for the project alternatives were calculated for both a peak and average loading condition.

Magnetic fields associated with transmission lines behave similarly to electric fields in that they are most intense very near the conductors and fall away relatively quickly as the distance from the conductor increases. The partial cancellation effect of adjacent conductors also occurs with magnetic fields, as it does with electric fields. However, where electric fields are rather easily shielded, magnetic fields penetrate structures and soil with little decrease of field strength. Physical distance thus becomes a factor in strength of magnetic field exposure.

In its recent final report to Congress as required by the 1992 Energy Policy Act (PL 102-486, Section 2118), the National Institute of Environmental Heath Sciences (NIEHS) makes the following policy recommendations"

> "The NIEHS suggests that the level and strength of evidence supporting ELF-EMF exposure as a human health hazard are insufficient to warrant aggressive regulatory actions; thus, we do not recommend actions such as stringent standards on electric appliances and a national program to bury all transmission and distribution lines. Instead, the evidence suggests passive measures such as a continued emphasis in educating both the public and the regulated community on means aimed at reducing exposures. NIEHS suggests that the power industry continue its current practice of siting power lines to reduce exposures and continue to explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating new hazards." June 1999 NIEHS Report to Congress titled "NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields", pp 37-38.

PNM has applied these concepts in the design of this project. PNM recognizes that some level of public concern will persist regarding the EMF issue. Therefore, PNM will do what is reasonably possible to develop substation layouts and transmission line configurations that are intended to reduce electric and magnetic field levels at the edge of station property lines and at the edge of transmission line right-of-ways.

Magnetic fields for both peak and average loading conditions were calculated for the proposed project alternatives. Peak loading is the maximum one-hour loading the line will experience in a year, and average loading is the fiftieth percentile hourly loading the line will experience in a year. Magnetic field values calculated for the proposed project under projected peak line loading are shown in Figures 6,7,8 and 9. The magnetic fields vary from a high of approximately 70 mG directly under the conductors at midspan to approximately 28 mG at the ROW edge for the AN Corridor. For the NZ-2 Corridor, the maximum field under the line at peak load will be approximately 20 mG and at the edge of the ROW the field levels will be slightly less due to the presence of a 46 kV existing distribution line that will remain. Additionally attenuation of fields for all alternatives will be realized as the distance from the ROW edge is increased. Most states have not established maximum magnetic field levels within the ROW or at the ROW edge, nor have federal standards been established. Table 2 gives a summary of existing and proposed standards from other states, and guidelines for transmission line magnetic field strength limits.

Note that the magnetic field levels for all alternatives are well below all of these standards so that any of these alternatives could be built in any state with magnetic field standards.

The calculated 60 Hz magnetic field profiles at one meter (3.3-feet) above ground for typical spans at midspan conductor clearances for the average line loadings are shown in Figures 10, 11 12 and 13 for the various alternatives. The average magnetic fields range from a high of 45 mG to a low of 8 mG directly beneath the conductors.

AN Corridor: Peak and Average magnetic field profiles for the AN Corridor are presented in Figures 6 and 7 below. The AN Corridor is a flat-configuration H-frame with an overall right of way width of 75 feet.

FIGURE 6. Peak magnetic field profile for AN Corridor (all alternatives)

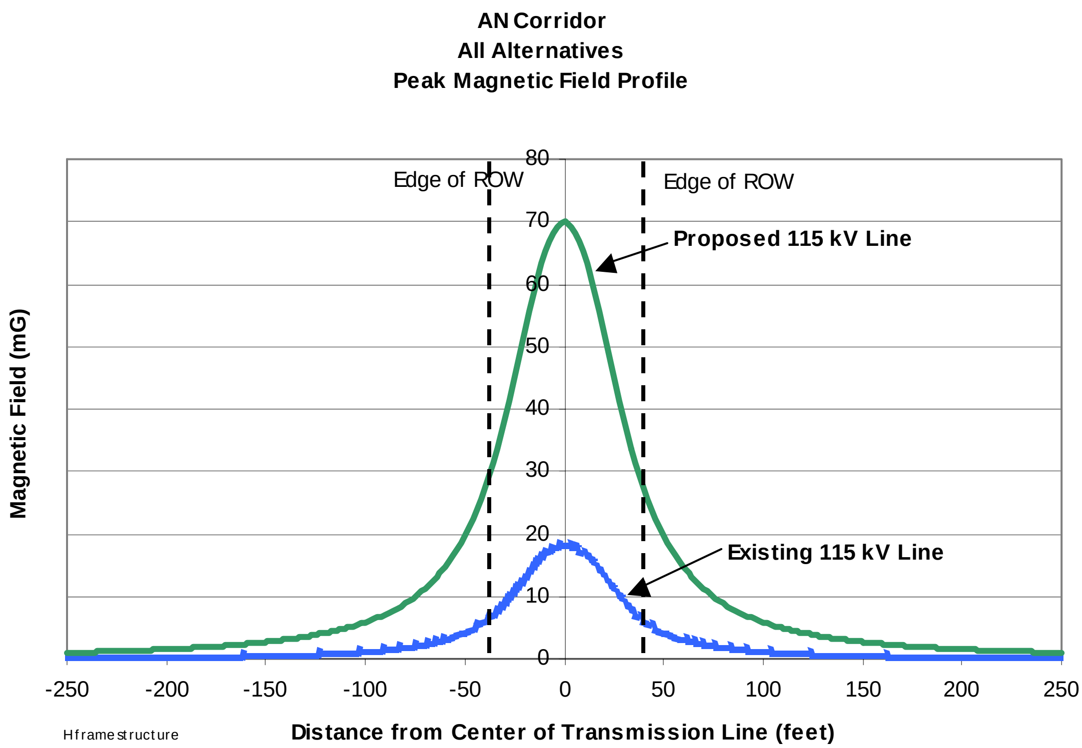
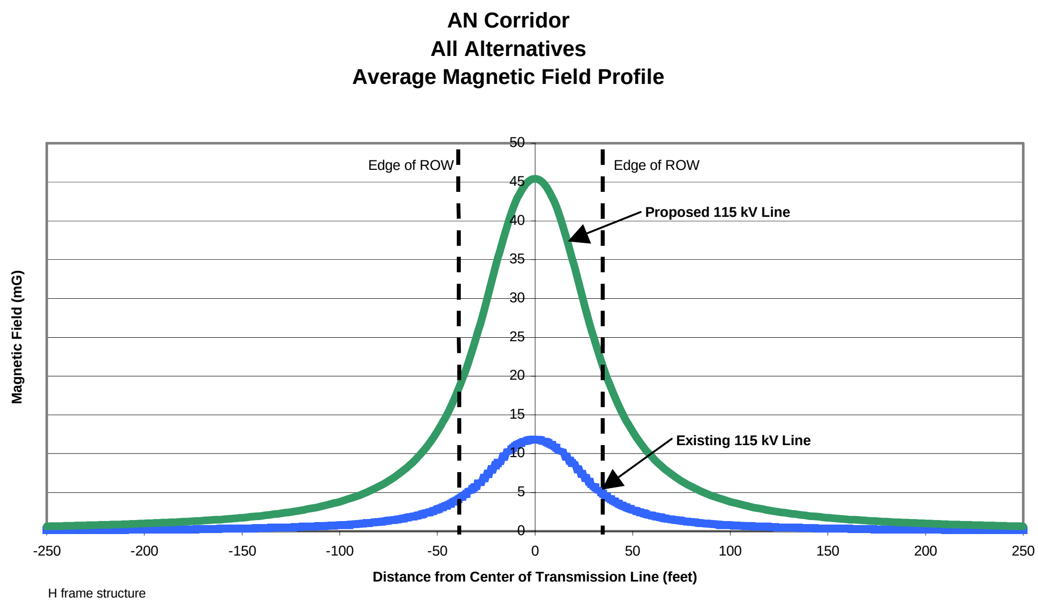


Figure 7. Average magnetic field profile for AN Corridor (all alternatives)



NZ-1 Corridor: Peak and Average magnetic field profiles for the NZ-1 Corridor are presented in Figures 8 and 9 below. The current NZ-1 corridor is a flat configuration H-frame with an overall right of way width of 100 feet. The proposed line in this corridor is a double-circuit single pole structure with vertical configuration and rolled phasing.

FIGURE 8. Peak magnetic field profile for NZ-1 Corridor (A and F alternatives)

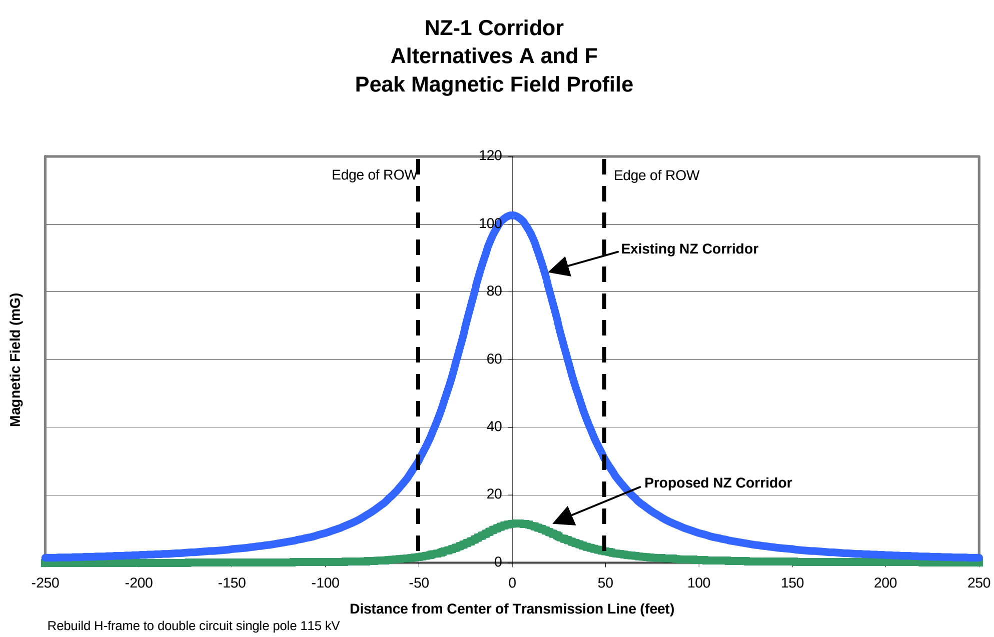
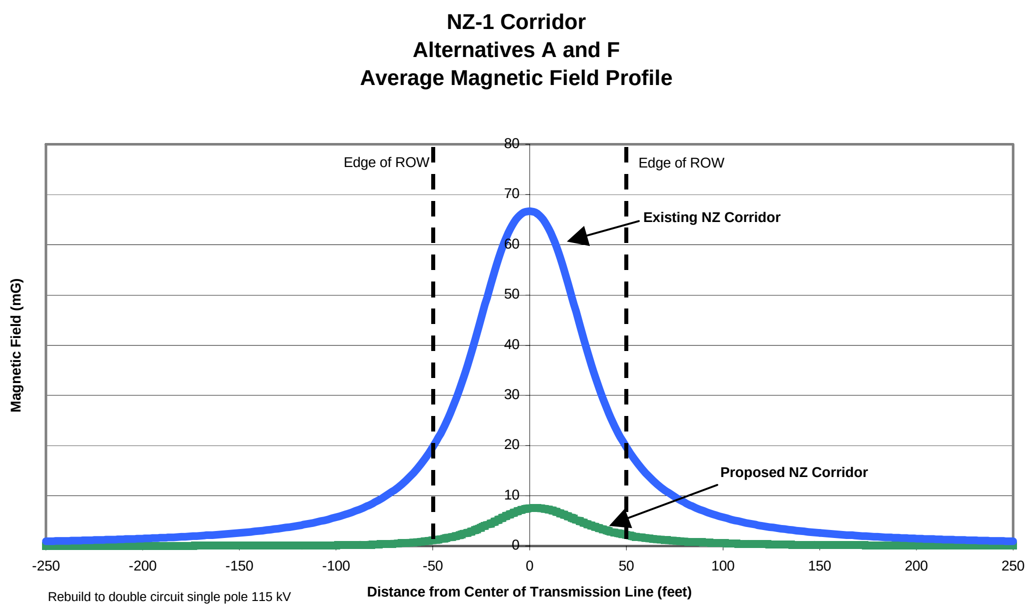


Figure 9. Average magnetic field profile for NZ-1 Corridor (A & F)



NZ- 2 Corridor: Peak and Average magnetic field profiles for the NZ-2 Corridor are presented in Figures 10 and 11 below. The current NZ-2 corridor is a flat configuration 115kV H-frame in the same corridor with two vertical configuration 46kV circuits. The overall right of way width is generally 120 feet. The proposed 115kV line in this corridor is a double-circuit single pole structure with vertical configuration and rolled phasing. The 46kV lines will remain in their existing configuration.

FIGURE 10. Peak magnetic field profile for NZ-2 Corridor (A, F, and O alternatives)

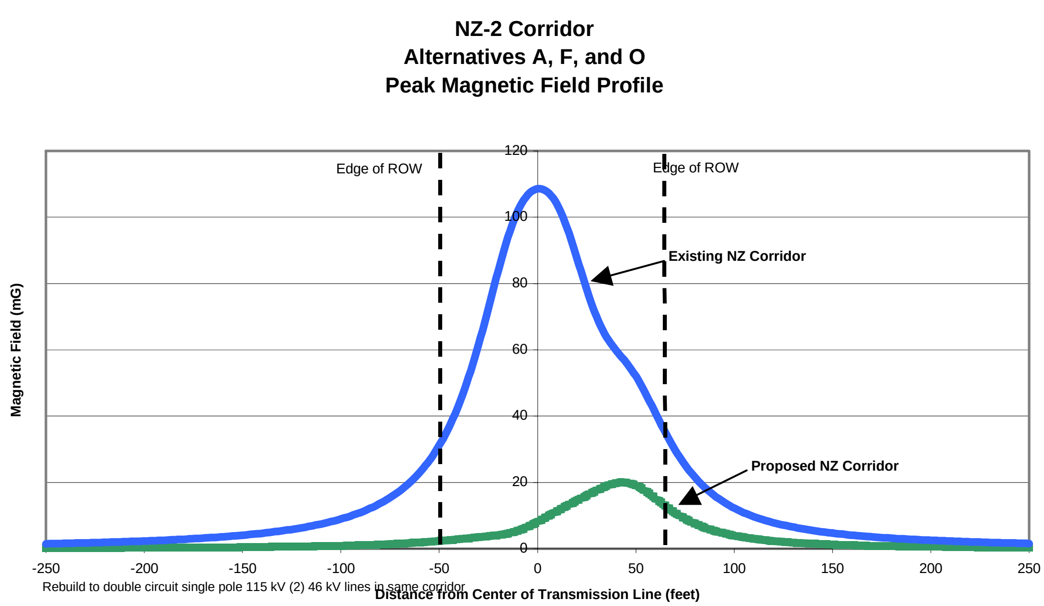
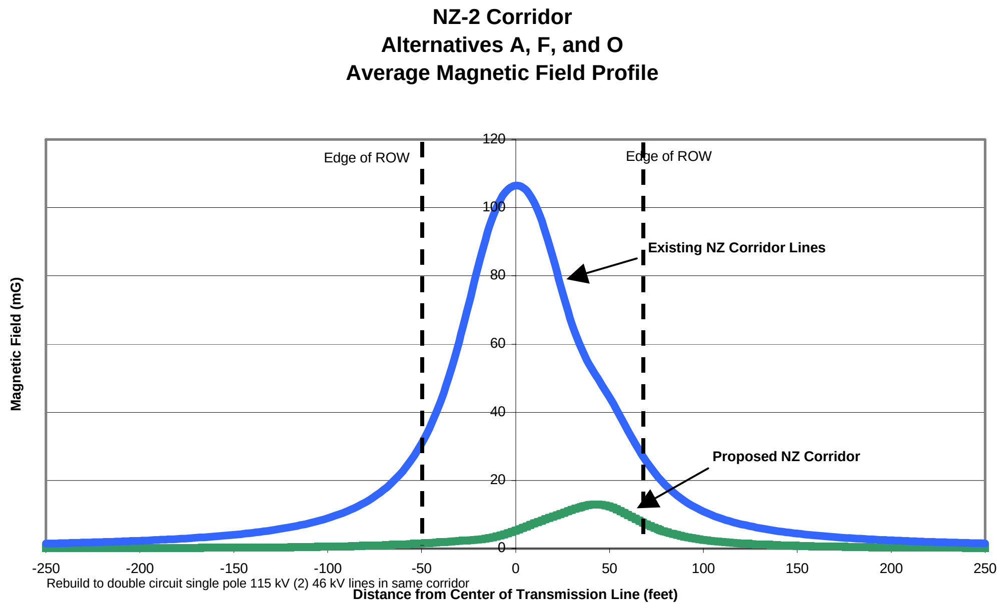


FIGURE 11. Average magnetic field profile for NZ-2 Corridor (A, F, and O alternatives)



New Single Circuit Corridor: Peak and Average magnetic field profiles for a new single circuit 115kV line are presented in Figures 12 and 13 below. The structure configuration is phase over opposite. A typical right-of-way width for this corridor is 50 feet.

FIGURE 12. Peak magnetic field profile for single circuit new corridor (new line: O & S alternatives)

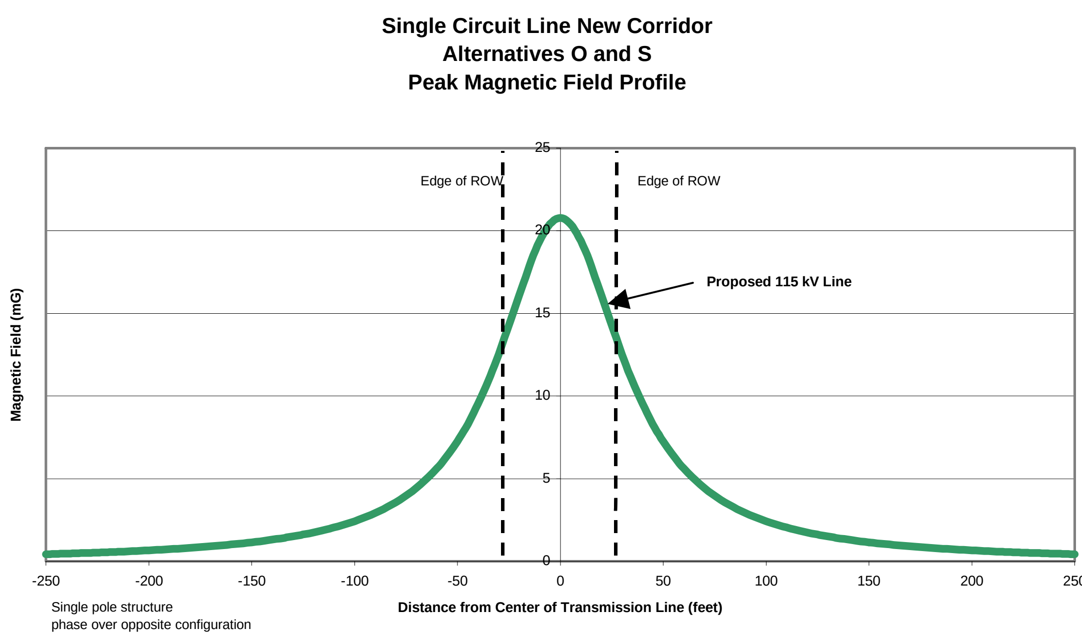


FIGURE 13. Average magnetic field profile for single circuit new Corridor (new lines: O & S)