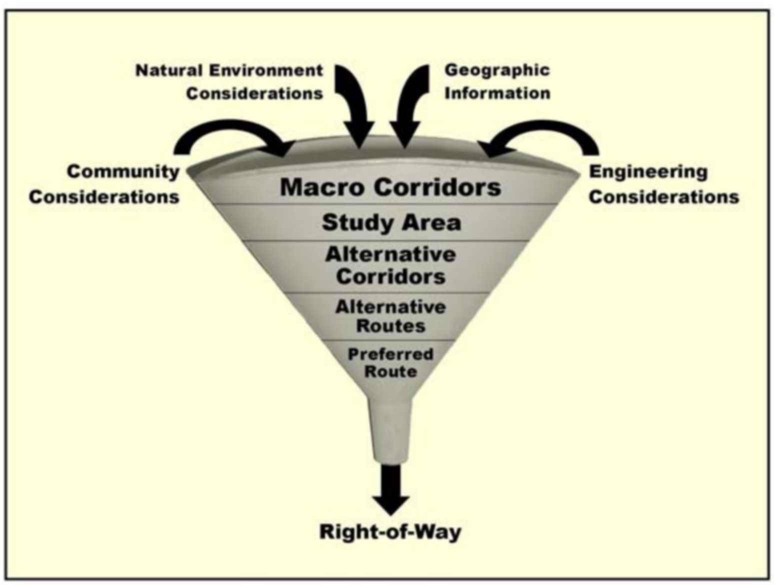
# Part IV: Overview of Suitability Analysis

## 1. EPRI-GTC Methodology

Exelon Corporation incorporated a computer-based methodology that was developed by the Electric Power Research Institute (EPRI) and Georgia Transmission Corporation (GTC). The EPRI-GTC methodology is used as a tool to evaluate the suitability of individual land tracts, or “grid cells,” for locating transmission facilities. Based on analysis of a large area between and in the vicinity of the endpoints for the line, a study area is developed. Then, using more-detailed information for the grid cells within the Study Area, Alternate Corridors are developed for further evaluation.

Among its advantages, the EPRI-GTC methodology is objective, comprehensive and consistent. Employing increasingly detailed data, it allows the utility to take into consideration vast amounts of information and to quantitatively consider stakeholder input in developing Alternative Corridors by using the Siting Model discussed in the next section. Figure 5 below represents the EPRI-GTC methodology.

**FIGURE 5: EPRI-GTC SITING METHODOLOGY**



The EPRI-GTC methodology approaches corridor development by considering three broad perspectives or "environments":

**Built Environment,** which is concerned with <u>minimizing</u> the impact on people places and cultural resources;

**Natural Environment,** which is concerned with <u>protecting</u> water resources, plants and animals;

**Engineering Environment,** which is concerned with <u>maximizing</u> co-location and considering physical restraints; and

**Simple Average,** which is concerned with <u>weighing</u> each environment equally.

Features within each of these environments are identified and evaluated to map the suitability of grid cells in each environment and develop Alternative Corridors for each. Simple Average Alternative Corridors are developed to consider all three environments equally. These processes are discussed in detail in the following sections.

## 2. The Siting Model

A siting model was developed using data collected from stakeholders during workshops conducted in June, 2003, in Atlanta, Georgia; and in February, 2006, in Lexington, Kentucky. The workshops were conducted and the model developed and tested by a project team of independent experts. Stakeholders at the workshops represented a range of interests, such as environmental concerns, historic preservation, homeowners associations, agricultural groups and government agencies, as well as personnel and representatives of utility companies. The resulting model (see Figure 6) includes data layers, features, layer weights and suitability values that are used for siting transmission lines. More information concerning these workshops is available in the EPRI-GTC Project Report (published by EPRI in 2006) and the Kentucky Transmission Line Siting Methodology (published by EPRI in 2007). Some minor alterations were made to this model for site specific and data availability reasons. The alterations are discussed in the following chapters.

Based on the interest he or she represented, each stakeholder was assigned to a breakout group for each of the three environments—Built, Natural or Engineering. Guided by an independent expert from the project team, each of these groups developed a set of data layers (in green on Figure 6) with component features (in yellow), as well as avoidance areas (in red). For example, one of the data layers in the Natural Environment is floodplains, which has two component features: background and 100-year floodplain.

For each feature, the stakeholders then used consensus-building techniques to develop a relative suitability value. Numbers between 1 and 9 were used to represent degrees of suitability, with 1 being most suitable for locating a transmission line and 9 being least suitable for locating a line. These values are described in the EPRI-GTC Project Report (2006) as follows:

**Areas that have High Suitability for an Overhead Electric Transmission Line (1, 2, 3)** - These are areas that do not contain known sensitive resources or physical constraints, and therefore should be considered as suitable areas for the development of corridors.

**Moderate Suitability for an Overhead Electric Transmission Line (4, 5, 6)** - These are areas that contain resources or land uses that are moderately sensitive to disturbance or that present a moderate physical constraint to overhead electric transmission line construction and operation. Resource conflicts or physical constraints in these areas can generally be reduced or avoided using standard mitigation measures.

**Low Suitability for an Overhead Electric Transmission Line (7, 8, 9)** - These are areas that contain resources or land uses that present a potential for significant impacts that cannot be readily mitigated. Locating a transmission line in these areas would require careful siting or special design measures. Note that these areas can be crossed but it is not desirable to do so if other alternatives are available.

After assigning suitability values to features, stakeholders then weighted each data layer based on their view of its relative importance in the siting process. This was accomplished by conducting pair-wise comparisons. The result is a percentage weighting for each data layer within each environment, totaling 100 percent within each environment.

The EPRI-GTC methodology recognizes it is prohibitive to locate overhead transmission lines on or around some features, because, for example, of physical constraints or permitting delays. These areas are termed “avoidance areas” because the methodology seeks to avoid entering them, if possible. Features that constitute avoidance areas were determined by the stakeholder groups and are listed in red in Figure 6. One of the first steps in implementing the EPRI-GTC methodology is identifying avoidance areas on the Study Area surface to avoid locating transmission in those areas, if possible.

A final note—in each data layer where “background” appears, this feature represents areas that are not the location of any of the other features in that layer. For example, in the Floodplain data layer of the Natural Environment, all areas that are not within a 100-year floodplain are considered background.

**FIGURE 6: SITING MODEL**

| Engineering | |
|---|---|
| **Linear Infrastructure** | **48.3%** |
| Rebuild Existing Transmission Lines | 1 |
| Parallel Existing Transmission Lines | 1.4 |
| Parallel Roads ROW | 3.6 |
| Parallel Gas Pipelines | 4.5 |
| Parallel Railway ROW | 5 |
| Background | 5.5 |
| Future GDOT Plans | 7.5 |
| Parallel Interstates ROW | 8.1 |
| Road ROW | 8.4 |
| Scenic Highways ROW | 9 |
| **Slope** | **9.1%** |
| Slope 0-15% | 1 |
| Slope 15-30% | 5.5 |
| Slope >30% | 9 |
| **Intensive Agriculture** | **42.6%** |
| Background | 1 |
| Fruit Orchards | 5 |
| Pecan Orchards | 9 |
| Center Pivot Agriculture | 9 |
| **AVOIDANCE AREAS** | |
| Non-Spannable Waterbodies | |
| Mines and Quarries | |
| Buildings + Buffer | |
| Airports | |
| Military Facilities | |

| Natural Environment | |
|---|---|
| **Floodplain** | **6.2%** |
| Background | 1 |
| 100 Year Floodplain | 9 |
| **Streams/Wetlands** | **20.9%** |
| Background | 1 |
| Streams < 5cfs+ Regulatory Buffer | 5.1 |
| Non-forested Non-Coastal Wetlands a+ 30' Buffer | 6.1 |
| Rivers/Streams > 5cfs+ Regulatory Buffer | 7.4 |
| Non-forested Coastal Wetlands + 30' Buffer | 8.4 |
| Trout Streams (50' Buffer) | 8.5 |
| Forested Wetlands + 30' Buffer | 9 |
| **Public Lands** | **16.0%** |
| Background | 1 |
| WMA - Non-State Owned | 4.8 |
| Other Conservation Land | 8.3 |
| USFS | 8 |
| WMA - State Owned | 9 |
| **Land Cover** | **20.9%** |
| Open Land (Pastures, Scrub/Shrub, etc…) | 1 |
| Managed Pine Plantations | 2.2 |
| Row Crops and Horticulture | 2.2 |
| Developed Land | 6.5 |
| Hardwood/Mixed/Natural Coniferous Forests | 9 |
| **Wildlife Habitat** | **36.0%** |
| Background | 1 |
| Species of Concern Habitat | 3 |
| Natural Areas | 9 |
| **AVOIDANCE AREAS** | |
| EPA Superfund Sites | |
| State and National Parks | |
| USFS Wilderness Area | |
| Wild/Scenic Rivers | |
| Wildlife Refuge | |

| Built Environment | |
|---|---|
| **Proximity to Buildings** | **11.5%** |
| Background | 1 |
| 900-1200 | 1.8 |
| 600-900 | 2.6 |
| 300-600 | 4.2 |
| 0-300 | 9 |
| **Eligible NRHP Historic Structures** | **13.9%** |
| Background | 1 |
| 0 - 1500 | 9 |
| **Building Density** | **37.4%** |
| 0 - 0.05 Buildings/Acre | 1 |
| 0.05 - 0.2 Buildings/Acre | 3 |
| 0.2 - 1 Buildings/Acre | 5 |
| 1 - 4 Buildings/Acre | 7 |
| 4 - 25 Buildings/Acre | 9 |
| **Proposed Development** | **6.3%** |
| Background | 1 |
| Proposed Development | 9 |
| **Spannable Lakes and Ponds** | **3.8%** |
| Background | 1 |
| Spannable Lakes and Ponds | 9 |
| **Major Property Lines** | **8.0%** |
| Edge of field | 1 |
| Landlots | 7.9 |
| Background | 9 |
| **Land Use** | **19.1%** |
| Undeveloped | 1 |
| Non-Residential | 3 |
| Residential | 9 |
| **AVOIDANCE AREAS** | |
| Listed Archaeology Sites | |
| Listed NRHP Districts and Buildings | |
| City and County Parks | |
| Day Care Parcels | |
| Cemetery Parcels | |
| School Parcels (K-12) | |
| Church Parcels | |

**Data layers (green cells):** Percentages represent relative importance, or weighting, of each layer in the siting process, as determined by stakeholders.

**Features (yellow cells):** Numbers between 1 and 9 represent degrees of suitability, as determined by stakeholders, with 1 being most suitable for locating a transmission line and 9 being least suitable for locating a line.

**Avoidance Areas (red cells):** Features to avoid siting transmission lines, if possible, as determined by stakeholders.

For more detailed information on datasets used in the model, including data sources, please see Appendix C of the EPRI-GTC Project Report (2006). This report was used as a guideline for this project.

## 3. Suitability Mapping

The methodology begins with two endpoints as the basis for creating transmission line corridors. A large area in the vicinity of and between the endpoints is divided into grid cells.

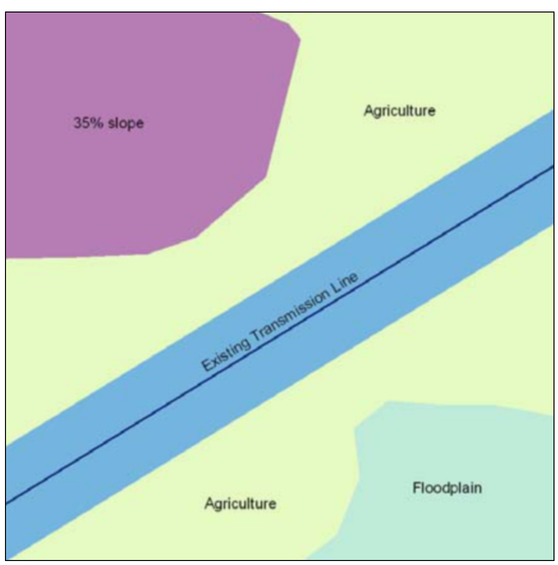
Data from aerial photography, geographic information systems, publicly available datasets and other sources are used to identify features within each grid cell. Based on these features and the values and data layer weights determined in the Georgia Siting Model, the methodology then assigns a suitability value to each cell. More-detailed data are employed by the methodology as corridor locations are narrowed down more precisely.

Because cells deemed to have lower suitability for locating a transmission line are assigned higher values, the methodology employs an algorithm that seeks to minimize the sum of values as it works its way from one endpoint to the other. The resulting corridor is referred to as the "least-cost path." In this sense, "least cost" refers not to economic costs, but to the fact that low values indicate greater suitability for locating transmission facilities.

Figures 7-9 demonstrate the development of a sample "least-cost path" using information from a hypothetical situation.

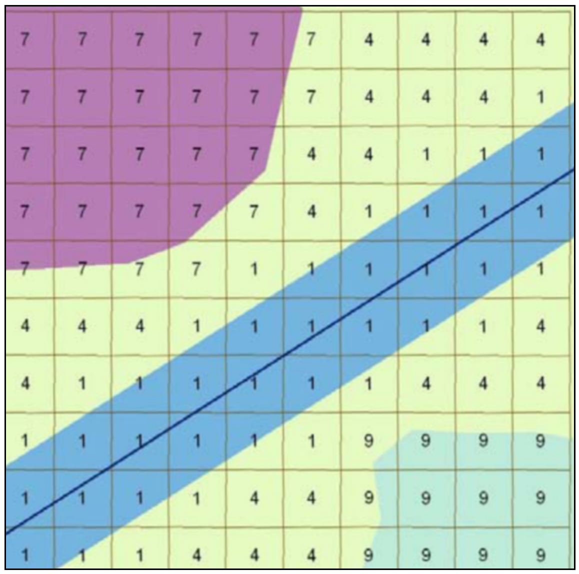
Figure 7 displays an example area that has four features: an existing transmission line through the center of the area, surrounded by agricultural land with an area of steep slopes to the northwest and a floodplain to the southeast.

**FIGURE 7: FEATURE MAP OF EXAMPLE AREA**



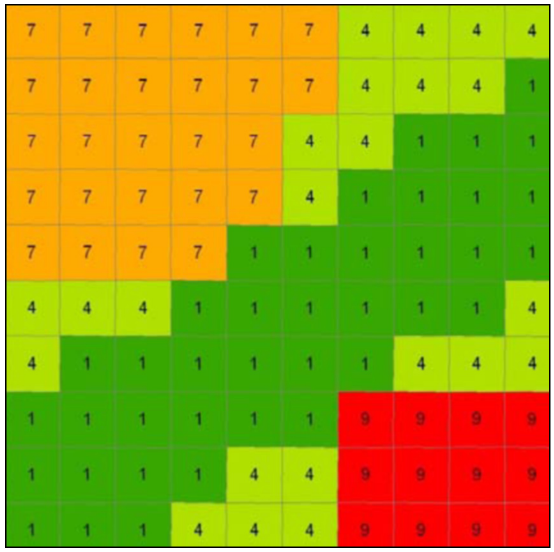
In Figure 8, grid cells are overlain and assigned suitability values based on the features. (The suitability values used in this example do not necessarily correspond to the Siting Model.) The area of the existing line is considered highly suitable. Agricultural land is moderately suitable. Steep slopes and floodplains have low suitability values.

**FIGURE 8: GRID CELL MAP OF EXAMPLE AREA WITH SUITABILITY VALUES**




Finally, Figure 9 shows in green the most suitable corridor through the area for locating a transmission line. Light green areas are moderately suitable. The orange area has a low suitability value and the red area is highly unsuitable. The most suitable corridor from east to west in this example is the one that follows the existing transmission line.

**FIGURE 9: SUITABILITY MAP OF EXAMPLE AREA**




## 4. Developing Alternative Corridors

Beginning with a large area around and between the endpoints, the EPRI-GTC methodology analyzes land tracts, or "grid cells," within that area to develop Alternative Corridors. This analysis is based on satellite and GIS information that is readily available from public sources as well as data delineated from aerial photo interpretation. The data is then used to develop the grids cells. The numbers that are applied to the grid cells are taken from the siting model. The corridors developed from the model are the top 3 percent—that is, the most suitable 3 percent—of possible corridors within the Study Area.

**Built Environment,** which is concerned with <u>minimizing</u> the impact on people, places, and cultural resources;

**Natural Environment,** which is concerned with <u>protecting</u> water resources, plants, and animals; and

**Engineering Environment,** which is concerned with <u>maximizing</u> co-location and considering physical restraints.

Alternative Corridors are generated for each of the three environments. It should be noted that, when generating Alternative Corridors for each environment, data layers from the other two environments are taken into account. While the target environment is weighted much more heavily (5 times), values and weights from the other environments can affect Alternative Corridors generated for that respective environment. The final step in generating Alternative Corridors is to equally weigh the three environments and generate a Simple Average Alternative Corridor.

The Composite Corridor (Figure 43) depicts areas in which a transmission line should minimize adverse impacts on people, environmentally sensitive areas, and cultural resources. The Composite Corridor also provides a reasonable balance between co-location of the proposed line, minimization of the overall impacts, and construction and maintenance of the line in a cost effective manner. The specific routing of a right-of-way within the Corridor will be implemented to avoid sensitive land uses. Moreover, the alternates inherently examined in the Study by application of the proceduralized EPRI-GTC methodology provides assurance that the composite corridor avoids, minimizes and mitigates adverse environmental impacts during this phase of routing activities.

The following sections of this report provide information about features that were found within the Study Area based on available information, and about the Alternative Corridors that were generated.

# Part V: Engineering Environment

## 1. Avoidance Areas

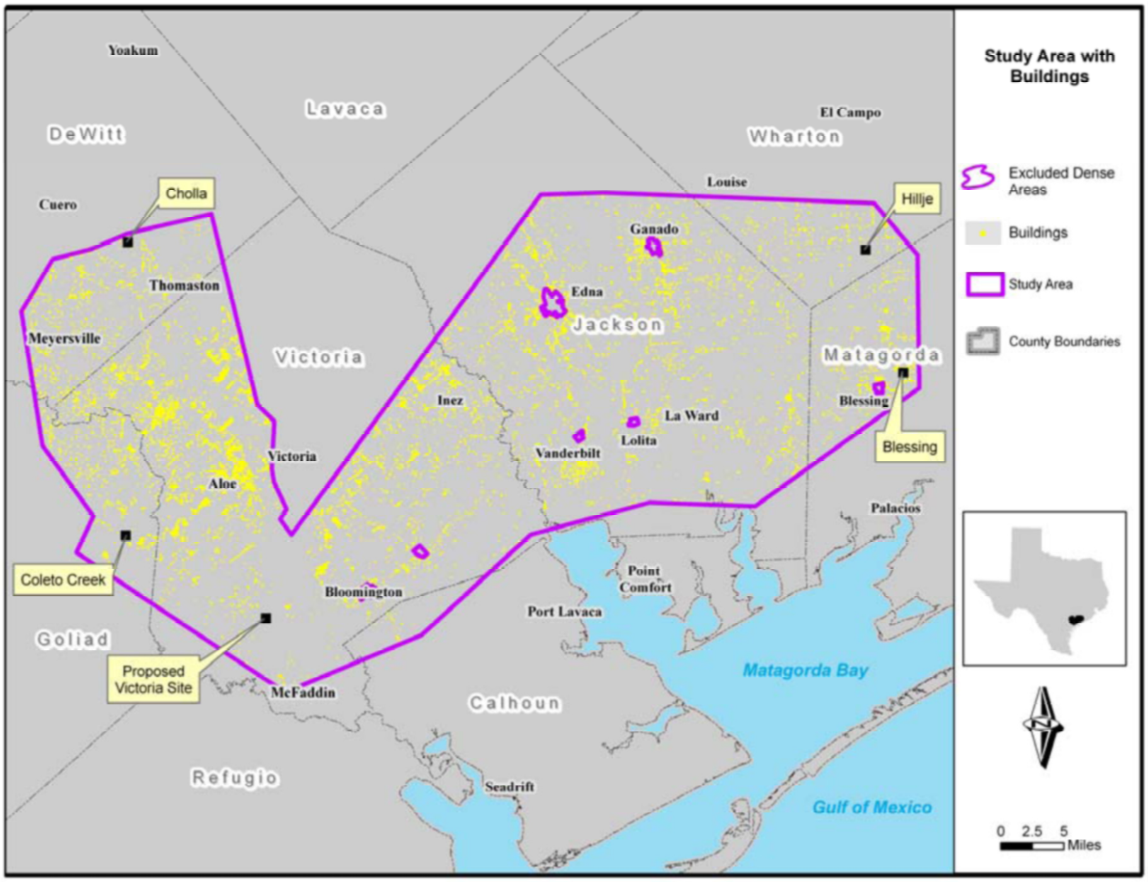
Non-Spannable waterbodies, mines, quarries, airports, military facilities and buildings are designated as avoidance areas in the Engineering Environment of the Siting Model. Military facilities were not found within the study area.

### Buildings

Buildings are designated as Avoidance Areas within the Engineering Environment. There are numerous existing buildings in the study area, with notable concentrations around the cities of Ganado and Edna. Oil heads are scattered throughout the study site and were collected as building structures. There is a cluster of oil heads just south of the town of Vanderbilt. This information was developed by Photo Science Inc., from 2005 NAIP aerial photography.

A few areas where buildings were extremely dense were excluded from data collection for this data layer. These included the densest sections of Edna, Ganado, Vanderbilt, Lolita, Blessing, Placedo, and Bloomington. With these areas being identified up front in the process, it saved considerable time in the data collection phase.

**FIGURE 10: BUILDINGS**

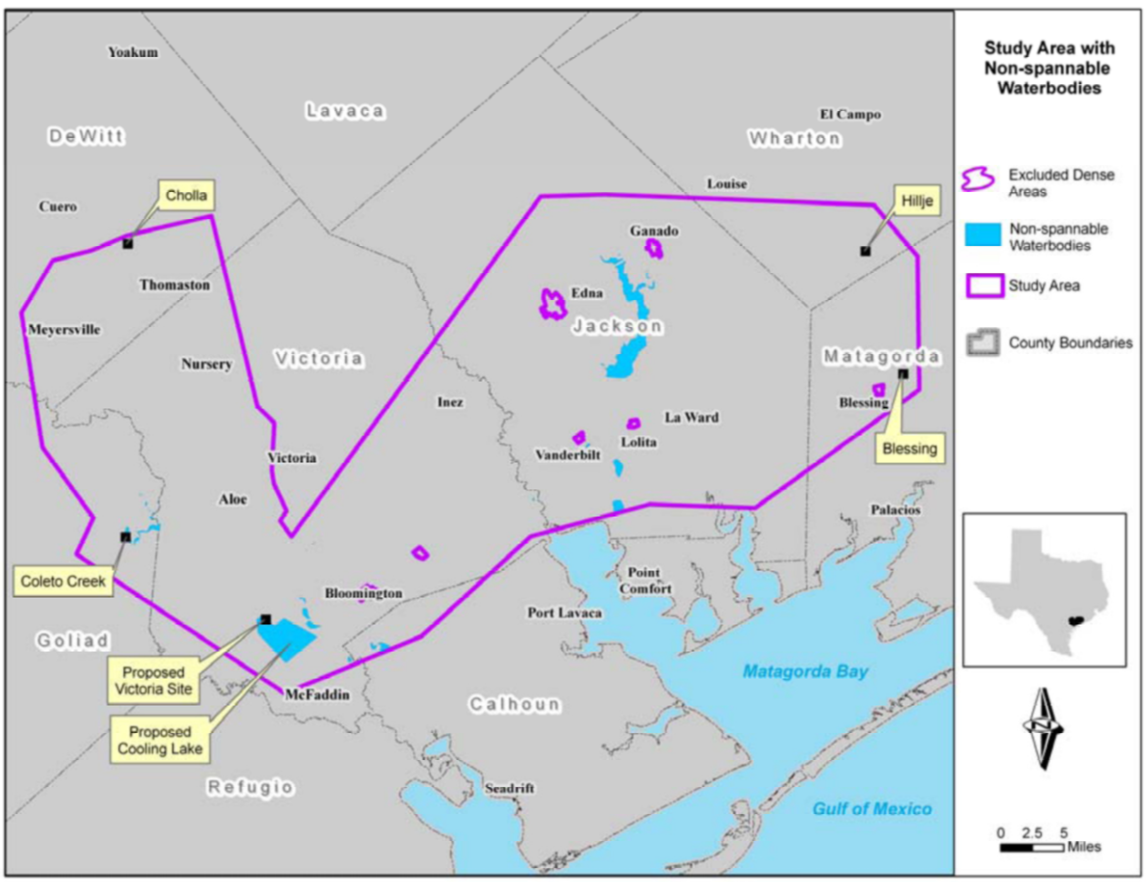


## Non-Spannable Water Bodies

A spannable distance of 1000 feet was assumed for this project. Non-Spannable sections of the water bodies are shown below, for example, a large part of Lake Texana and the cooling lake at the Victoria Site are non-spannable, so are several sections of Coleto Creek Reservoir. The water body source data was retrieved from the Texas General Land Office website.

In discussions with American Electric Power, it was learned that these corridors could span as much as 1200 feet.

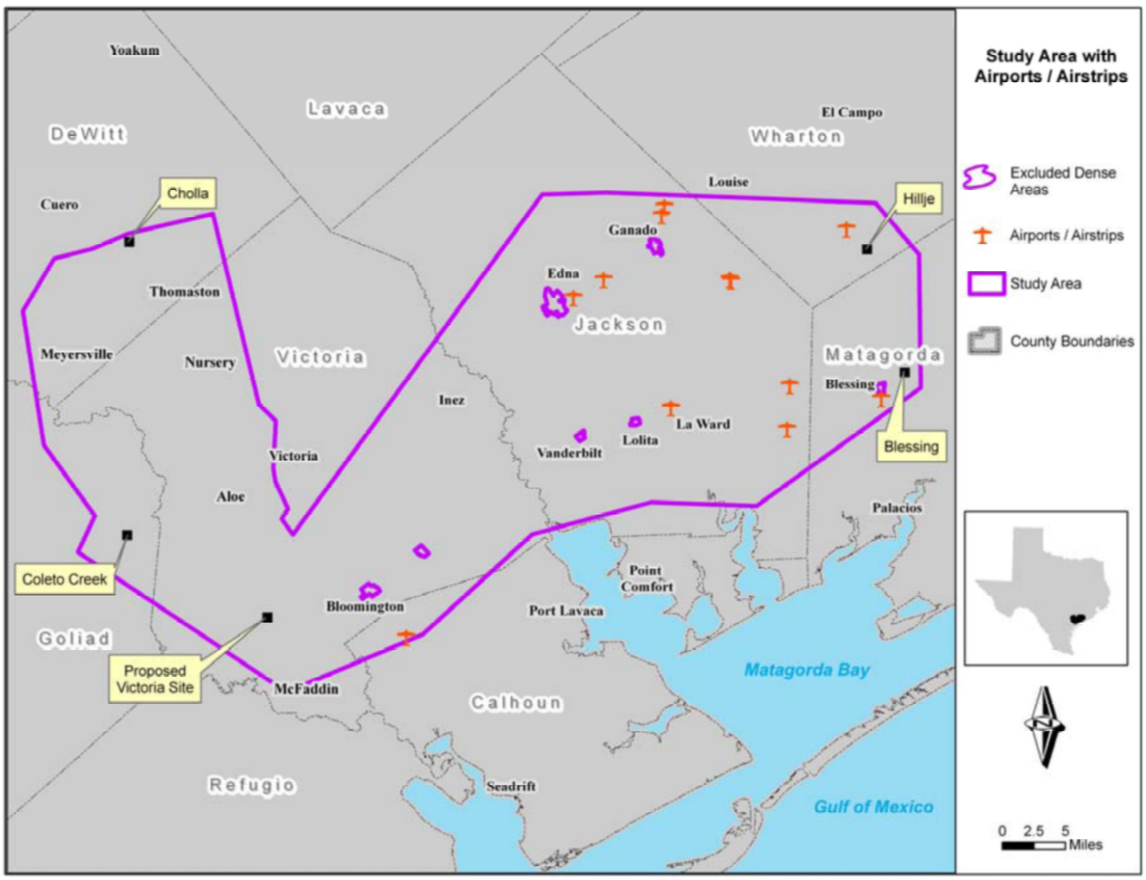
**FIGURE 11: NON-SPANNABLE WATER BODIES**



## Airports/Airstrips

Thirteen regional airports and private airstrips exist within the study area, with the majority in Jackson County. The information was obtained by interpretation of 2005 NAIP aerial photography with reference to the USGS quadrangle maps and data from the Bureau of Transportation Statistics.

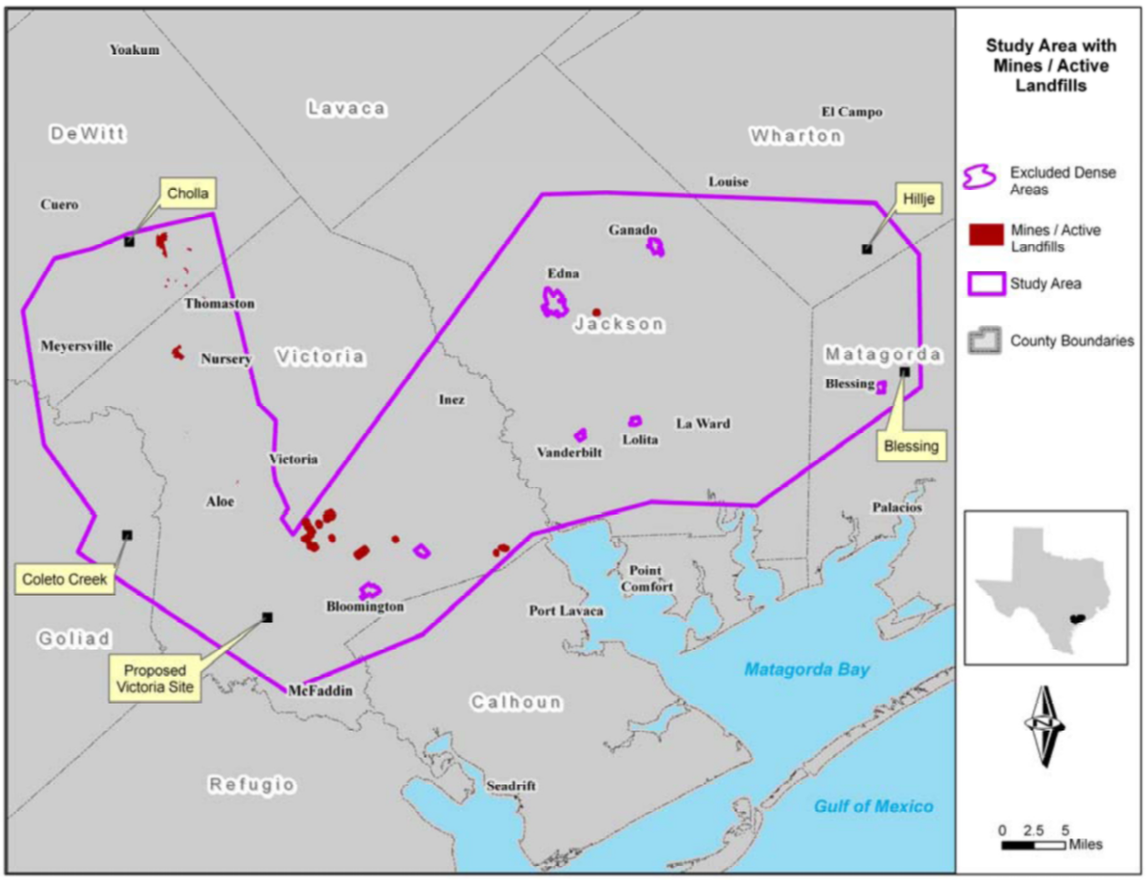
**FIGURE 12: AIRPORTS / AIRSTRIPS IN THE STUDY AREA**



## Mines/Active Landfills

All mines and active landfills found exist in Victoria County, except for one site in Jackson County, and several sites in DeWitt County. This information was compiled by Photo Science Inc., from 2005 NAIP aerial photography.

**FIGURE 13: MINES / ACTIVE LANDFILLS**

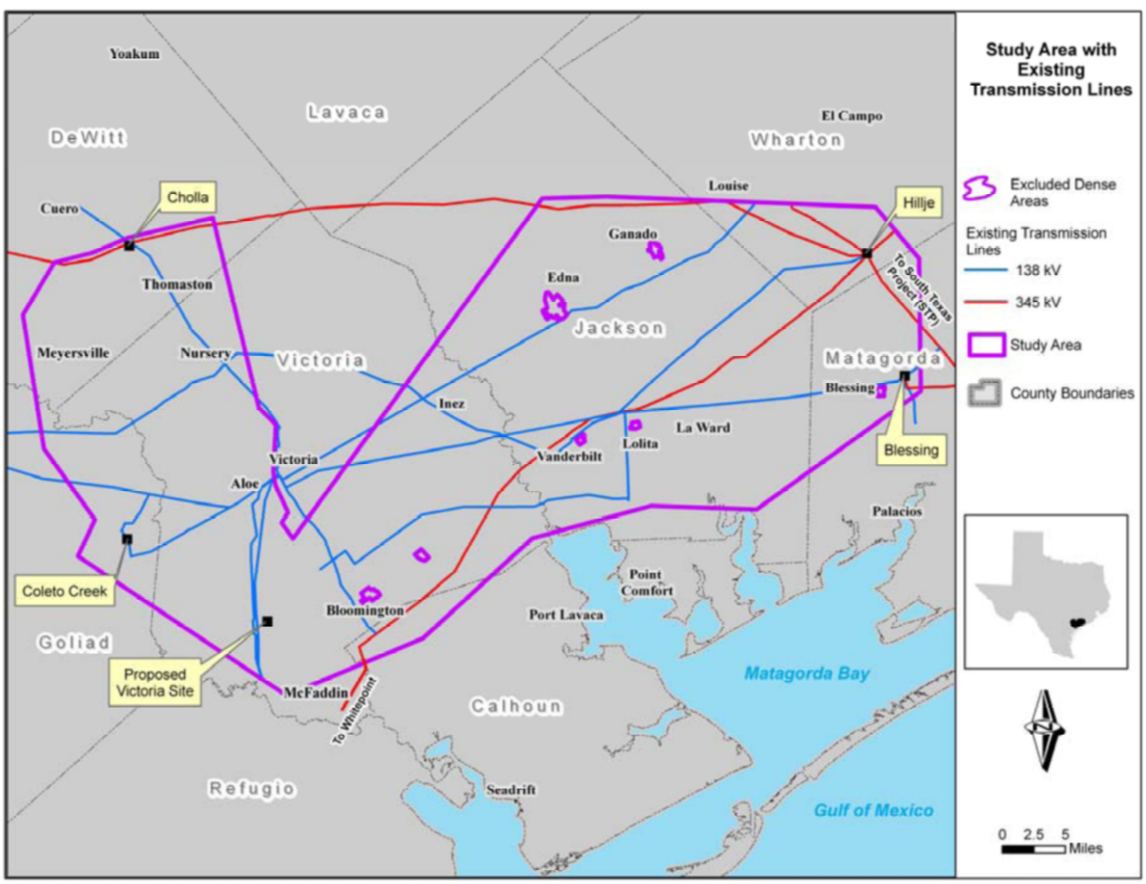


## 2. Linear Infrastructure Features

### High Suitability: Parallel Existing Transmission Lines

In the Engineering Environment, the model gives high suitability to paralleling existing transmission lines. Several existing transmission lines traverse the study area. Since the lines being sited will be 345 kV, 345 kV Double Circuit, or 765 kV, only voltages at 138 kV or higher were identified in the model as suitable collocation opportunities for the proposed corridor. Small voltage lines tend to have many more angles, come closer to the centers of towns to serve smaller substations, and parallel roads. All of these factors would not be considered desirable for the location of higher voltage lines. (Note: The South Texas Project (STP) – Whitepoint 345 kV Transmission Line does not terminate into the Hillje Substation)

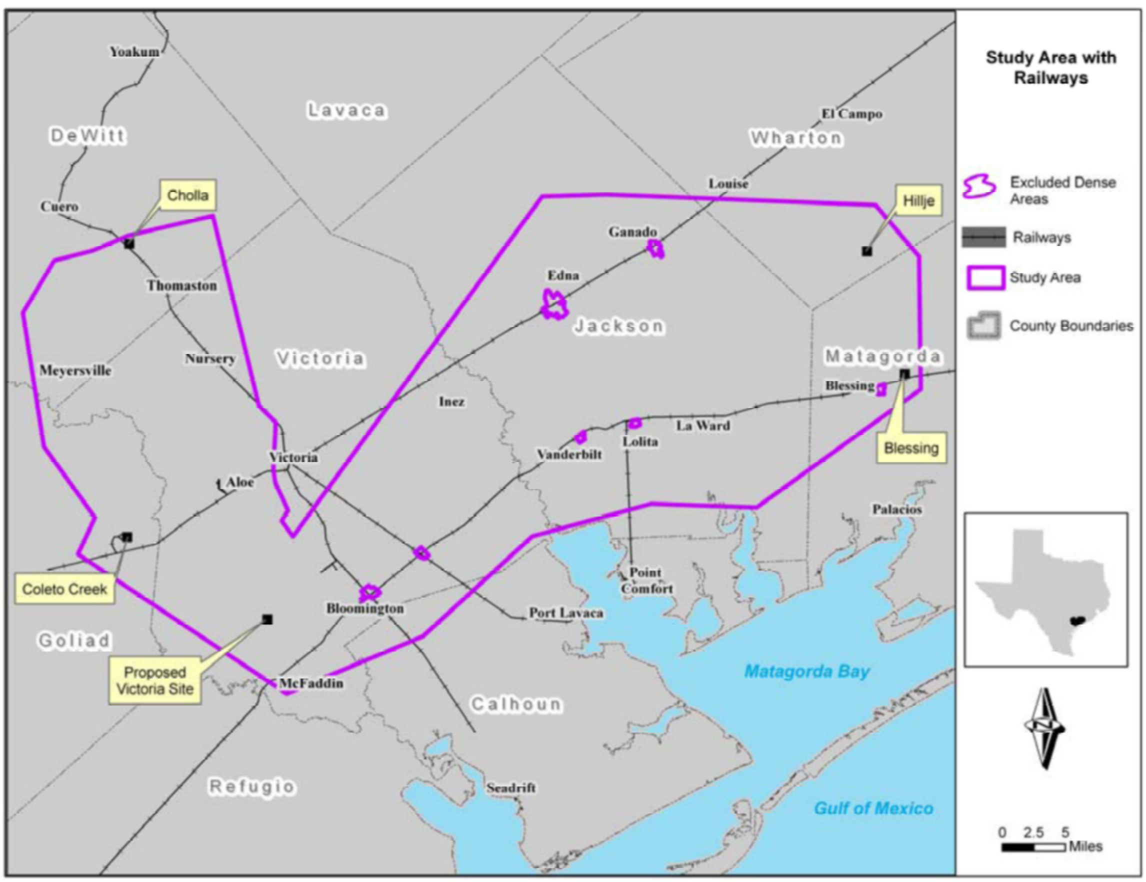
**FIGURE 14: EXISTING TRANSMISSION LINES**



## Moderate Suitability: Parallel Railway Right-of-Ways

Paralleling railway right-of-ways are given a moderate suitability in the Engineering Environment. Five rail tracks run through the project site, connecting cities and towns in this area. There are two northeast-southwest lines, two northwest-southeast lines and one north-south line. Data was obtained from the ESRI Data and Maps. Although these railroads are fairly straight and some are aligned in the general direction that the corridors would need to travel to connect the end points of the project, they travel through many towns and communities, which would not be suitable for proposed transmission line corridors.

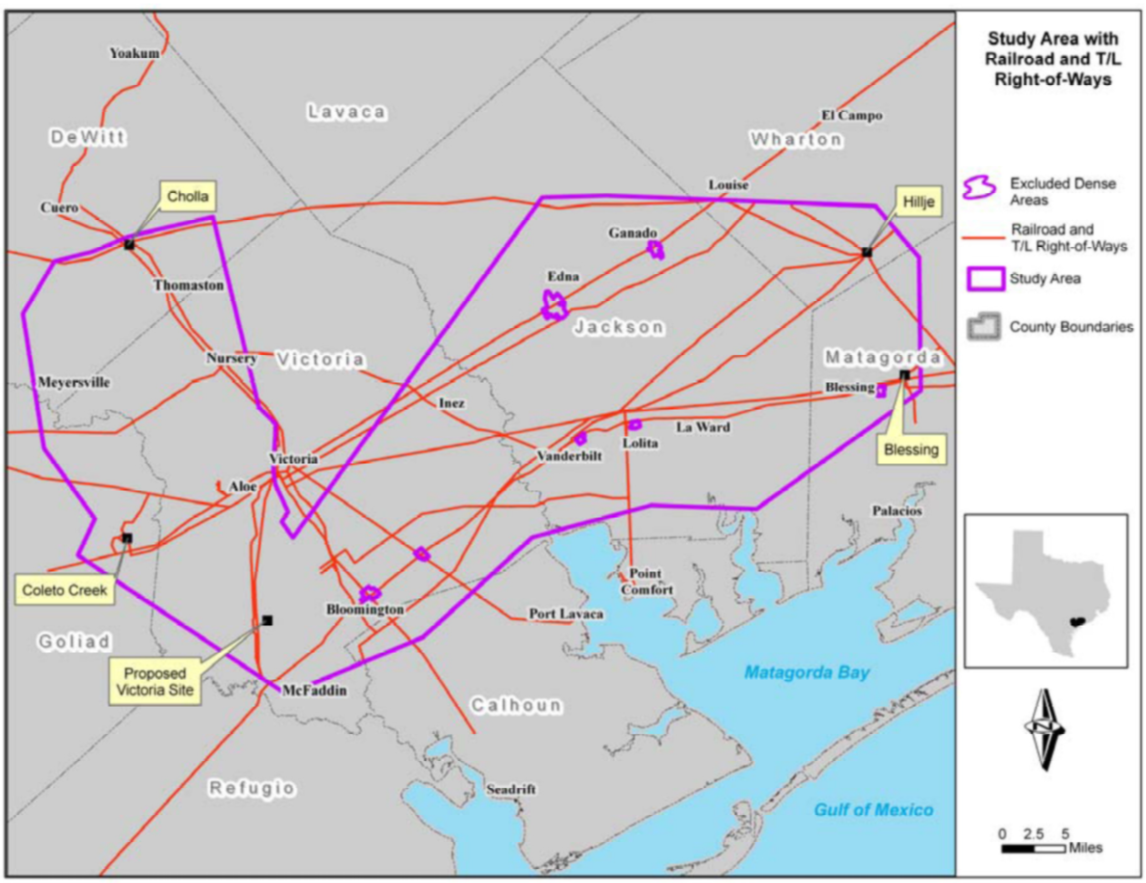
**FIGURE 15: RAILWAYS**



## Low Suitability: Railroad Right-of-Way, T/L Right-of-Way

The Engineering Environment model gives low suitability to locating a new transmission line within a railroad right-of-way or an existing T/L right-of-way. In these areas, infrastructure already exists. It could be feasible in some circumstances to rebuild with an existing transmission line and use the existing easement in place or only purchase a minimal amount of additional right-of-way. However, in this application, wide corridors are being selected and rebuild feasibility decisions can be made once the process starts to produce a right-of-way for the proposed transmission lines.

**FIGURE 16: RAILROAD RIGHT-OF-WAYS / T/L RIGHT-OF-WAYS**

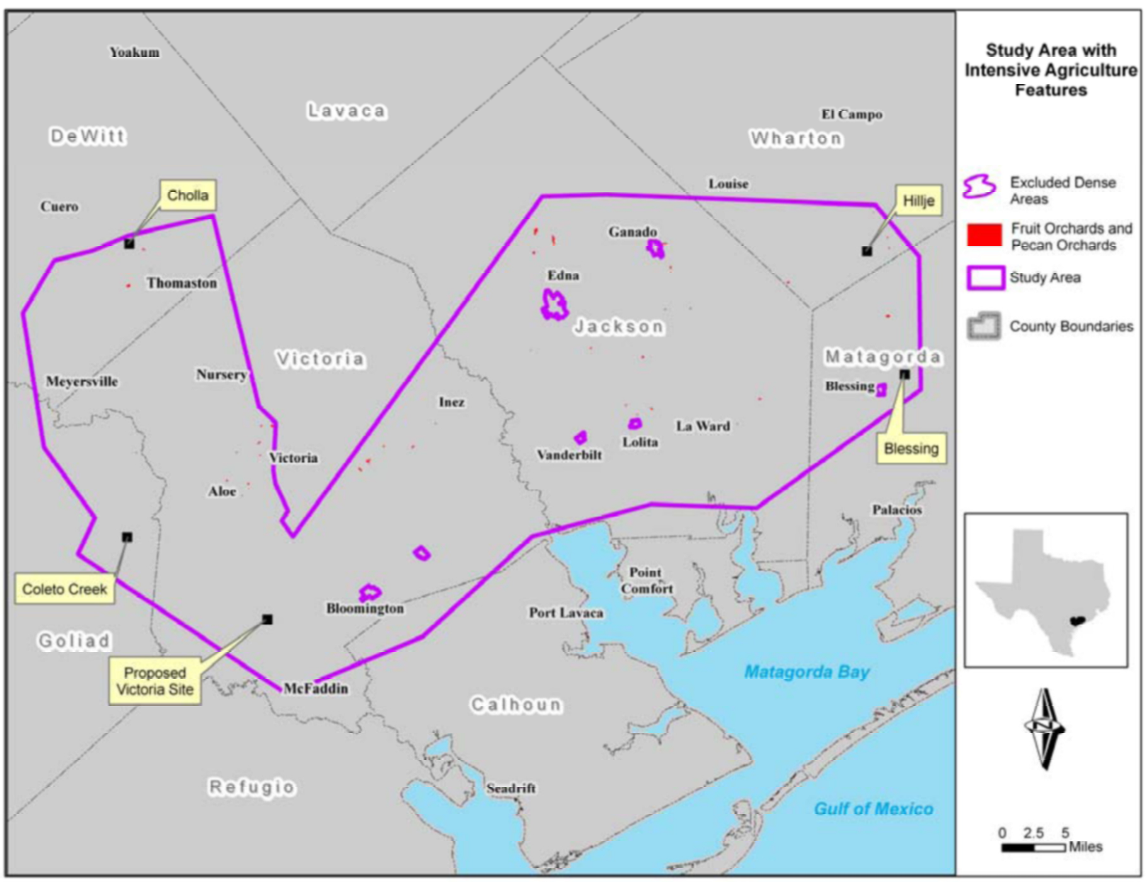


### 3. Intensive Agriculture Features

There are some fruit and pecan orchards scattered throughout the study area. The Siting model categorizes intensive agriculture as fruit orchards, pecan orchards and center pivot irrigation. The model assigns a low suitability to the intensive agriculture features.

No center pivot irrigation systems were found in the study area. These features were located through aerial photography interpretation.

**FIGURE 17: INTENSIVE AGRICULTURE FEATURES**



## 4. Slope Features

Recognizing the challenges of constructing a transmission line on steep slopes, the Engineering Environment of the Siting Model categorizes slopes. Slopes become less suitable as they become steeper. Slope from 15 to 30 percent is considered moderate slope and slope 30 percent and up is considered extreme slope. The source of the slope layer is the USGS 7.5 minute National Elevation Dataset. Due to the location of the project in the Coastal Plain region of Texas, moderate and extreme slopes that would impact the construction and maintenance of a transmission line do not exist in the eastern part of the study area. The only area that has a moderate slope is around the proposed Cholla substation site.

**FIGURE 18: USGS 7.5 MINUTE NATIONAL ELEVATION DATASET (1999)**

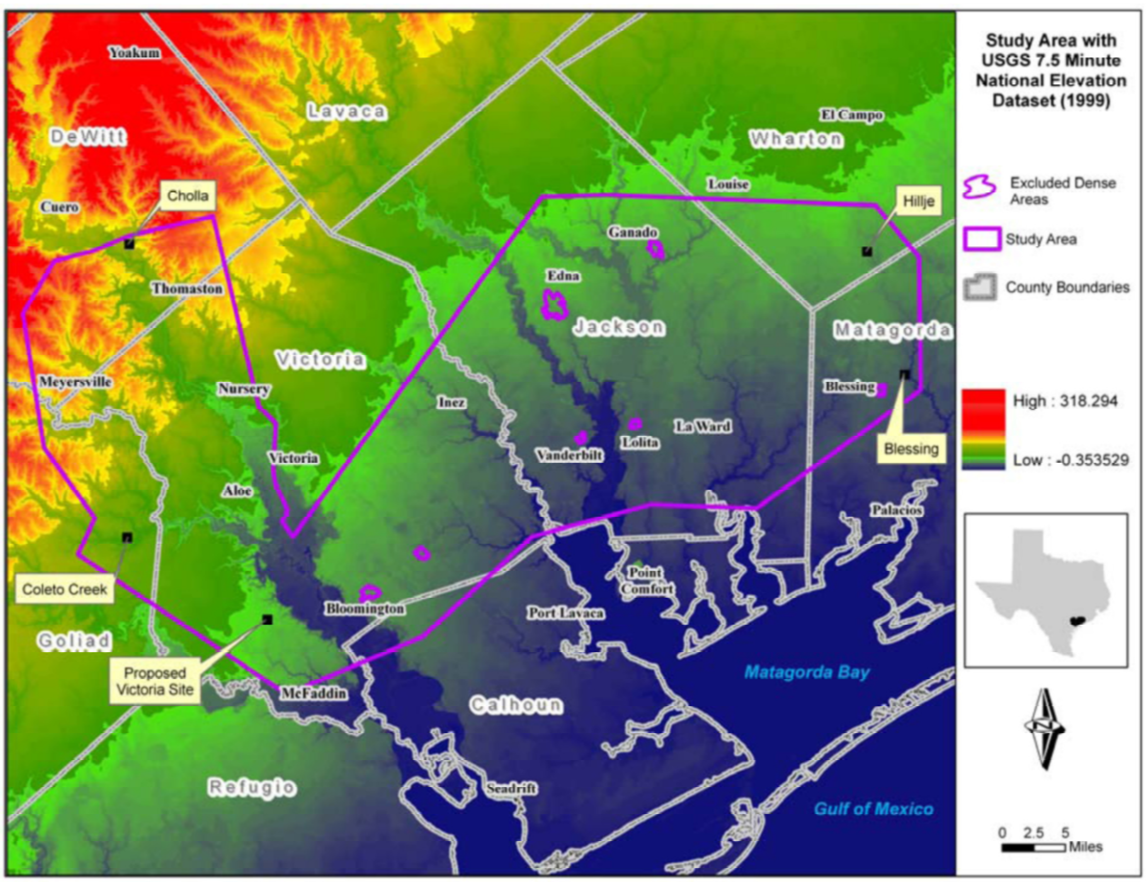


**FIGURE 19: DERIVED SLOPE FROM NATIONAL ELEVATION DATASET CLASSIFIED BY PERCENT**

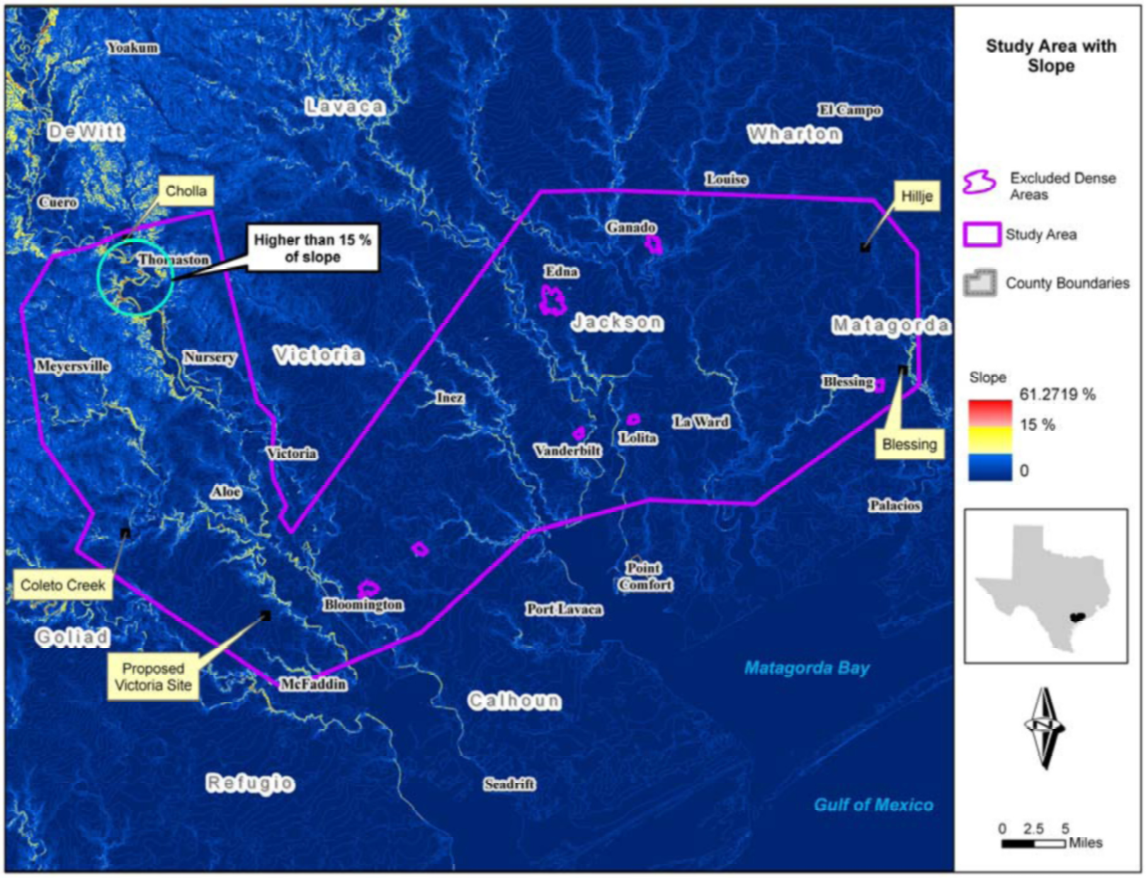



Figure 19 illustrates areas of slope along streams and rivers. However, the slope in and near the study area falls mostly below the threshold of 15%. The only area that is higher than 15 percent is the northwestern part of the study area along the Guadalupe River.

## 5. Engineering Environment Data Layer Weights

The Engineering Environment data layers and their relative weights are summarized in Table 7 below. Items highlighted in gray are not present in the study area unless otherwise discussed.

**TABLE 7: ENGINEERING ENVIRONMENT LAYERS AND WEIGHTS**

| Engineering | |
|---|---|
| **Linear Infrastructure** | **48.3%** |
| Rebuild Existing Transmission Lines | 1 |
| Parallel Existing Transmission Lines | 1 |
| Parallel Roads ROW | 3.6 |
| Parallel Gas Pipelines | 4.5 |
| Parallel Railway ROW | 5.1 |
| Non-Linear Places | 5.7 |
| Future GDOT Plans | 7.5 |
| Parallel Interstates ROW | 8.1 |
| Road ROW, TL ROW | 9 |
| Scenic Highways ROW | |
| **Slope** | **9.1%** |
| Slope 0-15% | 1 |
| Slope 15-30% | 5.5 |
| Slope >30% | 9 |
| **Intensive Agriculture** | **42.6%** |
| Outside of Intensive Agriculture | 1 |
| Fruit Orchards | 5 |
| Pecan Orchards | 9 |
| Center Pivot Agriculture | 9 |

Although numerous pipelines crisscross the study area, pipelines were not included in the model for this project, but are considered when defining a representative route for statistical comparison. The pipelines are so numerous in this section of the state, that no matter where corridors are developed an opportunity would exist to utilize the pipelines for co-location purposes.

Roads are not considered as co-location opportunities for this project. Due to the high voltage of this project and the likely lattice configuration of the towers, road corridors are not an opportunity. Roads attract most of the development in this study area and most of the transportation corridors pass through small towns and crossroad communities. For smaller voltage lines, road corridors are more practicable since they would be able to overhang road right-of-ways with single pole, vertical configurations and would be able to jump back and forth across the road to avoid development.