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Chapter 3
Affected Environment and Environmental Consequences

3.1 INTRODUCTION

The first two chapters of this Draft Environmental Impact Statement (EIS) have described the background and context of the United States (US) Highway 281 Corridor Project, Need and Purpose for improvements, and the reasonable alternatives being considered. This chapter examines how each of the reasonable alternatives could affect the existing constructed and natural environments within the US 281 project corridor. The discussion in this chapter describes the potential environmental consequences of proposed transportation improvements in the US 281 project corridor for the Proposed Build Alternatives as presented in **Chapter 2 - Alternatives Considered**. The resources and topics being evaluated include:

- land use
- farmlands
- socioeconomics
- pedestrian and bicycle facilities
- transportation facilities
- air quality
- traffic noise
- surface water
- groundwater
- floodplains
- wetlands and other waters of the US
- vegetation
- wildlife
- threatened and endangered species
- cultural resources
- parkland and recreational areas
- hazardous/regulated materials
- visual and aesthetic qualities

At the end of this chapter in **Section 3.25** , **Table 3-58** provides a concise overview of the difference in costs, impacts, and benefits of the Proposed Build Alternatives examined in the Draft EIS.

3.2 LAND USE

This section describes existing land use within a defined study area and discusses local government plans and policies that may help shape the land use along the US 281 project corridor, and considers the potential land use impacts that each Proposed Build Alternative may have.

3.2.1 Methodology

The land use study area is located in northern Bexar County with a small portion in southern Comal County. The study area is defined as an area approximately one-half mile in width or one-quarter mile on either side of the centerline of the existing US 281 project corridor (**Figure 3-2a** through **Figure 3-2e**). An inventory of existing land uses in the land use study area was compiled from 2010 data provided by the Bexar Appraisal District and was then verified using aerial photography and field surveys. To quantify the potential direct impacts to land use, Geographic Information Systems (GIS) were used to calculate the number of acres, for each land use type, that could be impacted by the acquisition of additional acres of right-of-way (ROW) for both of the Proposed Build Alternatives. The Final EIS will use the same methodology as the Draft EIS and will be updated with any changes to land use and/or changes that may result from adjustments to the alignment of the Preferred Alternative. In addition, the Final EIS will be updated to reflect changes in land use plans and polices.

3.2.2 Affected Environment and Future Projections/Plans

Northern Bexar County's existing land development pattern can be described as suburban residential development, which is spread somewhat uniformly over a large area with commercial services concentrated along major roadways like US 281 and Blanco Road. Existing land uses in and near the land use study area are shown in **Figure 3-2a** through **Figure 3-2e**, beginning at Loop 1604 and US 281 in the south of the study area moving in a north-northeast direction. In general, the land uses adjacent to the US 281 project corridor south of Stone Oak Parkway include a quarry, commercial centers, multi-family residential development, and single-family residential development. North of Stone Oak Parkway, the developed uses tend to be smaller commercial properties adjacent to US 281 with single-family residential set back from the ROW.

Impacts to businesses and relocations required by the US 281 Corridor Project are discussed in the subsequent sections on required ROW and socioeconomic conditions. Existing land use along the US 281 project corridor consists of residential, commercial, educational, rangeland and forest uses. There are several single-family residential subdivisions and two apartment complexes adjacent to the existing US 281 project corridor. Single-family residential subdivisions include: Encino Park, Big Spring, Stone Oak, The Oaklands, Mountain Lodge, Sendero Ranch, Summerglen, Lookout Canyon, The Estates at Stonegate and Trinity Oaks. Apartment complexes adjacent to the existing US 281 project corridor include The Ravinia and The View.

Local Government Plans and Polices

The following are brief discussions of regional planning actions and joint development measures, which further support and identify the need for the US 281 Corridor Project. It should be noted that implementation of these planning actions may vary within the US 281 project corridor. This is because a portion of the corridor is located in the City of San Antonio, from Loop 1604 to approximately Marshall Road, and the unincorporated area north of Marshall Road is regulated by Bexar County. Unlike the City of San Antonio, Bexar County does not have the power to regulate zoning on land in the county, or the use or appearance of property. Counties in Texas are also not legally bound to develop comprehensive plans like a municipality.

San Antonio Comprehensive Master Plan Framework

The San Antonio Comprehensive Master Plan Framework (Master Plan) provides the framework to coordinate the city's efforts, to plan for future growth and development, and promote a high quality of life for all residents over the next 25 years. The plan focuses primarily on the physical growth and development of the city. These physical aspects of city growth, however, must be placed within the context of the overall social environment that is a part of life within the city. Decisions about the location and pattern of growth within the city have a profound effect on the city's social characteristics. To that extent, issues such as education, health care, and public safety are addressed in the Master Plan. However, it does not address these topics in a detailed manner.

The City of San Antonio is divided into five sectors and subsequent sector plans are being developed to support the policies of the adopted Master Plan and to provide appropriate guidance for land use, transportation, and public facilities planning efforts in each of the city's seven sectors (**Figure 3-1**). Sector plans do not supersede adopted Neighborhood, Community or Perimeter Plans.

As of August 5, 2010, the City of San Antonio adopted the North Sector Plan, as a component of the City's Master Plan. The North Sector is generally bounded by: Loop 410, Grissom Road, and Culebra Road to the south; Loop 1604 and Texas Highway 16/Bandera Road to the west; the City of San Antonio extraterritorial jurisdiction boundary to the north; and the City of San Antonio extraterritorial jurisdiction boundary, Toepperwein Road and IH-35 to the east. The North Sector is the first of the seven sector plans to be created for the City of San Antonio and its extraterritorial jurisdiction. This sector plan will function as the long-range guide to the preferred growth, conservation, and redevelopment for this area.

The West/Southwest Sector Plan was adopted as a component of the City's Master Plan on April 21, 2011. The West/Southwest Sector is generally bounded by: Loop 410 and IH-35 to the south; the City of San Antonio extraterritorial jurisdiction boundary to the west; Bandera Road, State Highway 16, Cuelbra Road and Grissom Road to the north; and, South General McMullen Drive, Port San Antonio, and Pleasanton Road to the east. The West/Southwest Sector Plan is the third of the five sector plans to be adopted as a long-range guide for the growth, conservation and redevelopment for this planning area.

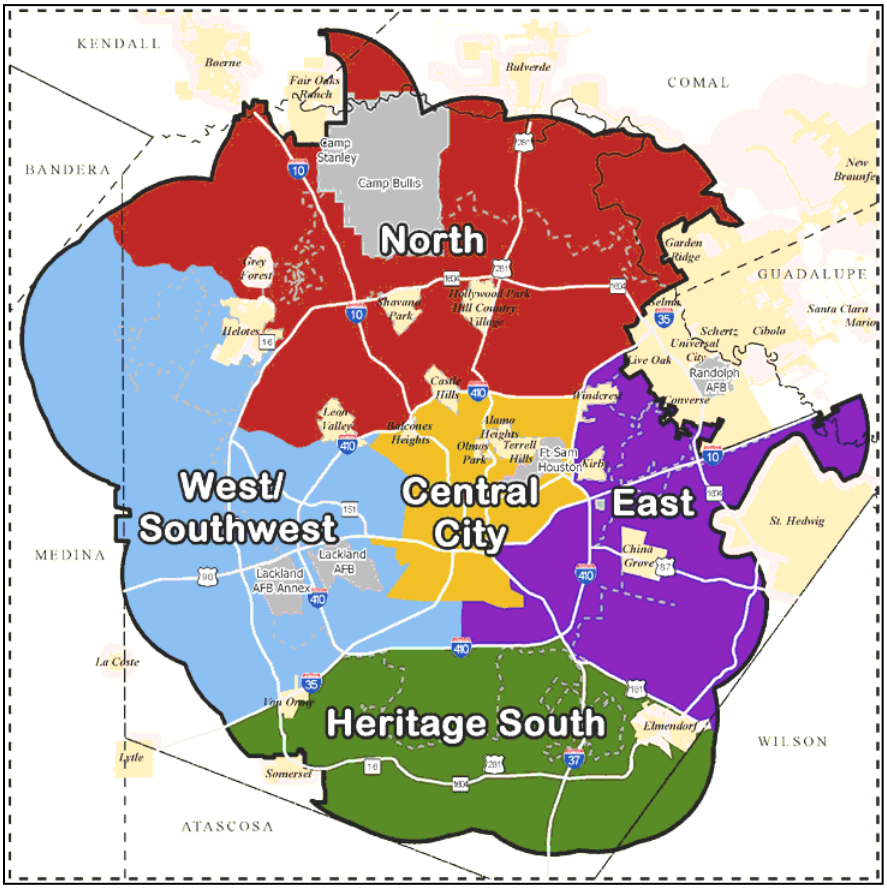
Alamo Regional Mobility Authority (RMA) Roadmap - 2011 – 2015 Strategic Plan

This updated Strategic Plan further defines the planning strategies established in the three previous Strategic Plans of the Alamo RMA, for congestion relief and acceleration

of needed added capacity projects within the region. The Strategic Plan is updated every two years to re-examine and establish the direction of the Alamo RMA.

San Antonio-Bexar County Metropolitan Planning Organization (SA-BC MPO)
Mobility 2035
This is a financially constrained, multi-modal transportation plan that identifies roadway, transit, and other transportation projects needed for the region. Transportation infrastructure, increasing congestion, funding issues, environmental concerns, and bicycle and pedestrian needs are key topics throughout this document. *Mobility 2035* varies from the previous plans by incorporating Scenario Planning. The Scenario Planning process included a series of public workshops in 2006, and was used to enhance the traditional transportation planning process and raise awareness of the factors that affect population and employment growth which impact the transportation system. *Mobility 2035* was locally adopted by the Transportation Policy Board on December 7, 2009, and updated July 25, 2011. A comprehensive and formal update is required every five years. See **Chapter 1 - Need for and Purpose of Proposed Action** for a detailed discussion about *Mobility 2035* and the US 281 Corridor Project.

Figure 3-1: City of San Antonio planning areas



Source: City of San Antonio, Sector Plans, 2012.

City of San Antonio's Major Thoroughfare Plan (Thoroughfare Plan)
The Thoroughfare Plan is a long-range transportation plan for both the City and Bexar County. Originally adopted in 1978 and substantially updated over the years, the

Thoroughfare Plan designates the desired or future location, cross sections, and dedication requirements of roadways. This Thoroughfare Plan also incorporates the Regional Bicycle Master Plan which is currently being updated by the City and County and VIA Metropolitan Transit (VIA) public transportation plans.

San Antonio Bike Plan 2011

A regional bicycle master plan was first envisioned in 1997 to reflect the community's desire for a comprehensive network of on-road bicycle facilities and off-road hike and bike trails as part of the existing transportation infrastructure. While a stand-alone, fiscally constrained document, this plan is also an element of *Mobility 2035*, and is reflected in the goals of the Master Plan. The 2005 regional bicycle master plan was recently updated and the San Antonio Bike Plan 2011 was adopted in June 2011.

VIA Metropolitan Transit *SmartWaySA*

SmartWaySA is a process to develop VIA's Long Range Comprehensive Transportation Plan. *SmartWaySA* will establish policy structure, set forth strategies, and provide a framework for directing future transit investments in Bexar County. In addition, *SmartWaySA* will identify the financial resources and tools necessary to implement and sustain these services. One key outcome of *SmartWaySA* will be a system plan, outlining a network of high-capacity corridors, each with a range of transportation alternatives. The alternatives for the selected corridors will include a No-Build (or no-action) Alternative, one or more fixed guideway options, such as light rail, bus rapid transit, or busway (which may include provisions for use by carpools), and at least one non-guideway option, i.e., Transportation System Management (TSM). The plan will utilize the newly adopted *Mobility 2035* land use scenario which promotes Infill Development (IND) and Transit Oriented Development (TOD) in the San Antonio area as a growth management strategy.

Mission Verde Sustainability Plan

The San Antonio City Council formally adopted the *Mission Verde Sustainability Plan* by resolution on February 4, 2010. The plan focuses on strategies to reduce energy use as a means to advance a sustainable environment and economy in San Antonio. The plan includes initiatives focused on the energy infrastructure, green technology, energy efficient buildings, mixed-use and transit-oriented land development, and multi-modal transportation.

Edwards Aquifer Authority Act and Rules

The Edwards Aquifer Authority Act was adopted on May 30, 1993 and was followed by the adoption of a set of rules and permitting requirements in order to protect the quality and quantity of water in the Edwards Aquifer. The rules and permit requirements in these documents are administered by the Edwards Aquifer Authority. The Edwards Aquifer Authority Rules regulate and contain permitting requirements for the use and conservation of the groundwater in the aquifer, and for the protection of the water quality in the aquifer, including the monitoring of potential sources of contamination within the recharge and contributing zones.

Existing Land Use

The US 281 land use study area, as defined above, is a diverse geographical area with pockets of developed and undeveloped land uses. As shown in **Table 3-1**, the study

area is dominated by range land use (21.40 percent), commercial use (19.41 percent), and residential use (17.10 percent). The land uses immediately adjacent to the US 281 project corridor are mixed with pockets of highly urbanized areas while the periphery of the land use study area is generally less densely developed. From south to north, **Figure 3-2a** through **Figure 3-2e** illustrate all land use categories identified within the US 281 land use study area.

Table 3-1: Land Use Category - US 281 Land Use Study Area

Land Use Category	Acreage	% of Total
Range Land	575.33	21.40%
Commercial (Office, Retail, and Mixed)	522.00	19.41%
Residential (Single-Family and Multi-Family)	459.91	17.10%
Transportation/Utilities	437.15	16.26%
Forest	374.30	13.92%
Mining	136.26	5.07%
Open Space	133.74	4.97%
Industry	18.70	0.70%
Educational	16.21	0.60%
House of Worship	12.38	0.46%
Government/Institution	3.02	0.11%
Parks	0.00	0.00%
Total	2689.00	100.00%

Source: Bexar Appraisal District, 2010, US 281 EIS Team, July 2011.

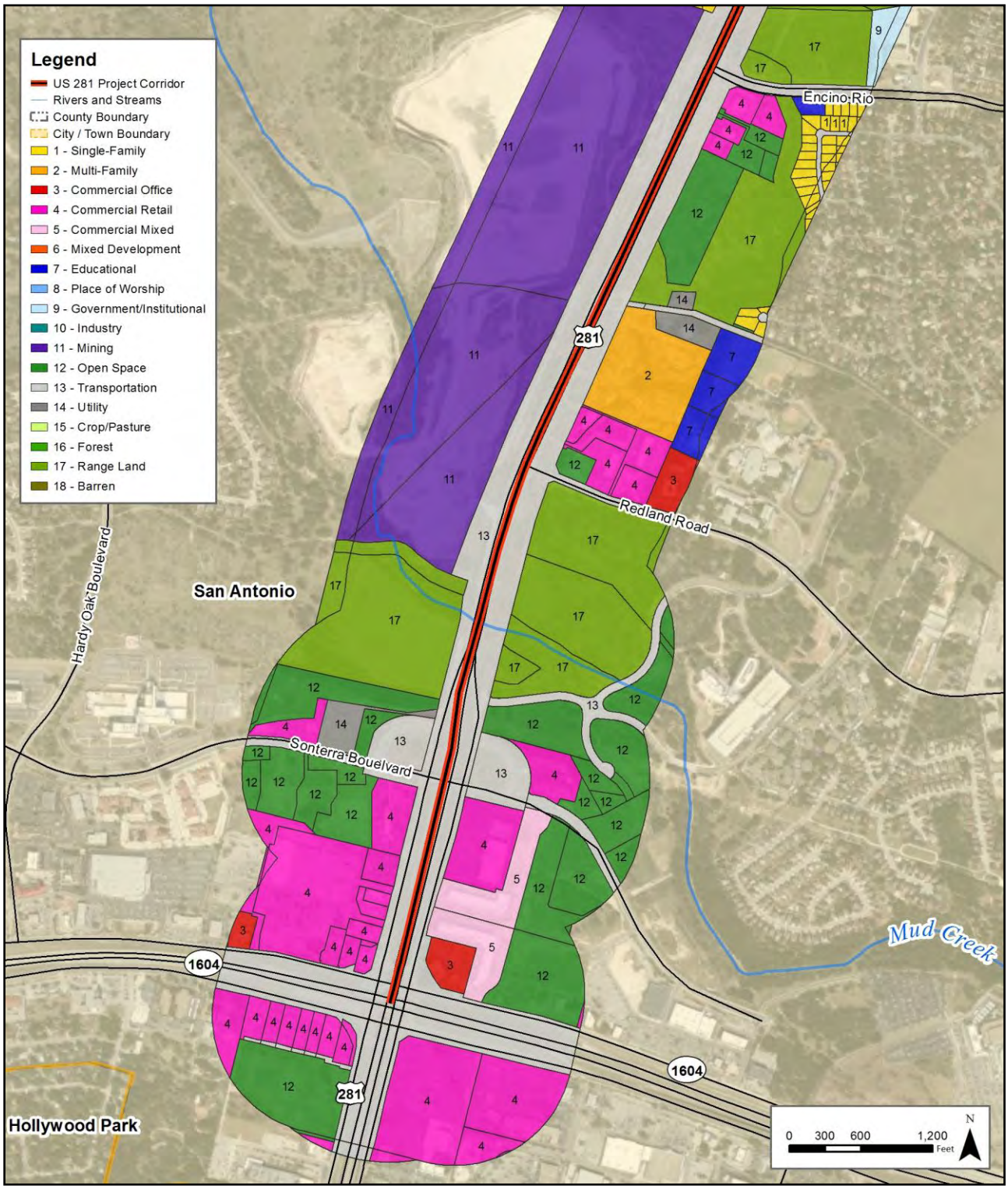
Undeveloped Land

Undeveloped land within the study area includes open spaces and range land. Of all the land uses within the study area, range land covers the greatest amount of area and is more abundant towards the northern limits of the study area. The observed range land includes mostly large areas of natural vegetation (native grasses, grass-like plants, forbs, shrubs and small woody vegetation). While largely developed, there are pockets of undeveloped land near the southern limits of the study area which are predominantly open spaces. Within the ROW of the US 281 project corridor, the vegetation is landscaped and maintained open space.

Development

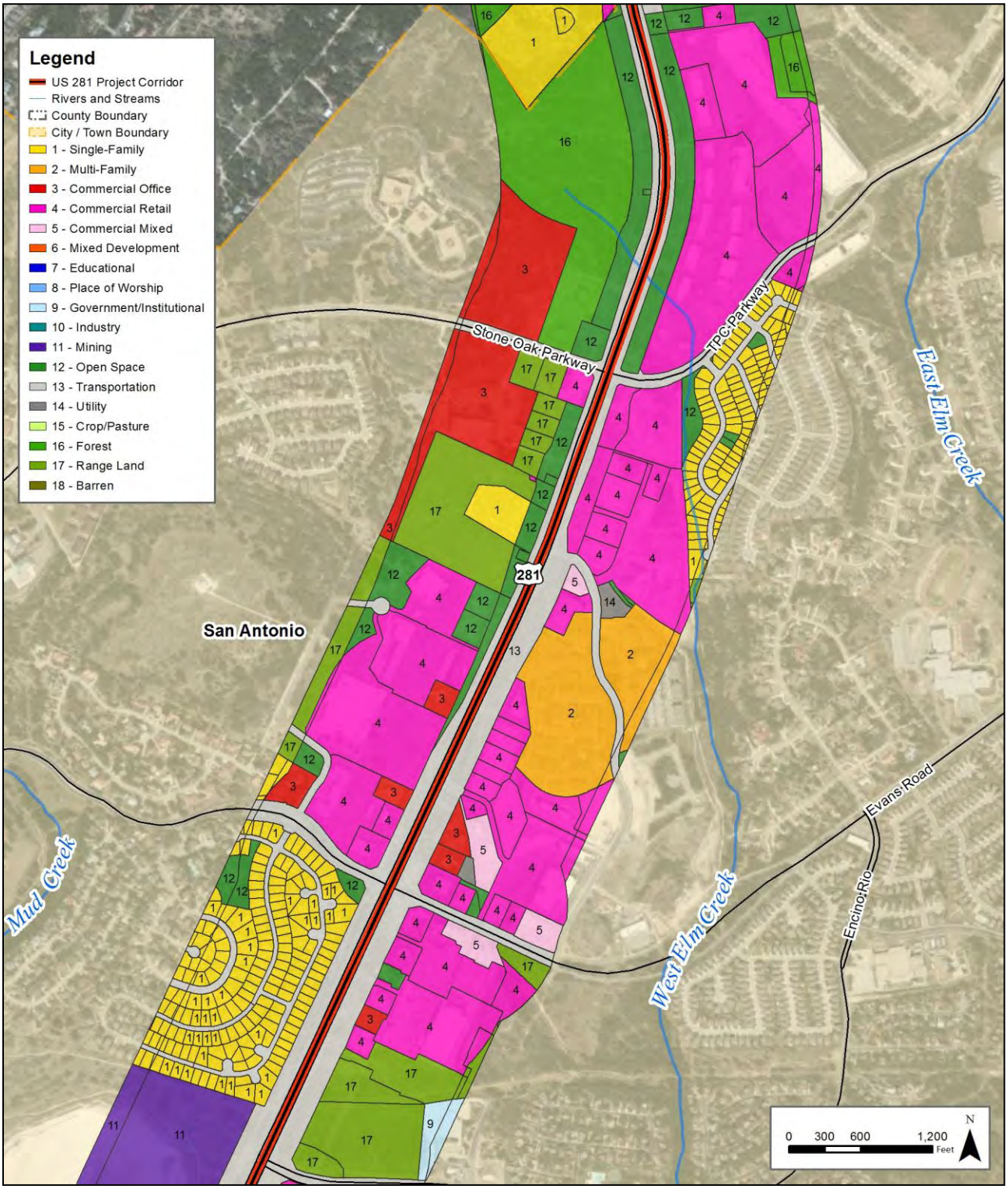
Urban development in the land use study area is primarily concentrated near the southern limits of the US 281 project corridor, between Loop 1604 and Marshall Road, and consists of, but is not limited to: commercial, residential, educational, industrial, transportation, utility, and mining operations. The second most abundant land use type in the land use study area is commercial use, followed by single-family residential land use. It should be noted, that land use development trends within the land use study area, particularly toward the northern limits, show increasing residential densities are extending into previously low-density areas.

Figure 3-2a: Existing land use in the land use study area



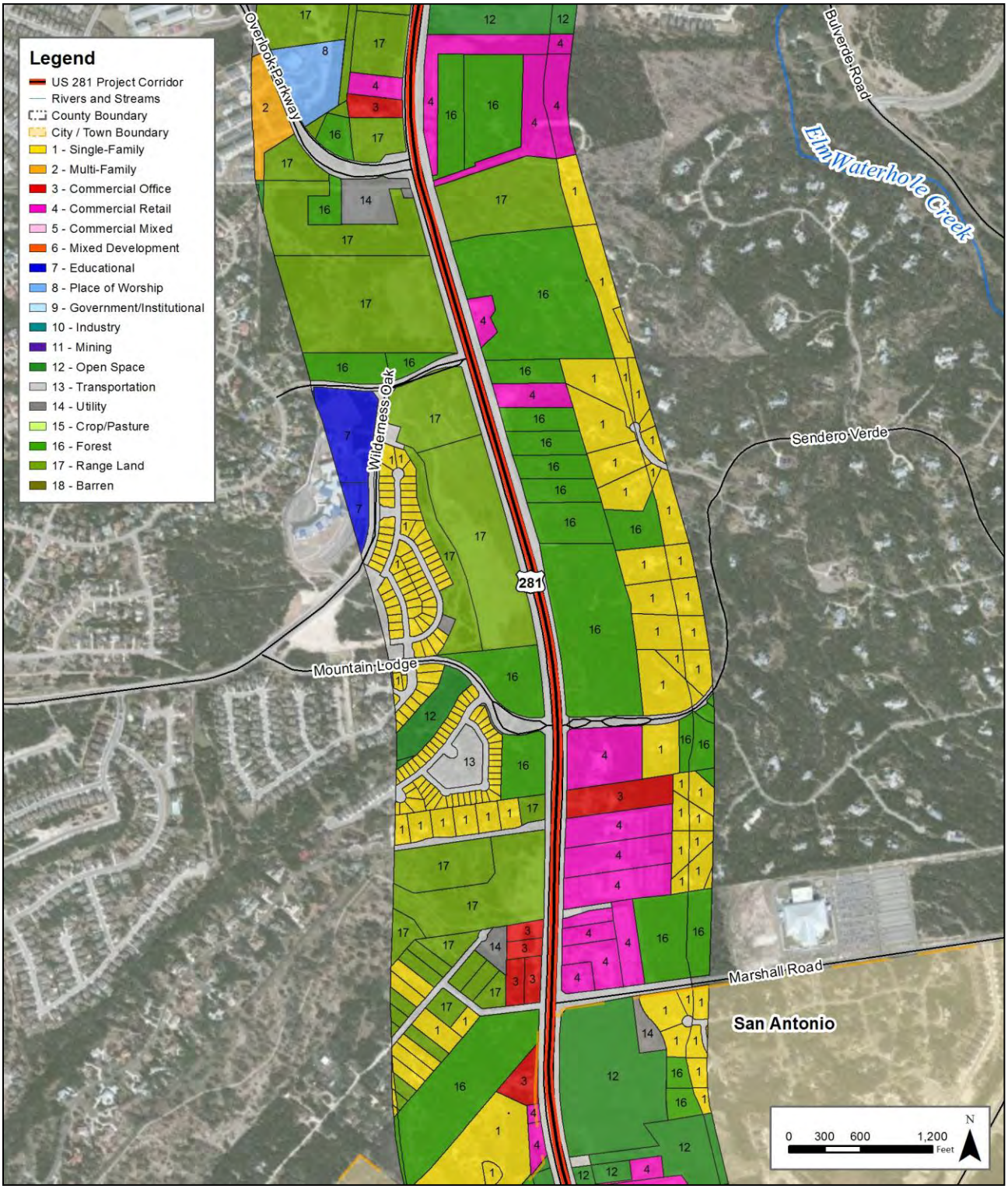
Source: Bexar Appraisal District, 2010, US 281EIS Team, July 2011.

Figure 3-2b: Existing land use in the land use study area



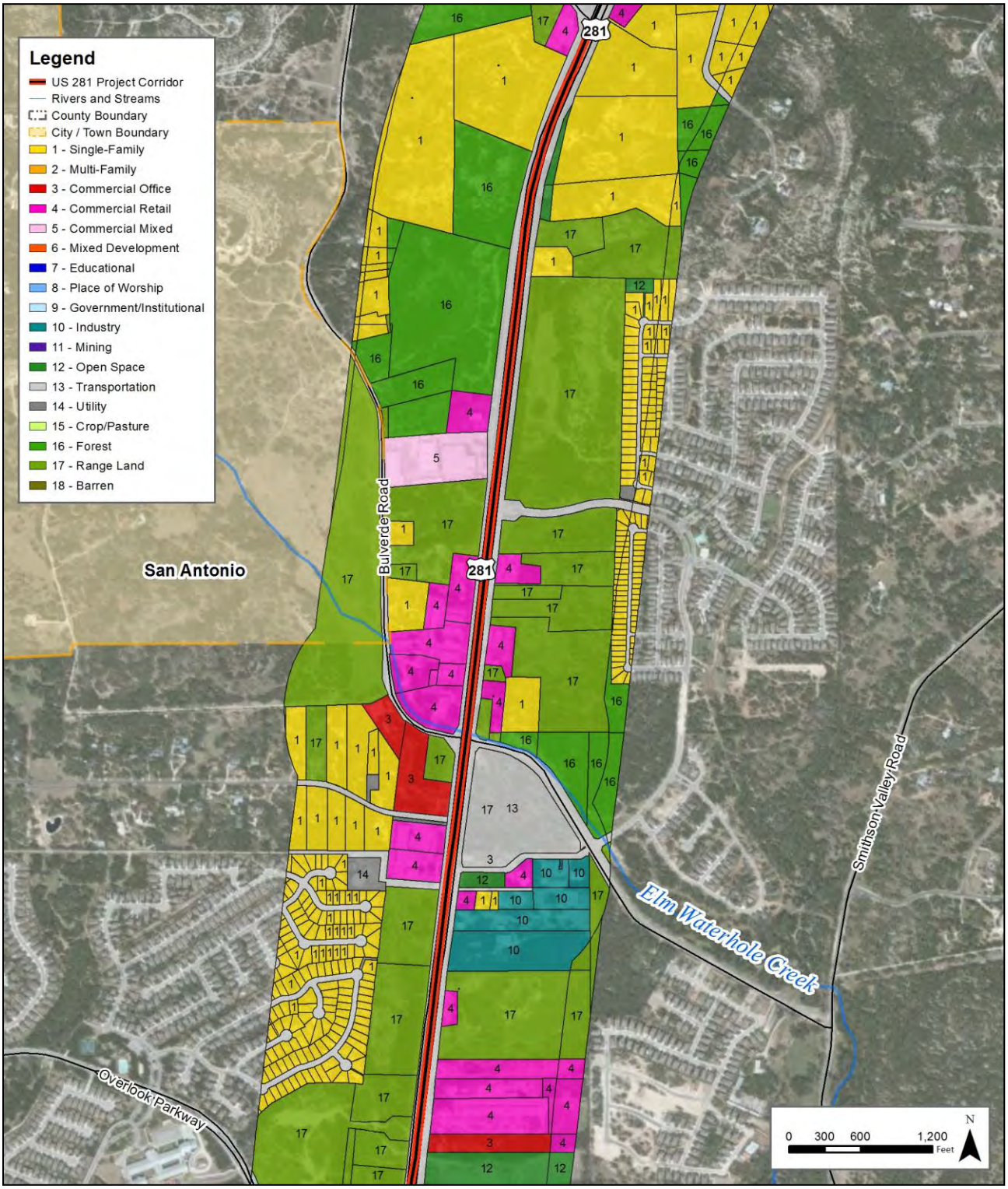
Source: Bexar Appraisal District, 2010, US 281EIS Team, July 2011.

Figure 3-2c: Existing land use in the land use study area



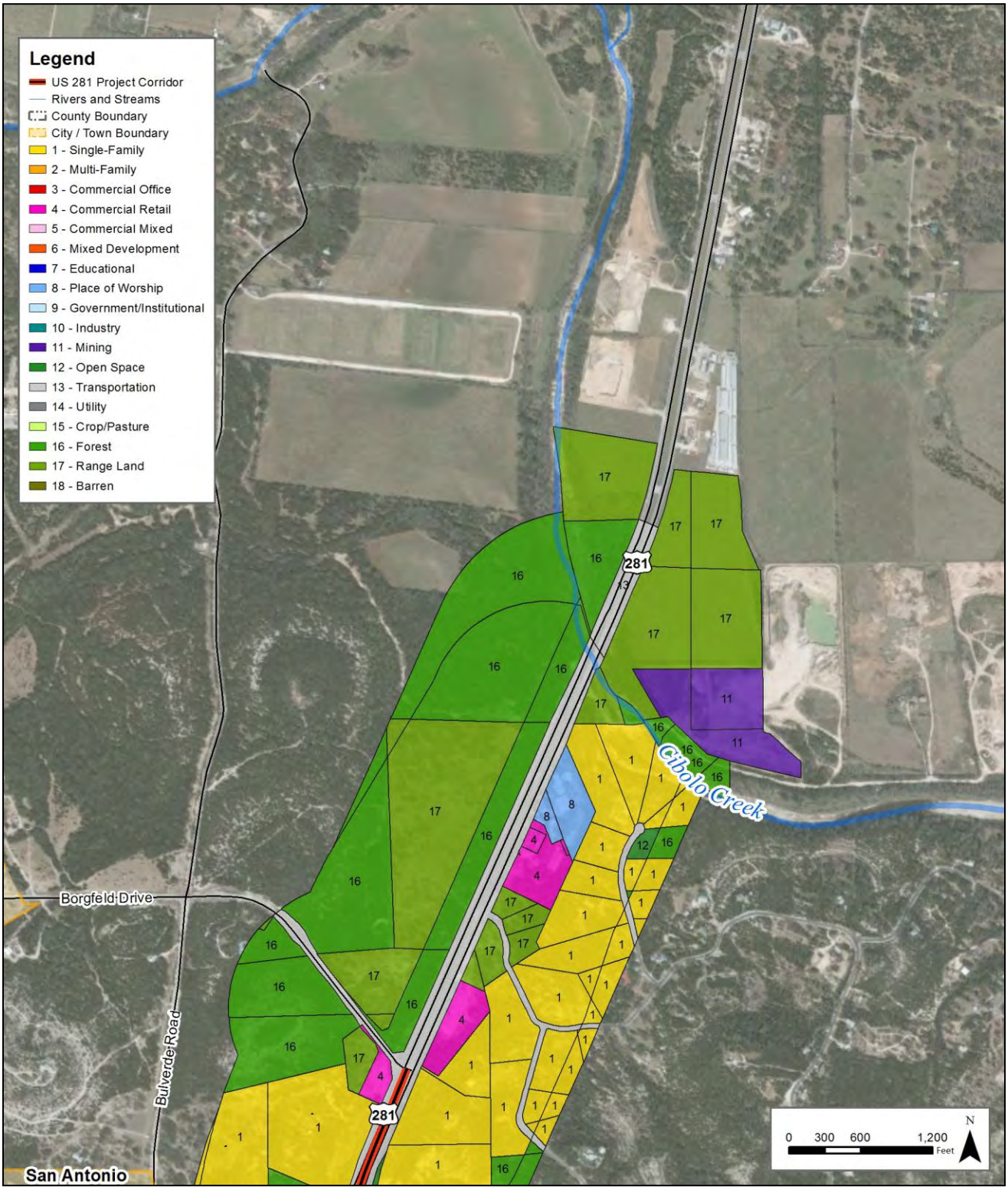
Source: Bexar Appraisal District, 2010, US 281EIS Team, July 2011.

Figure 3-2d: Existing land use in the land use study area



Source: Bexar Appraisal District, 2010, US 281EIS Team, July 2011.

Figure 3-2e: Existing land use in the land use study area



Source: Bexar Appraisal District, 2010, US 281EIS Team, July 2011.

3.2.3 Environmental Consequences

The following section focuses on the potential impacts to land use in the study area for each of the Proposed Alternatives. Criteria used to measure potential land use impacts include current development trends along the US 281 project corridor, state and/or local government plans and policies on land use and growth in the land use study area.

No-Build Alternative

The No-Build Alternative would not require the acquisition of land and would not result in direct land use impacts. If the No-Build Alternative is identified as the Preferred Alternative, land development trends are expected to continue as planned. The land use patterns along the US 281 project corridor would reflect these development trends, travel delays would increase, and vehicle access would deteriorate.

Proposed Build Alternatives

The potential direct land use impacts resulting from the acquisition of land for the Proposed Build Alternatives are shown in **Table 3-2.** The percentages represent the share of additional land, for each land use, that would be required for each Proposed Build Alternative relative to the total acres that currently exist within the land use study area.

Table 3-2: Land Acquisition (in Acres) per Proposed Build Alternative

Land Use Category	Total Acres in Land Use Study Area	Expressway Alternative		Elevated Expressway Alternative	
		Acres	%	Acres	%
Range Land	575.33	69.5	12.1%	41.7	7.2%
Commercial (Mixed, Office, Retail)	522.00	26.8	5.1%	26.1	5.0%
Residential (single/multi-family)	459.91	5.0	1.1%	1.6	0.3%
Transportation/Utilities	437.15	6.4	1.5%	2.7	0.6%
Forest	374.30	18.3	4.9%	20.3	5.4%
Mining	136.26	0.0	0.0%	0.0	0.0%
Open Space	133.74	2.1	1.6%	6.4	4.8%
Industrial	18.70	0.1	0.5%	0.3	1.6%
Educational	16.21	0.0	0.0%	0.0	0.0%
Place of Worship	12.38	0.3	2.4%	0.0	0.0%
Government/Institution	3.02	0.0	0.0%	0.0	0.0%
Parks	0.00	0.0	0.0%	0.0	0.0%
Total	2689.00	128.5	4.8%	99.1	3.7%

Source: Bexar Appraisal District, 2010, US 281EIS Team, July 2011.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to land use would not change based on funding options.

3.2.4 Conclusion and Proposed Mitigation Measures

The implementation of either of the Proposed Build Alternatives would require the acquisition of land along the US 281 project corridor in the land use study area while the No-Build Alternative would not. Overall the Proposed Build Alternatives would have the greatest impacts to range land, commercial land uses and forest use. The proposed Expressway Alternative has the potential to impact a total of 128.5 acres and the Elevated Expressway Alternative has the potential to impact a total of 99.1 acres. In comparing the two Proposed Build Alternatives, the Expressway Alternative would impact more acres of range land, residential land use, and transportation and utilities land use than the Elevated Expressway Alternative; whereas the Elevated Expressway Alternative would impact more acres of forest and open space land uses in comparison to the Expressway Alternative. The impact of the Proposed Build Alternatives is relatively small, ranging between 3.7 and 4.8 percent of the total acreage in the land use study area.

It is not anticipated that either of the Proposed Build Alternatives would result in substantial direct impacts to the land uses along the US 281 project corridor within the land use study area. The proposed US 281 Corridor Project is consistent with the planning efforts of the City of San Antonio and Bexar County and is compatible with existing land use, existing zoning regulations, and the Master Plan for the City of San Antonio (which includes the North Sector Plan).

3.3 FARMLANDS

The *FarmlandProtection Policy Act* (FPPA), Subtitle I of Title XV of the *Agricultural and Food Act of 1981*, Pub. L. 97-98, provides protection to prime and unique farmlands, all of which are classified into four distinct types. The four types of farmland as defined by FHWA Technical Advisory T6640.8A are (1) prime, (2) unique, (3) other than prime or unique and of statewide importance, and (4) other than prime or unique that is of local importance (FHWA 1987). According to the US Department of Agriculture - Natural Resources Conservation Service (NRCS), there are no unique farmlands or farmlands of local importance within or adjacent to the US 281 project corridor.

The purpose of the FPPA is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of prime, unique, and other farmlands of statewide or local importance to non-agricultural uses. Direct prime farmland impacts result from acquiring prime farmland for additional ROW and converting it from farmland to transportation use.

Prime farmland soils, as defined by the US Department of Agriculture (USDA), are soils that are best suited to producing food, feed, forage, and oilseed crops. Such soils have properties that are favorable for the production of sustained high yields. Prime farmland soils typically produce the highest yields with a minimum of input of energy and economic resources, and farming these soils has been found to keep damage to the environment at a minimum.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10

acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

3.3.1 Methodology

The farmland study area includes all land within and adjacent to the proposed ROW for both of the Proposed Build Alternatives. The soil data used to describe the existing conditions in the farmland study area was obtained from the NRCS Soil Survey of Bexar County, Texas dated June 1991 and October 2009 (online) and is presented below. This data was used to complete a Farmland Conversion Impact Rating Form (form NRCS-CPA-106) and the results were coordinated with the NRCS.

In the Final EIS, this form will be updated and the results coordinated with the NRCS if the ROW for the Preferred Alternative differs from that proposed in the Draft EIS.

3.3.2 Affected Environment

There are two soil associations located within the farmland study area: Tarrant-Brackett and Crawford-Bexar. The soils within the study area consist of six soil series. Generally, these six soil series are clayey loams to clays and are shallow to moderately deep soils over limestone. These soils are well drained and are moderately permeable.

The specific soil types that occur within the farmland study area, including a description and a hydric and prime farmland classification, are shown in **Table 3-3**.

Table 3-3: Mapped Soil Units in the Farmland Study Area

Map Abbreviation	Mapped Soil Unit	Drainage Classification	Percent Slope
BrE	Brackett gravelly clay loam	Well drained, loamy and clayey, occurs on undulating to hilly uplands, moderately permeable.	12 to 20
BtE	Brackett-Eckrant association	Well drained, clayey soils, occurs on tops and upper side of ridges, moderately permeable	20 to 60
Ca	Anhalt clay	Well drained, noncalcareous clays, clay loams and loams, occurs mainly in uplands, moderately permeable. Prime farmland if irrigated.	0 to 1
Cb	Crawford and Bexar stony soils	Well drained, noncalcareous loams, occur as broad, nearly level to gently undulating areas, variable permeability	0 to 5
Kr	Krum clay	Well drained, silty clay loam to gravelly clay loam, occurs in nearly level to rolling uplands, moderately permeable. Prime farmland if irrigated.	1 to 5
TaB	Eckrant cobbly clay	Well drained, very shallow, stony clay, occurs in limestone prairie, moderately slow permeable soils	1 to 5
TaC	Eckrant cobbly clay	Well drained, very shallow, stony clay, occurs in undulating limestone prairie, moderately slow permeable soils	5 to 15
TaD	Eckrant-Rock outcrop complex	Well drained, steep, rocky, shallow clay soils, occurs on broad ridgetops, moderately slow permeable soils	15 to 60
Tf	Tinn and Frio soils	Moderately well drained, clayey loam alluvium, occurs in floodplains. Hydric soil	0 to 1

Source: USDA 's NRCS Soil Data Mart. http://soildatamart.nrcs.usda.gov/Report.aspx?Survey=TX029&UseState=TX (accessed July 2011). Soil Survey. Bexar County Texas. June 1991. USDA.

3.3.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would not require acquisition of ROW and therefore would not directly impact prime and unique farmland soils.

Proposed Build Alternatives

The additional ROW required for each Proposed Build Alternative would impact two soils designated as prime farmland, if irrigated; however, the NRCS determined that the US 281 project corridor is exempt from the FPPA requirements as it has previously been converted to urban uses; the FPPA excludes areas that are already converted to urban uses from the definition of "Farmland." As such, neither of the Proposed Build Alternatives would directly impact prime farmland or unique farmland soils.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lanes option for each alternative are the same, therefore the impacts to farmland would not change based on funding options.

3.3.4 Conclusion and Proposed Mitigation Measures

Correspondence was initiated with the NRCS on July 13, 2010 and a response was received on July 22, 2010. According to the NRCS, the soils in the farmland study area may contain Important Farmland Soils; however, the project corridor has already been converted to urban uses. The FPPA excludes from the definition of "Farmland" areas that are already converted to urban areas. As such, the US 281 project corridor is exempt and will not require mitigation measures for farmland impacts.

The *Farmland Conversion Impact Rating Form for Corridor Type Projects* (NRCS-CPA-106) is based on a 260-point scale. One-hundred and sixty (160) points is the critical score for consideration for protection; those alternatives receiving scores totaling less than 160 points are given a minimal level of consideration for protection. Because the NRCS has determined that the US 281 project corridor is exempt, all alternatives received a score of zero. Please see **Appendix L** for the correspondence and the completed *Farmland Conversion Impact Rating Form for Corridor Type Projects* (NRCS-CPA-106).

No mitigation for impacts to farmlands are required or proposed.

3.4 SOCIOECONOMICS

The purpose of the National Environmental Policy Act (NEPA) is to ensure that environmental factors, including effects to the human environment, considered in the decision-making process undertaken by federal agencies. There are several federal laws that have a nexus with NEPA and require analysis of socioeconomic factors. These laws prevent discrimination based on race, color, and national origin; they help ensure that the adverse effects of a federal action are not disproportionately borne by minority and/or low-income populations; and they help ensure that all people have access to

meaningful communications about, and participation in any program or activity receiving federal assistance. Analyzing effects of a proposed action on the human environment requires an understanding of the effects that a project may have on socioeconomic characteristics of the community including land development activities, employment, access to community facilities, and land values; changes to these characteristics could affect the people who live, work and/or utilize the US 281 project corridor. This section describes the socioeconomic characteristics of the US 281 project corridor and presents potential impacts to population, employment, minority and low-income populations, limited English proficiency (LEP) populations, community cohesion, and economic conditions.

3.4.1 Methodology

Historical data from the US Census Bureau and forecasts from the SA-BC MPO were compiled and analyzed using Census geographies (Tracts, Blocks Groups, and Blocks), and Traffic Analysis Zones (TAZ). TAZs are used by the SA-BC MPO and other transportation professionals to model social and economic interactions for the purpose of transportation planning. The 2010 Census and the American Community Survey provides a detailed look at the existing socioeconomic characteristics of the US 281 project corridor while the SA-BC MPO forecast describes the changes that would occur in the future.

The US Census Bureau has released 2010 data in the 2010 Census and the 2006-2010 American Community Survey, including population, race, and ethnicity from the 2010 Census at the block level and income and poverty, and ability to speak English at the block group level from the 2006-2010 5-year survey.

Any subsequent updates to the SA-BC MPO's *Regional Toll and Managed Lane Analysis* will be utilized to analyze the Preferred Alternative.

Study Area

The area highlighted in yellow in **Figure 3-3** is the demographic study area. It was delineated to capture the demographic characteristics of individuals that currently use and/or are likely to use the US 281 project corridor in the future. In addition to proximity to the US 281 Corridor Project, the study area was determined based on the availability of alternate routes to downtown San Antonio. The demographic study area is made up of 23 Census Tracts in Bexar and Comal counties.

3.4.2 Affected Environment

Historical Population Growth in the Region

While the US 281 Corridor Project is located in Bexar County, the SA-BC MPO uses demographic data from a five-county region to understand the effects of regional growth on the transportation network; therefore, demographic trends in Bexar, Comal, Guadalupe, Kendall, and Wilson counties were considered. Over the past 100 years, this region has grown from almost 175,000 people in 1910 to over 2 million people in 2010, as shown in **Table 3-4**.

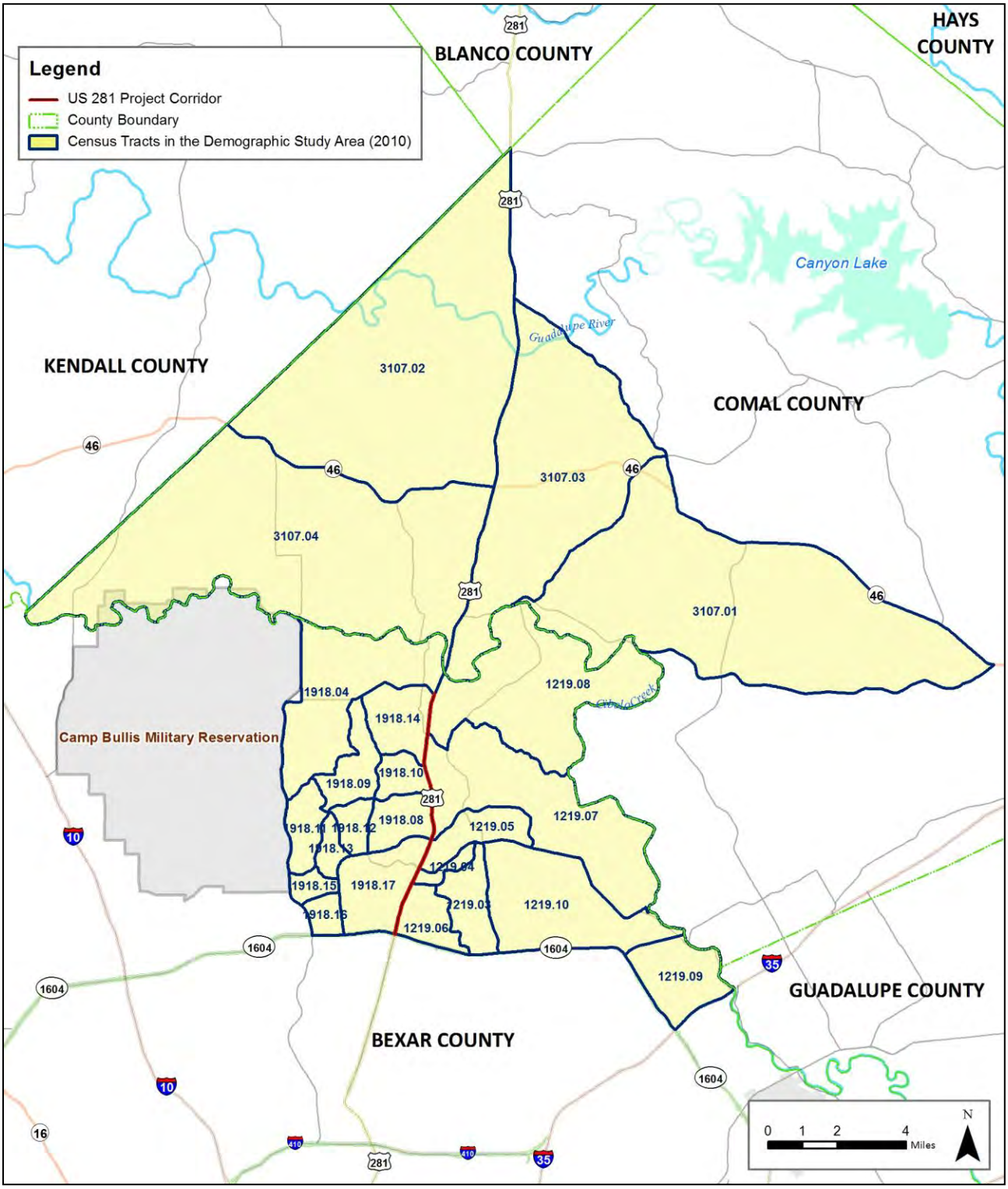
Bexar County has doubled its population almost four times over the past 100 years and Comal County has more than doubled three times.

Table 3-4: Historical Population Growth in the Region

	Bexar	Comal	Guadalupe	Kendall	Wilson	Total
1910	119,676	8,434	24,913	4,517	17,066	174,606
1920	202,096	8,824	27,719	4,779	17,289	260,707
1930	292,533	11,984	28,925	4,970	17,606	356,018
1940	338,176	12,321	25,596	5,080	17,066	398,239
1950	500,460	16,357	25,392	5,423	14,672	562,304
1960	687,151	19,844	29,017	5,889	13,267	755,168
1970	830,460	24,165	33,554	6,964	13,041	908,184
1980	988,800	36,446	46,708	10,635	16,756	1,099,345
1990	1,185,394	51,832	64,873	14,589	22,650	1,339,338
2000	1,392,931	78,021	89,023	23,743	32,408	1,616,126
2010	1,714,773	108,472	131,533	33,410	42,918	2,031,106
1910-2010% Change	1332.9%	1186.1%	428.0%	639.7%	151.5%	1063.3%

Source: US Census Bureau, 1930 Census (data for 1910, 1920 and 1930), 1950 Census (data for 1940 and 1950), 1980 Census (data for 1960, 1970 and 1980), 1990 Census (data for 1990), 2000 Census (data for 2000), 2010 Census (data for 2010)

Figure 3-3: US 281 - Demographic study area

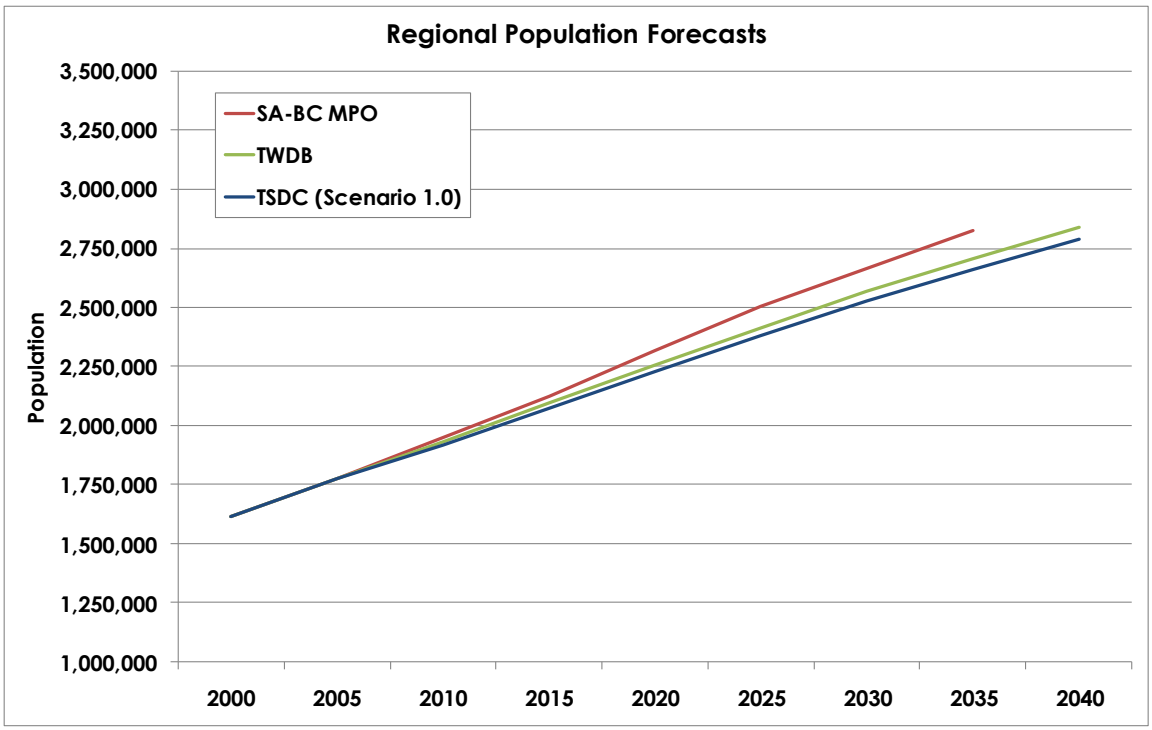


Source: US Census Bureau, 2010 & US 281 EIS Team, January 2011.

Forecasted Population Growth in the Region

According to a US Census Bureau estimate of the 100 fastest growing counties in the US between 2000 and 2008, 3 counties within the region of the US 281 Corridor Project make the list. Comal County ranks number 39 on the list at 40.5 percent growth; Kendall County ranks number 47 at 38.5 percent growth; and Guadalupe County ranks number 95 at 31.6 percent growth. The growth trends in the region are anticipated to continue into the future. As shown in **Figure 3-4,** the SA-BC MPO population forecast is comparable to those produced by other agencies in the region, such as the Texas Water Development Board (TWDB), and the Texas State Data Center (TSDC). The region was home to approximately 1.6 million people in 2000 and is forecasted to be between 2.75 and 3 million people by 2040.

Figure 3-4: Regional population forecasts comparison



Source: SA-BC MPO, 2035 Projections, Texas Water Development Board, 2011 Regional Water Plan, July 2010, and Texas State Data Center Population Projections (Scenarios 1.0)
Note: TSDC Scenario 1.0 assumes that the growth rate of the 1990s will continue into the future
http://txsdc.utsa.edu/tpepp/2008projections/2008_txpopprj_method.php

Forecasted Growth in the Demographic Study Area

Table 3-5 shows the SA-BC MPO's forecasted growth of population, households and employment within the demographic study area. Overall, the study area is anticipated to continue to grow and is forecasted to be home to over 47,000 households and over 142,000 people by 2035, which is an increase of over 111 percent from 2005. In addition, over 43,000 jobs are projected to be situated around the US 281 project corridor by 2035.

Table 3-5: Forecasted Growth in the Demographic Study Area

	2005	2008	2015	2025	2035	2005-2035 % Change
Population	73,537	86,505	115,560	128,270	142,240	93.4%
Households	22,545	27,203	38,118	42,636	47,723	111.7%
Employment	25,635	29,320	37,963	40,265	43,762	70.7%

Source: SA-BC MPO, 2035 Projections

Socioeconomic Characteristics of the Region

To understand the US 281 project corridor in context with the region, socioeconomic characteristics such as race, ethnicity, and household income were analyzed within the demographic study area and were compared with those of Bexar and Comal counties.

Race and Ethnicity

The 2010 Census asks respondents to self-identify their race from the following options:

- White alone
- Black or African American alone
- American Indian and Alaska Native alone
- Asian alone
- Native Hawaiian and Other Pacific Islander alone
- Some Other Race alone
- Two or More Races

In addition, respondents were also given the option to identify themselves ethnically as Hispanic or Latino. Ethnicity represents a segment of the population sharing common characteristics such as religion, traditions, culture, language, or tribal/national origin which differs from race. As such, one might identify himself/herself ethnically as Hispanic or Latino, but can be of any race, and for this reason the US Census Bureau does not include Hispanic or Latino as a designated race.

As shown in **Table 3-6**, over 60 percent of the people who live in the demographic study area identify themselves as white non-Hispanic or Latino, compared to 32.7 percent in Bexar and Comal counties. Overall, the demographic study area has a smaller share of minority population (all people except white non-Hispanic or Latino) and a smaller share of Hispanic or Latino of all races than Bexar and Comal counties. The demographic study area is 39.4 percent minority and 28.5 percent Hispanic or Latino compared to 67.3 percent minority and 56.7 percent Hispanic or Latino in Bexar and Comal counties combined. Race and ethnicity will be discussed in more detail in **Section 3.4.3** .

Table 3-6: Race and Ethnicity – 2010 Census

	Bexar & Comal County Total	Percentage of Total	Demographic Study Area Total	Percentage of Total
Total 2010 Population	1,823,245	100.0%	120,212	100.0%
Total non-Hispanic or Latino	789,298	43.3%	85,972	71.5%
White	596,510	32.7%	72,888	60.6%
Black or African American	120,066	6.6%	4,696	3.9%
American Indian/ Alaska Native	4,164	0.2%	288	0.2%
Asian	40,374	2.2%	5,668	4.7%
Native Hawaiian/ Other Pacific Islander	1,851	0.1%	131	0.1%
Some Other Race	2,986	0.2%	163	0.1%
Two or More Races	23,347	1.3%	2,138	1.8%
Total Hispanic or Latino	1,033,947	56.7%	34,240	28.5%
White	750,786	41.2%	26,752	22.3%
Black or African American	10,553	0.6%	313	0.3%
American Indian/ Alaska Native	10,956	0.6%	192	0.2%
Asian	2,214	0.1%	145	0.1%
Native Hawaiian/ Other Pacific Islander	550	0.0%	31	0.0%
Some Other Race	220,211	12.1%	5,147	4.3%
Two or More Races	38,677	2.1%	1,660	1.4%
Total Minority	1,226,735	67.3%	47,324	39.4%

Source: US Census Bureau, 2010 Census, Table P5 – Hispanic or Latino by Race, January 2012.

Household Income

According to the American Community Survey 2006-2010 5-year survey, the median household income in Bexar County was approximately $47,000 and in Comal County was over $64,000. In comparison, the median household income in the demographic study area ranged from approximately $72,000 to $130,000 per year. In Bexar and Comal counties combined, 19.5 percent of the households earned less than $20,000 per year, 32.2 percent earned between $20,000 and $49,999, and 48.3 percent earned $50,000 or more. In the demographic study area, 5.3 percent of the households earned less than $20,000 per year, 15.0 percent earned between $20,000 and $49,999, and 79.7 percent earned $50,000 or more. Almost half of the population in the study area reported a household income of $100,000 per year or more. **Table 3-7** compares the household income of Bexar and Comal counties to the demographic study area. See **Appendix G** for the process used to validate the income data source.

Table 3-7: Household Income – American Community Survey 2006-2010 5-year Survey

Household Income	Bexar & Comal County Total	Percent of Total	Demographic Study Area Total	Percent of Total
Total Households	$619,208	100.0%	$36,804	100.0%
Less than $10,000	$53,568	8.7%	$581	1.6%
$10,000 to $14,999	$34,671	5.6%	$729	2.0%
$15,000 to $19,999	$32,324	5.2%	$644	1.7%
$20,000 to $24,999	$37,450	6.0%	$723	2.0%
$25,000 to $29,999	$36,003	5.8%	$650	1.8%
$30,000 to $34,999	$34,949	5.6%	$871	2.4%
$35,000 to $39,999	$31,689	5.1%	$870	2.4%
$40,000 to $44,999	$32,091	5.2%	$1,022	2.8%
$45,000 to $49,999	$27,348	4.4%	$1,376	3.7%
$50,000 to $59,999	$52,767	8.5%	$2,132	5.8%
$60,000 to $74,999	$62,189	10.0%	$3,203	8.7%
$75,000 to $99,999	$73,772	11.9%	$6,140	16.7%
$100,000 to $124,999	$44,563	7.2%	$5,217	14.2%
$125,000 to $149,999	$23,778	3.8%	$4,254	11.6%
$150,000 to $199,999	$22,029	3.6%	$4,408	12.0%
$200,000 or More	$20,017	3.2%	$3,984	10.8%
Median Household Income	$47,048 (Bexar County) $64,752 (Comal County)		Ranges between $72,017 and $130,208	

Source: US Census Bureau, 2006-2010 American Community Survey, Household Income (2010 Inflated Dollars), and Median Household Income, May 2012.

3.4.3 Environmental Justice

Background

Presidential Executive Order (EO) 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*, mandates that federal agencies "identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs on minority and low-income populations" (59 *Federal Register* 7629-7633, February 16,1994). The three fundamental principles of environmental justice (EJ) are to:

- avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
- ensure the full and fair participation by all potentially affected communities in the transportation decision-making process; and
- prevent the denial of, reduction in or significant delay in the receipt of benefits by minority and low-income populations

According to FHWA Order 6640.23 and the US Department of Transportation (USDOT) Order 5610.2(a), disproportionately high and adverse effects on minority or low-income populations generally means an adverse effect that is predominantly borne by a

minority population and/or low-income population, or would be suffered by the minority population and/or low-income population, and is appreciably more severe or greater in magnitude than the adverse effect that would be suffered by the non-minority population and/or non-low-income population (USDOT 2012).

A minority is defined in Order 5610.2(a) as a person who is:

- Black (having origins from any of the black racial group of Africa)
- Asian-American (having origins from of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, of the Pacific Islands)
- American Indian and Alaskan Native (having origins from any of the original people of North America and who maintain cultural identification through tribal affiliation or community recognition)
- Hispanic or Latino (of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race).

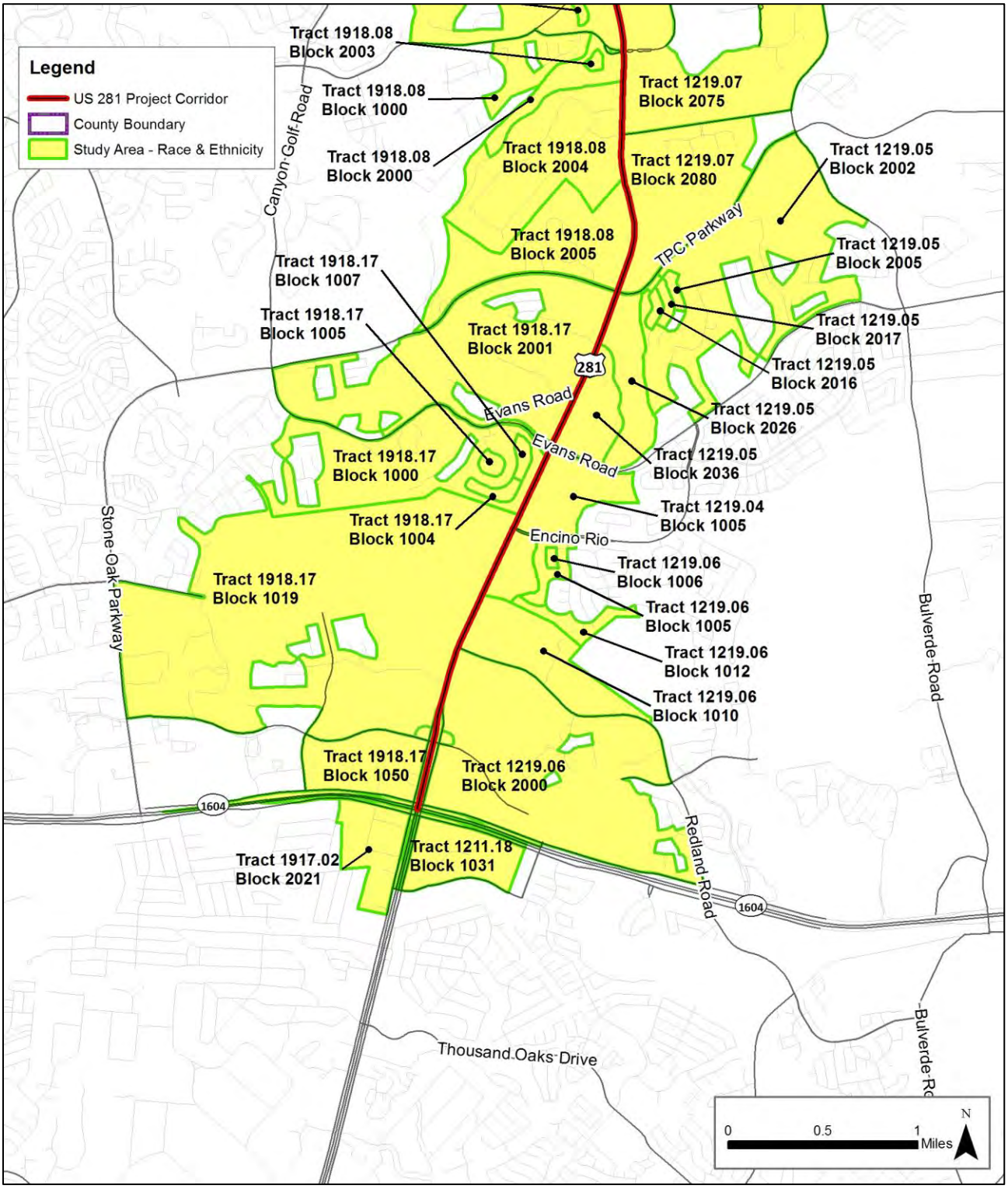
Low income is defined in Order 5610.2(a) as a person whose median household income is at or below the U.S. Department of Health and Human Services (USDHHS) poverty guidelines. The USDHHS poverty guidelines are categorized by the number of persons living in a household. The average household size in Bexar County was 2.75 people and in Comal County was 2.6 people in 2010 (U.S Census Bureau 2010). The 2012 USDHHS poverty guideline for a 2-person household is $15,130 and for a 3-person household is $19,090 (USDHHS 2012).

Methodology

In accordance with EO 12898 and FHWA Order 6640.23, data on the presence of minority and low-income populations should be analyzed at the project level to ensure that the Proposed Build Alternatives do not subject these populations to a "disproportionately high and adverse effect." As such, socioeconomic factors are analyzed using the most detailed geographies available; income and poverty are analyzed at the Census block group level and race and ethnicity are analyzed at the Census block level.

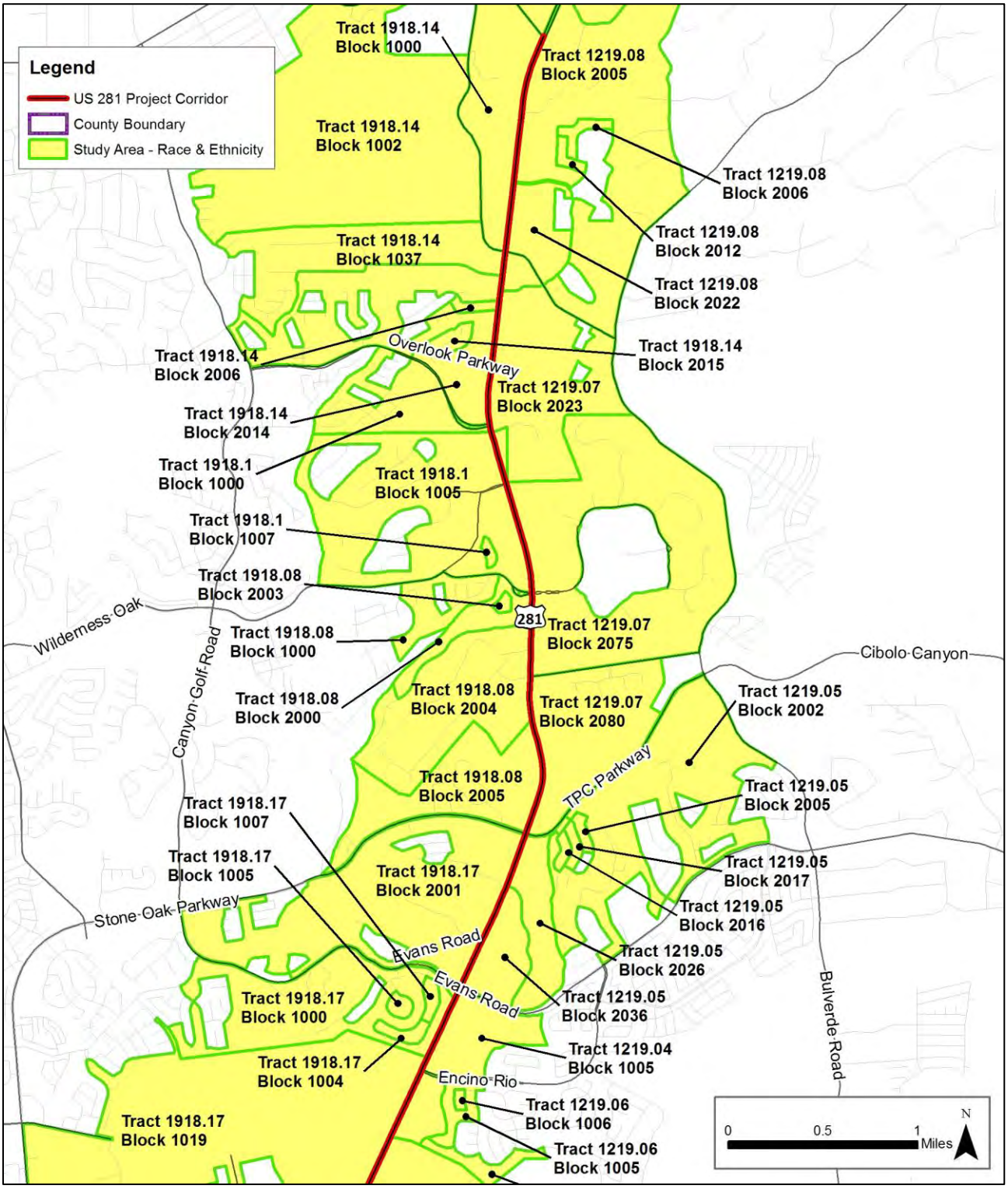
Direct effects are defined in 40 CFR 1508.08 as those caused by the proposed project and which occur at the same time and place. This means that the effects are likely to be experienced as a result of project activities, such as construction impacts, and are likely to be experienced at properties that are located at and adjacent to the project. For this analysis, direct effects to EJ populations are analyzed within and immediately adjacent to the ROW for the Proposed Build Alternatives; immediately adjacent is defined by a 500 foot buffer around the centerline of the existing US 281 corridor. The boundary of the Study Area for Income and Poverty are the Census block groups within or immediately adjacent to the ROW for the Proposed Build Alternatives and the boundary of the Study Area for Race and Ethnicity are the Census blocks within or immediately adjacent to the ROW for the Proposed Build Alternatives. As discussed in **Chapter 2 - Alternatives Considered**, both Proposed Build Alternatives follow the same general alignment of the existing US 281 project corridor. While the ROW requirements for both Proposed Alternatives are slightly different, the Census geographies within or adjacent to both ROWs are the same therefore, the study areas are the same for both Proposed Build Alternative. There are 128 Census blocks within or adjacent to the proposed ROWs (**Figure 3-5a** through **Figure 3-5c**) and nine Census Block Groups within or adjacent to the proposed ROWs (**Figure 3-6**).

Figure 3-5a: Study area for race and ethnicity – 2010 census blocks



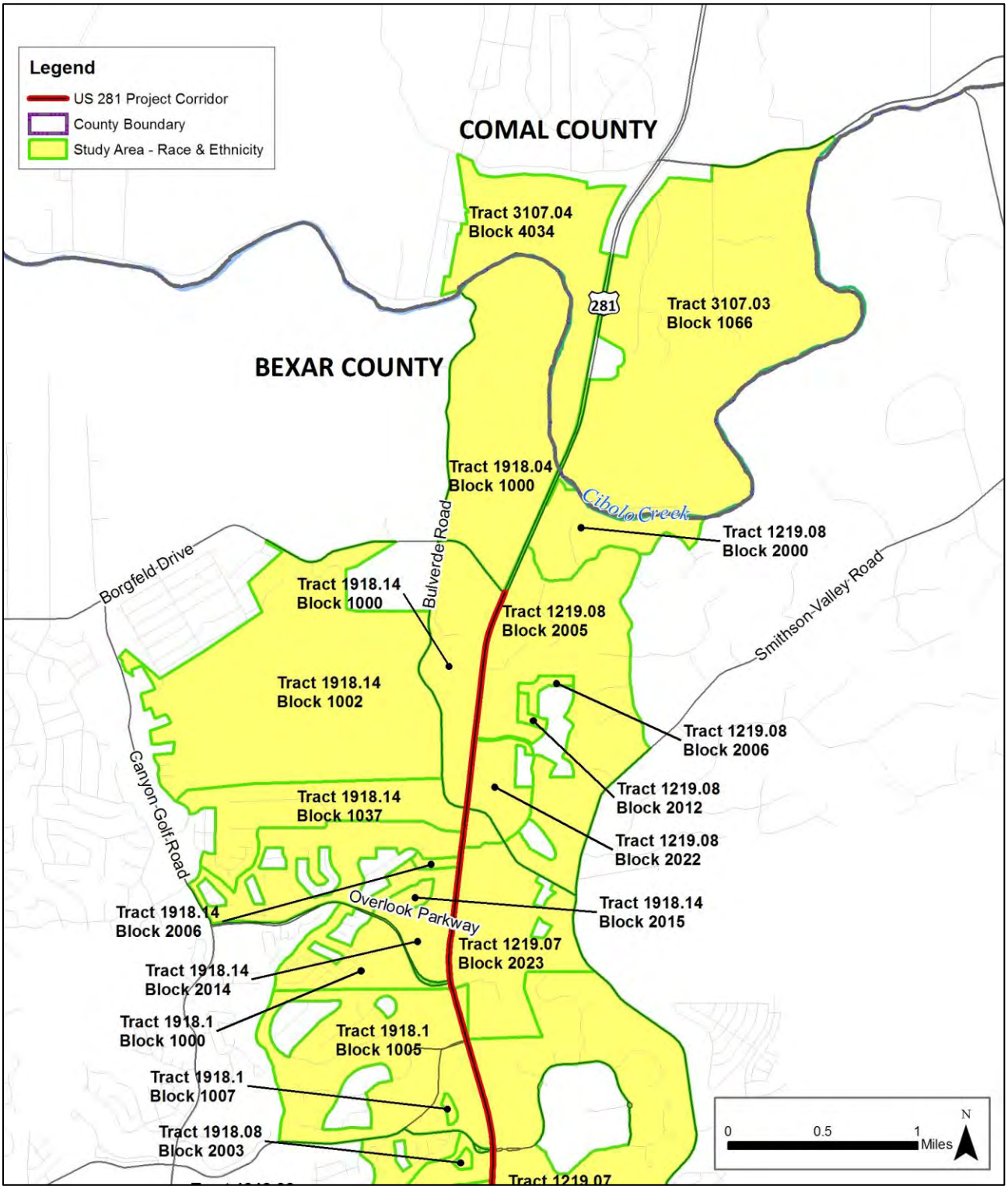
Source: US Census Bureau 2011.

Figure 3-5b: Study area for race and ethnicity – 2010 census blocks



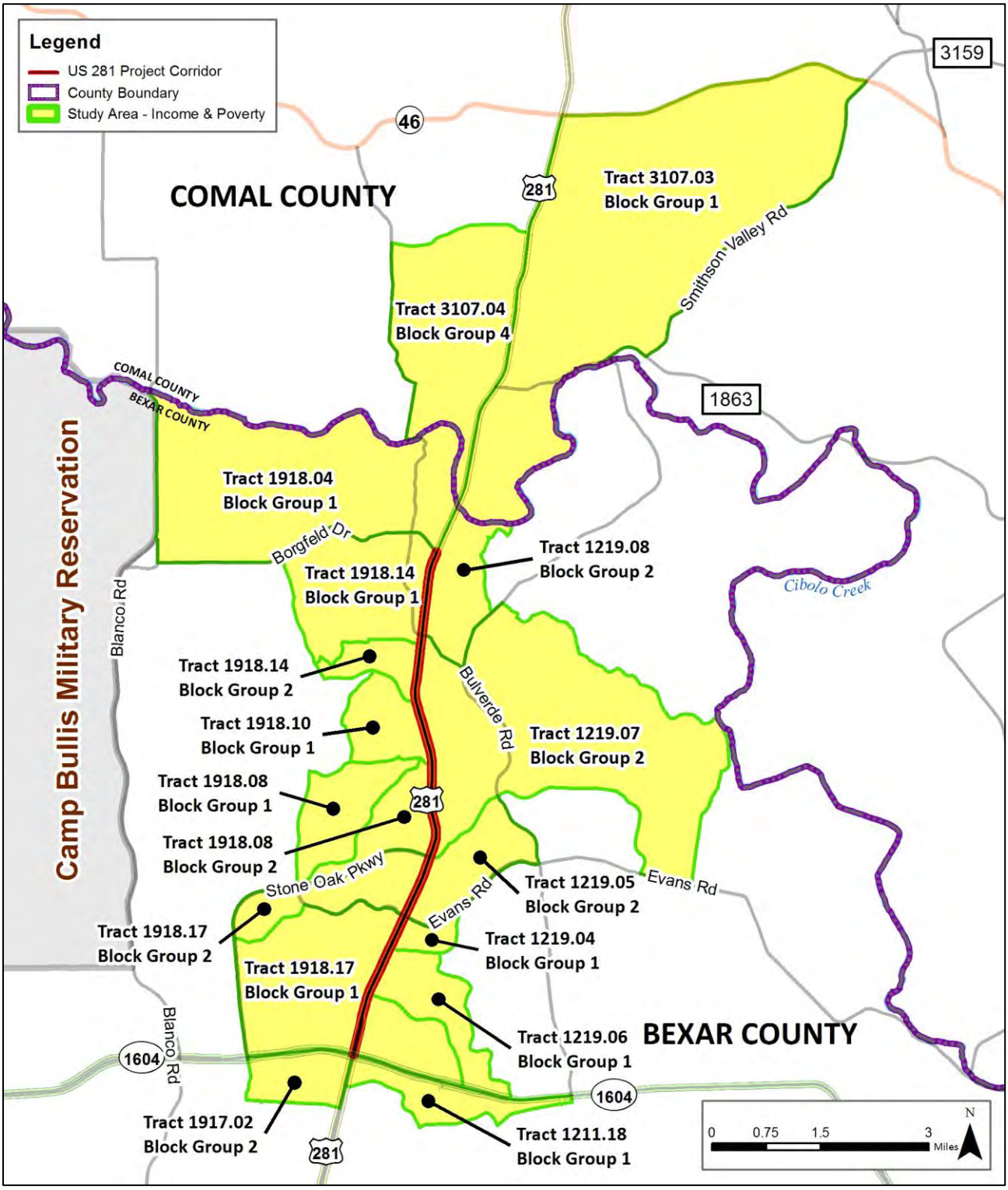
Source: US Census Bureau 2011.

Figure 3-5c: Study area for race and ethnicity – 2010 census blocks



Source: US Census Bureau 2011.

Figure 3-6: Study area for income and poverty – 2010 census block groups



Source: US Census Bureau 2011.

Based on existing guidance from the Council on Environmental Quality (CEQ) and the US Environmental Protection Agency (EPA) a "minority population may be present if the minority population percentage in the affected area is 'meaningfully greater' than the minority population percentage in the general population or other appropriate unit of geographic analysis." The CEQ guidance suggests that minority populations will always be "meaningfully greater" when the percentage of minorities exceeds 50 percent, regardless of what the percentage of minority population is in the comparison geographic unit. And, that this same method can be used to determine the presence of low-income populations.

- Minority populations that could be affected by the Proposed Build Alternatives are identified by applying the 50 percent threshold to each census block within the Study Area for Race and Ethnicity. If any minority population comprises more than 50 percent of the total population within that respective census block then it is considered an environmental justice block.

As described above, low income is defined as a person whose median household income is at or below the USDHHS poverty guidelines. The average household size around the US 281 project corridor is between 2.60 and 2.75 people in 2010. In order to be more inclusive, the USDHHS guideline for a 3-person household ($19,090) was used. The USDHHS poverty guideline is reported in 2012 dollars; however, income data reported by the US Census Bureau is in 2010 dollars. In order to ensure a fair comparison, the poverty guideline was adjusted using the US Bureau of Labor Statistics' consumer price index. In 2010 dollars, $19,090 is equal to $18,136; this value was used to indentify low-income household in the Study Area for Income and Poverty.

- Low-income populations that could be affected by the Proposed Build Alternatives are identified if the median household income in a census block group within the Study Area for Income and Poverty is equal to or below $18,136. If any low-income population is identified then the census block group is considered an environmental justice block group.

Distribution of Minority Populations

In the Study Area for Race and Ethnicity there are 83 blocks that contain no population; no population may signify that there are no residential land uses in that block. **Table 3-8** shows the racial and ethnic distribution of people within the Study Area for Race and Ethnicity for all populated census blocks. The red highlighting in the table signifies that the minority population within the respective census block exceeds the 50 percent threshold.

Table 3-8: Race and Ethnicity – 2010 Census

Geography	Total 2010 Population	White Only	Black or African American Only	American Indian/ Alaska Native Only	Asian Only	Native Hawaiian/ Other Pacific Islander Only	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Total Minority
Bexar County Blocks										
Tract 1219.05, Block 2001	9 100.0%	8 88.9%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 11.1%	0 0.0%	7 77.8%	7 77.8%
Tract 1219.05, Block 2002	1,324 100.0%	1,050 79.3%	108 8.2%	4 0.3%	93 7.0%	7 0.5%	31 2.3%	31 2.3%	396 29.9%	621 46.9%
Tract 1219.05, Block 2005	83 100.0%	58 69.9%	5 6.0%	0 0.0%	12 14.5%	0 0.0%	0 0.0%	8 9.6%	35 42.2%	56 67.5%
Tract 1219.05, Block 2016	89 100.0%	61 68.5%	0 0.0%	0 0.0%	22 24.7%	0 0.0%	1 1.1%	5 5.6%	28 31.5%	52 58.4%
Tract 1219.05, Block 2017	131 100.0%	101 77.1%	14 10.7%	0 0.0%	16 12.2%	0 0.0%	0 0.0%	0 0.0%	27 20.6%	57 43.5%
Tract 1219.05, Block 2026	438 100.0%	286 65.3%	26 5.9%	8 1.8%	87 19.9%	0 0.0%	10 2.3%	21 4.8%	148 33.8%	274 62.6%
Tract 1219.05, Block 2036	666 100.0%	399 59.9%	41 6.2%	1 0.2%	161 24.2%	1 0.2%	29 4.4%	34 5.1%	200 30.0%	424 63.7%
Tract 1219.06, Block 1005	164 100.0%	156 95.1%	1 0.6%	0 0.0%	7 4.3%	0 0.0%	0 0.0%	0 0.0%	22 13.4%	30 18.3%
Tract 1219.06, Block 1006	41 100.0%	41 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	7 17.1%	7 17.1%
Tract 1219.06, Block 1010	405 100.0%	309 76.3%	19 4.7%	2 0.5%	19 4.7%	0 0.0%	43 10.6%	13 3.2%	164 40.5%	211 52.1%
Tract 1219.06, Block 1012	140 100.0%	126 90.0%	3 2.1%	0 0.0%	6 4.3%	0 0.0%	1 0.7%	4 2.9%	30 21.4%	42 30.0%
Tract 1219.06, Block 2000	1,349 100.0%	1,083 80.3%	60 4.4%	1 0.1%	55 4.1%	0 0.0%	95 7.0%	55 4.1%	490 36.3%	634 47.0%
Tract 1219.07, Block 2023	196 100.0%	152 77.6%	24 12.2%	2 1.0%	9 4.6%	0 0.0%	6 3.1%	3 1.5%	50 25.5%	86 43.9%
Tract 1219.07, Block 2075	325 100.0%	300 92.3%	1 0.3%	1 0.3%	15 4.6%	0 0.0%	1 0.3%	7 2.2%	47 14.5%	70 21.5%
Tract 1219.07, Block 2080	201 100.0%	147 73.1%	16 8.0%	0 0.0%	12 6.0%	0 0.0%	11 5.5%	15 7.5%	65 32.3%	102 50.7%
Tract 1219.08, Block 2000	44 100.0%	44 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	14 31.8%	14 31.8%

Table 3-8: Race and Ethnicity – 2010 Census

Geography	Total 2010 Population	White Only	Black or African American Only	American Indian/ Alaska Native Only	Asian Only	Native Hawaiian/ Other Pacific Islander Only	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Total Minority
Tract 1219.08, Block 2005	593	505	22	1	19	0	24	22	129	184
	100.0%	85.2%	3.7%	0.2%	3.2%	0.0%	4.0%	3.7%	21.8%	31.0%
Tract 1219.08, Block 2006	56	47	6	0	3	0	0	0	11	20
	100.0%	83.9%	10.7%	0.0%	5.4%	0.0%	0.0%	0.0%	19.6%	35.7%
Tract 1219.08, Block 2012	102	80	6	0	9	0	3	4	41	57
	100.0%	78.4%	5.9%	0.0%	8.8%	0.0%	2.9%	3.9%	40.2%	55.9%
Tract 1219.08, Block 2022	128	104	4	1	3	0	6	10	47	58
	100.0%	81.3%	3.1%	0.8%	2.3%	0.0%	4.7%	7.8%	36.7%	45.3%
Tract 1917.02, Block 2021	11	10	0	0	0	0	0	1	1	2
	100.0%	90.9%	0.0%	0.0%	0.0%	0.0%	0.0%	9.1%	9.1%	18.2%
Tract 1918.08, Block 1000	434	301	33	1	57	0	23	19	91	194
	100.0%	69.4%	7.6%	0.2%	13.1%	0.0%	5.3%	4.4%	21.0%	44.7%
Tract 1918.08, Block 2000	222	196	3	0	5	0	13	5	64	75
	100.0%	88.3%	1.4%	0.0%	2.3%	0.0%	5.9%	2.3%	28.8%	33.8%
Tract 1918.08, Block 2003	59	45	0	0	2	0	7	5	27	36
	100.0%	76.3%	0.0%	0.0%	3.4%	0.0%	11.9%	8.5%	45.8%	61.0%
Tract 1918.08, Block 2004	135	115	1	0	5	0	4	10	41	51
	100.0%	85.2%	0.7%	0.0%	3.7%	0.0%	3.0%	7.4%	30.4%	37.8%
Tract 1918.08, Block 2005	583	457	55	3	17	0	36	25	215	300
	100.0%	78.4%	9.4%	0.5%	2.9%	0.0%	4.5%	4.3%	36.9%	51.5%
Tract 1918.10, Block 1000	1,508	1,168	115	5	54	4	98	64	492	695
	100.0%	77.5%	7.6%	0.3%	3.6%	0.3%	6.5%	4.2%	32.6%	46.1%
Tract 1918.10, Block 1005	857	687	28	4	91	0	25	22	224	355
	100.0%	80.2%	3.3%	0.5%	10.6%	0.0%	2.9%	2.6%	26.1%	41.4%
Tract 1918.10, Block 1007	59	20	1	0	22	0	3	13	16	41
	100.0%	33.9%	1.7%	0.0%	37.3%	0.0%	5.1%	22.0%	27.1%	69.5%
Tract 1918.14, Block 1000	15	14	0	0	0	0	1	0	3	3
	100.0%	93.3%	0.0%	0.0%	0.0%	0.0%	6.7%	0.0%	20.0%	20.0%
Tract 1918.14, Block 1002	227	195	3	0	10	0	12	7	75	93
	100.0%	85.9%	1.3%	0.0%	4.4%	0.0%	5.3%	3.1%	33.0%	41.0%
Tract 1918.14, Block 1037	568	513	17	5	8	1	15	9	140	175
	100.0%	90.3%	3.0%	0.9%	1.4%	0.2%	2.6%	1.6%	24.6%	30.8%
Tract 1918.14, Block 2000	998	818	40	2	42	4	48	44	273	382
	100.0%	82.0%	4.0%	0.2%	4.2%	0.4%	4.8%	4.4%	27.4%	38.3%
Tract 1918.14, Block 2006	83	61	0	0	7	0	10	5	32	41
	100.0%	73.5%	0.0%	0.0%	8.4%	0.0%	12.0%	6.0%	38.6%	49.4%

Table 3-8: Race and Ethnicity – 2010 Census

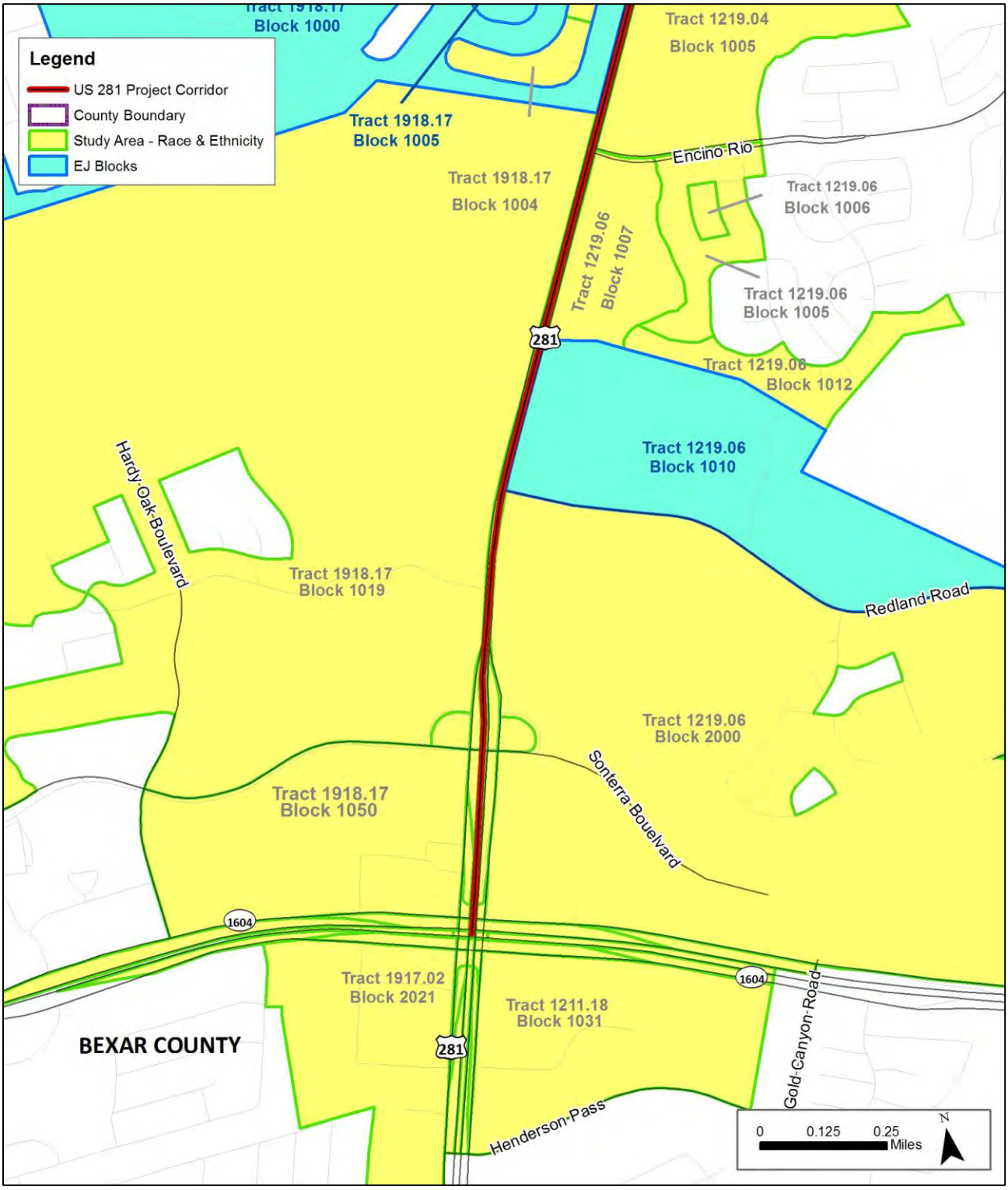
Geography	Total 2010 Population	White Only	Black or African American Only	American Indian/ Alaska Native Only	Asian Only	Native Hawaiian/ Other Pacific Islander Only	Some Other Race	Two or More Races	Hispanic or Latino (of any race)	Total Minority
Tract 1918.14, Block 2014	385 100.0%	301 78.2%	21 5.5%	4 1.0%	13 3.4%	0 0.0%	18 4.7%	28 7.3%	136 35.3%	183 47.5%
Tract 1918.14, Block 2015	187 100.0%	115 61.5%	34 18.2%	2 1.1%	14 7.5%	0 0.0%	15 8.0%	7 3.7%	57 30.5%	109 58.3%
Tract 1918.17, Block 1000	1,103 100.0%	849 77.0%	50 4.5%	1 0.1%	116 10.5%	2 0.2%	45 4.1%	40 3.6%	374 33.9%	558 50.6%
Tract 1918.17, Block 1004	146 100.0%	130 89.0%	0 0.0%	0 0.0%	7 4.8%	0 0.0%	9 6.2%	0 0.0%	56 38.4%	63 43.2%
Tract 1918.17, Block 1005	88 100.0%	73 83.0%	1 1.1%	0 0.0%	11 12.5%	0 0.0%	0 0.0%	3 3.4%	31 35.2%	46 52.3%
Tract 1918.17, Block 1007	129 100.0%	101 78.3%	0 0.0%	3 2.3%	13 10.1%	0 0.0%	5 3.9%	7 5.4%	14 10.9%	34 26.4%
Tract 1918.17, Block 1019	1,281 100.0%	1,104 86.2%	39 3.0%	0 0.0%	72 5.6%	2 0.2%	19 1.5%	45 3.5%	212 16.5%	353 27.6%
Tract 1918.17, Block 1050	2 100.0%	2 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Tract 1918.17, Block 2001	986 100.0%	771 78.2%	61 6.2%	5 0.5%	76 7.7%	0 0.0%	51 5.2%	22 2.2%	364 36.9%	520 52.7%
Comal County Blocks										
Tract 3107.03, Block 1066	23 100.0%	23 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	12 52.2%	12 52.2%
Tract 3107.04, Block 4034	8 100.0%	4 50.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	4 50.0%	0 0.0%	8 100.0%	8 100.0%
Study Area for Race and Ethnicity										
Total	16,581 100.0%	13,130 79.2%	858 5.2%	56 0.3%	1,190 7.2%	21 0.1%	713 4.3%	613 3.7%	4,916 29.6%	7,335 44.2%

Source: US Census Bureau, 2010 Census, Summary File 1, Table P5 – Hispanic or Latino Origin by Race, December 2011.

Note: Red-shading indicates greater than 50 percent minority population.

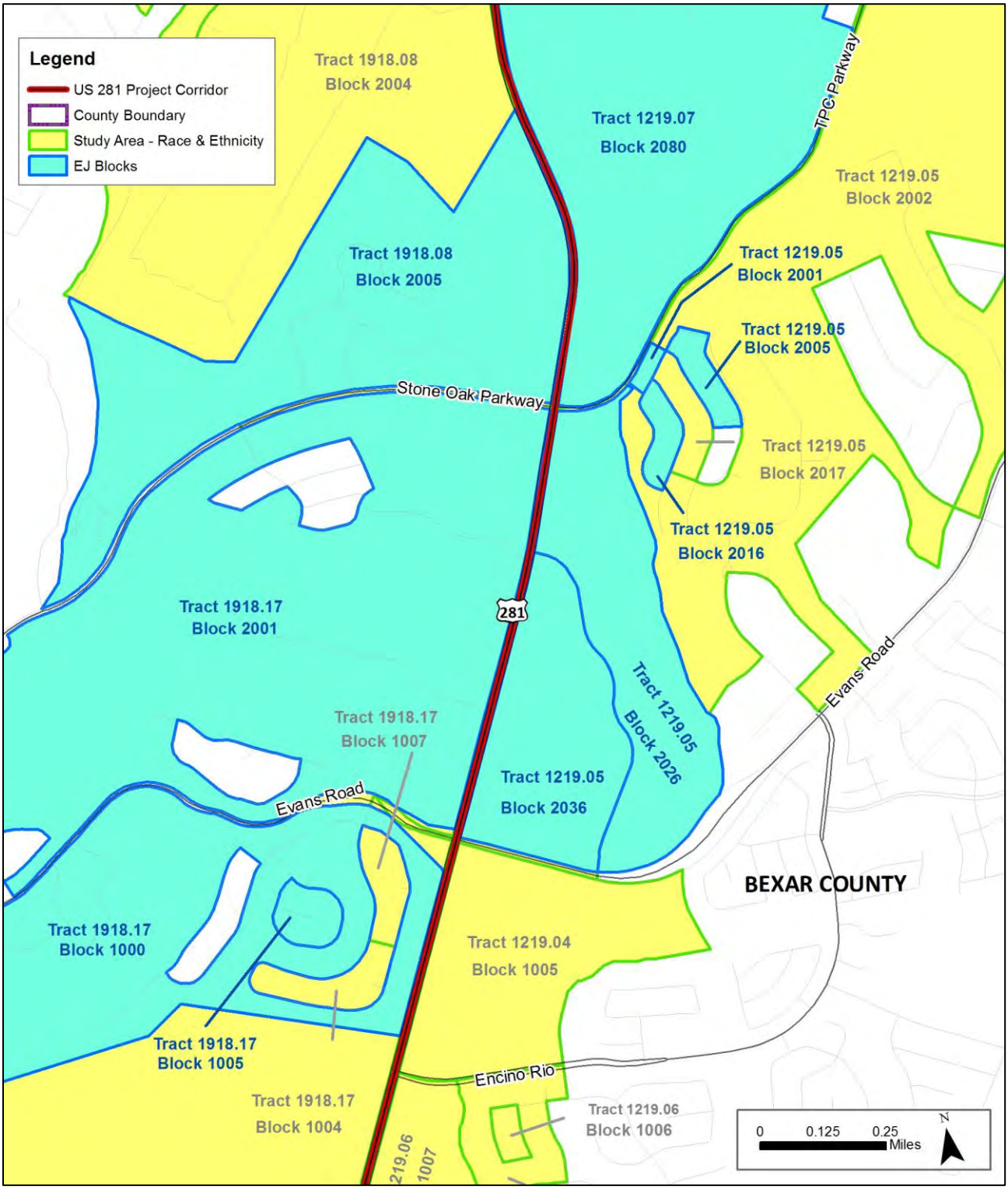
When applying the 50 percent threshold, 17 blocks, highlighted red in **Table 3-8** are identified as environmental justice blocks. **Figure 3-7a** through **Figure 3-7e** highlight where the environmental justice blocks have been identified in the Study Area for Race and Ethnicity.

Figure 3-7a: Environmental justice blocks in the study area for race and ethnicity



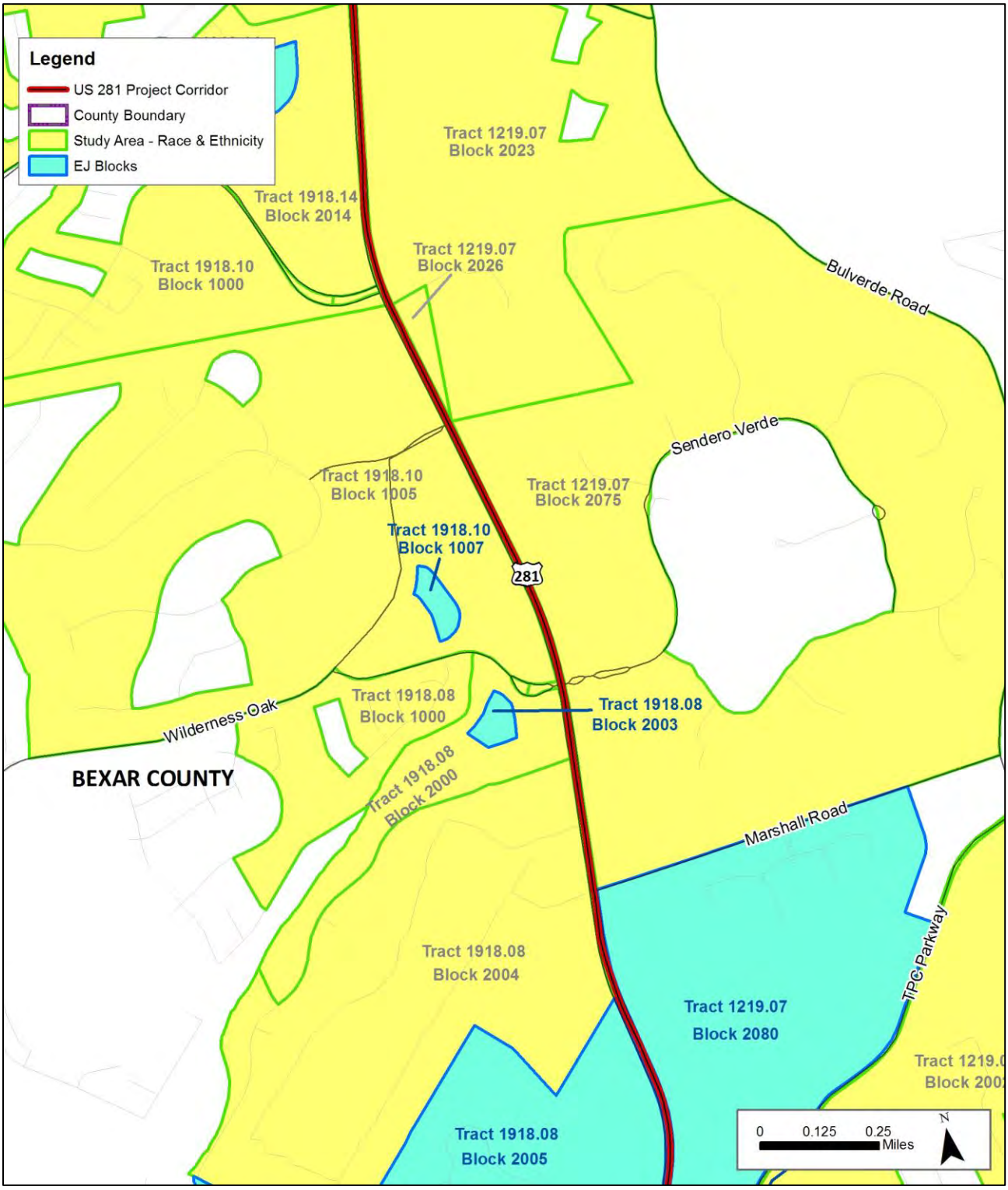
Source: US Census Bureau, 2010 Census, Summary File 1, Table P5 – Hispanic or Latino Origin by Race, US 281 EIS Team, December 2011.

Figure 3-7b: Environmental justice blocks in the study area for race and ethnicity



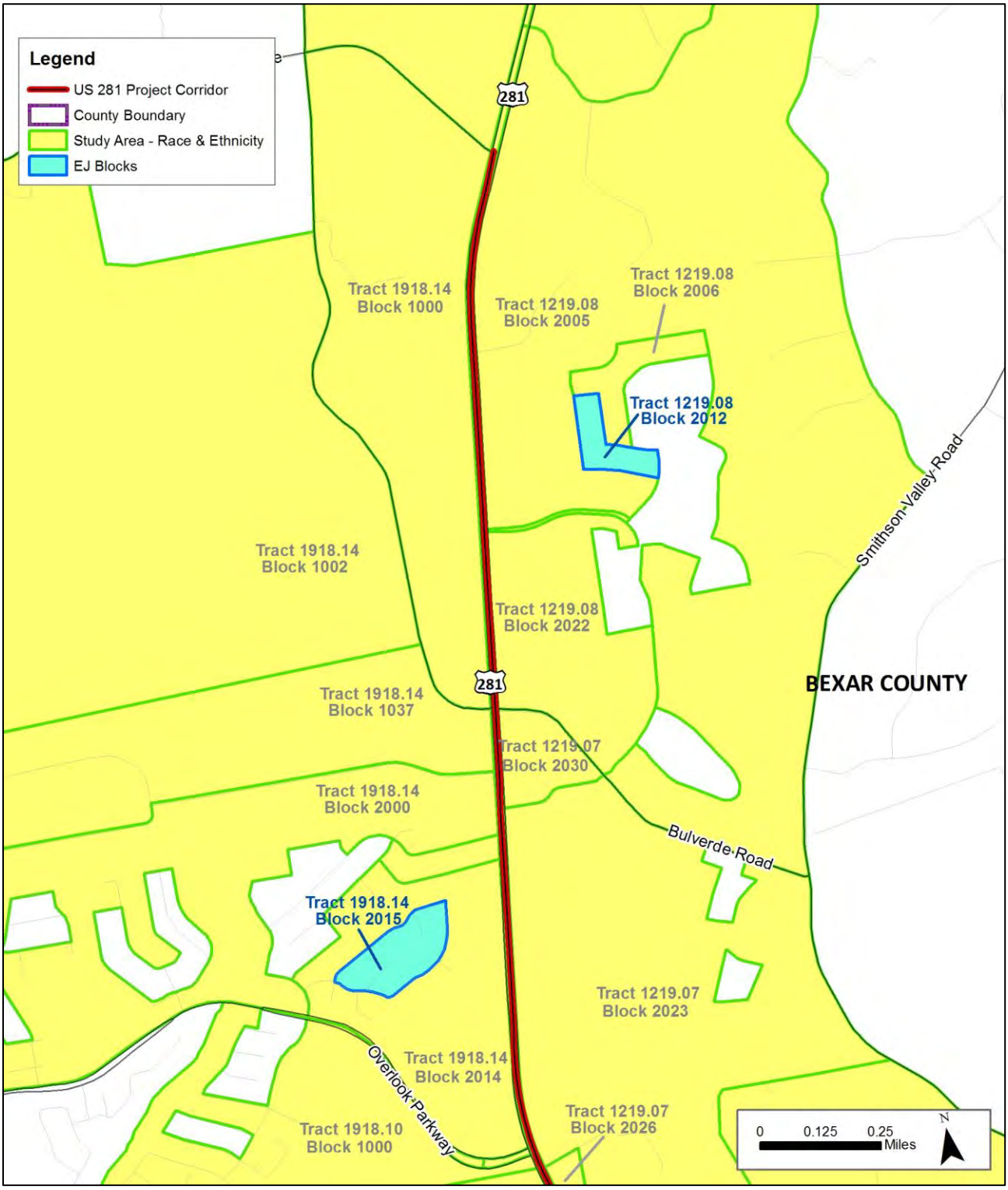
Source: US Census Bureau, 2010 Census, Summary File 1, Table P5 – Hispanic or Latino Origin by Race, US 281 EIS Team, December 2011.

Figure 3-7c: Environmental justice blocks in the study area for race and ethnicity



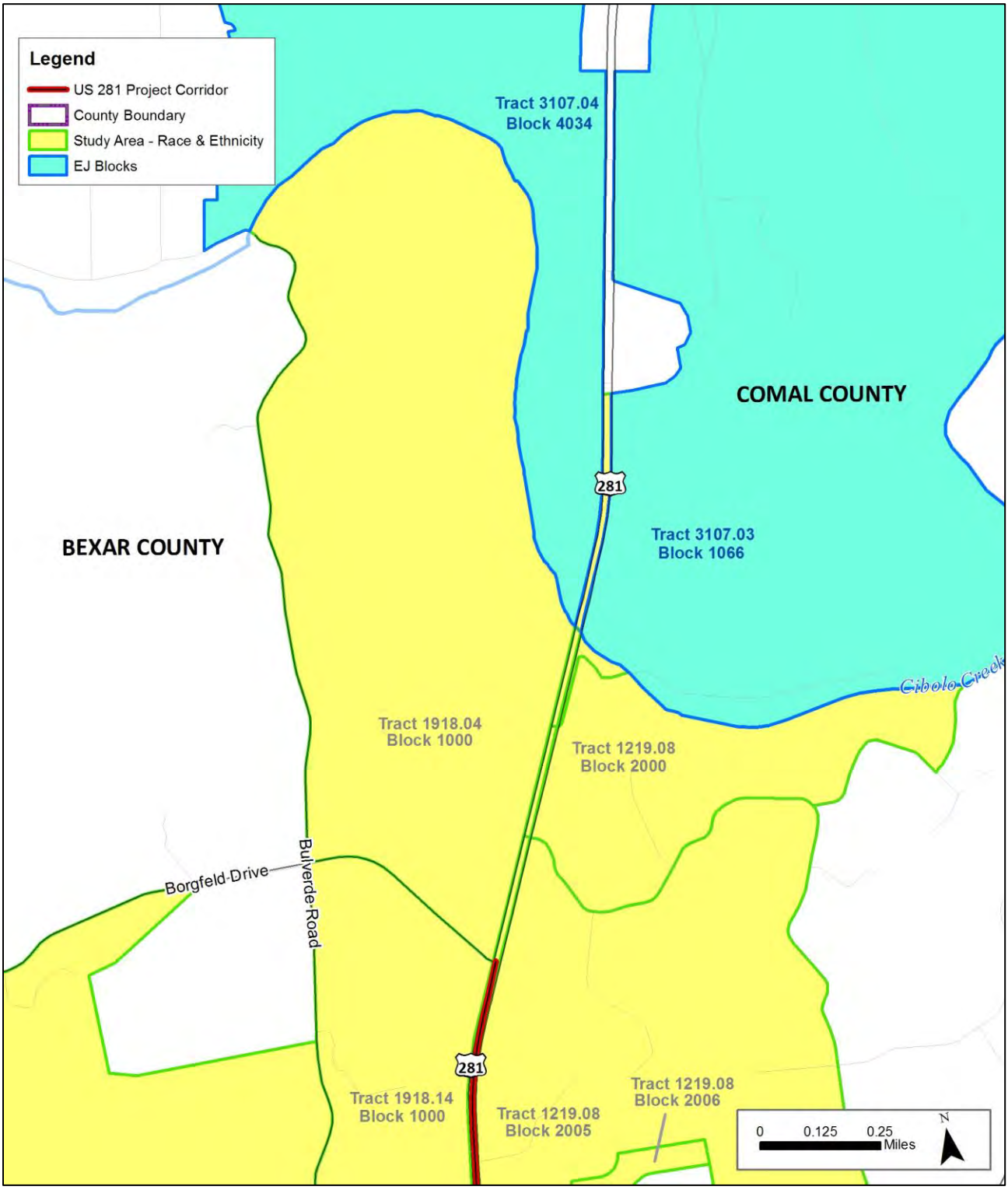
Source: US Census Bureau, 2010 Census, Summary File 1, Table P5 – Hispanic or Latino Origin by Race, US 281 EIS Team, December 2011.

1 **Figure 3-7d: Environmental justice blocks in the study area for race and ethnicity**



2
3 Source: US Census Bureau, 2010 Census, Summary File 1, Table P5 – Hispanic or Latino Origin by Race, US 281 EIS
4 Team, December 2011.

Figure 3-7e: Environmental justice blocks in the study area for race and ethnicity



Source: US Census Bureau, 2010 Census, Summary File 1, Table P5 – Hispanic or Latino Origin by Race, US 281 EIS Team, December 2011.

Distribution of Low-Income Populations

Table 3-9 reviews the distribution of household income in the Study Area for Income and Poverty.

Table 3-9: Household Income in the Study Area for Income and Poverty

Geography	Median Household Income	Total Households	Less than $10,000	$10,000 to $14,999	$15,000 to $19,999	Less than $19,999	$20,000 to $24,999	$25,000 to $29,000	$30,000 to $34,999	$35,000 to $39,999	$40,000 to $44,999	$45,000 to $49,999	$50,000 to $59,999	$60,000 to $74,999	$75,000 to $99,999	$100,000 to $124,999	$125,000 to $149,999	$150,000 to $199,999	$200,000 or More
Bexar County Block Groups																			
Tract 1211.18 Block Group 1	$105,880	471	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	21 4.5%	8 1.7%	0 0.0%	0 0.0%	38 8.1%	48 10.2%	111 23.6%	126 26.8%	23 4.9%	67 14.2%	29 6.2%
Tract 1219.04 Block Group 1	$86,339	405	16 4.0%	0 0.0%	13 3.2%	29 7.2%	15 3.7%	12 3.0%	0 0.0%	0 0.0%	0 0.0%	20 4.9%	39 9.6%	70 17.3%	67 16.5%	109 26.9%	26 6.4%	18 4.4%	0 0.0%
Tract 1219.05 Block Group 2	$120,543	1,014	8 0.8%	0 0.0%	37 3.6%	45 4.4%	29 2.9%	11 1.1%	8 0.8%	47 4.6%	79 7.8%	0 0.0%	40 3.9%	43 4.2%	109 10.7%	148 14.6%	144 14.2%	142 14.0%	169 16.7%
Tract 1219.06 Block Group 1	$86,838	1,011	14 1.4%	0 0.0%	0 0.0%	14 1.4%	0 0.0%	45 4.5%	69 6.8%	21 2.1%	0 0.0%	63 6.2%	67 6.6%	118 11.7%	208 20.6%	165 16.3%	105 10.4%	90 8.9%	46 4.5%
Tract 1219.06 Block Group 2	$67,917	823	13 1.6%	30 3.6%	59 7.2%	102 12.4%	0 0.0%	33 4.0%	51 6.2%	24 2.9%	15 1.8%	113 13.7%	16 1.9%	103 12.5%	81 9.8%	74 9.0%	155 18.8%	29 3.5%	27 3.3%
Tract 1219.07 Block Group 2	$76,904	2,177	0 0.0%	92 4.2%	12 0.6%	104 4.8%	45 2.1%	56 2.6%	70 3.2%	110 5.1%	9 0.4%	156 7.2%	174 8.0%	267 12.3%	487 22.4%	211 9.7%	190 8.7%	197 9.0%	101 4.6%
Tract 1219.08 Block Group 2	$121,681	419	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	11 2.6%	0 0.0%	10 2.4%	17 4.1%	24 5.7%	38 9.1%	119 28.4%	95 22.7%	62 14.8%	43 10.3%
Tract 1917.02 Block Group 2	$115,093	770	0 0.0%	15 1.9%	34 4.4%	49 6.4%	0 0.0%	0 0.0%	19 2.5%	15 1.9%	0 0.0%	61 7.9%	32 4.2%	17 2.2%	108 14.0%	126 16.4%	17 2.2%	202 26.2%	124 16.1%
Tract 1918.04 Block Group 1	$93,523	257	0 0.0%	12 4.7%	14 5.4%	26 10.1%	13 5.1%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	8 3.1%	13 5.1%	75 29.2%	25 9.7%	49 19.1%	28 10.9%	20 7.8%
Tract 1918.08 Block Group 1	$148,421	810	9 1.1%	8 1.0%	0 0.0%	17 2.1%	16 2.0%	0 0.0%	15 1.9%	0 0.0%	0 0.0%	0 0.0%	39 4.8%	51 6.3%	80 9.9%	49 6.0%	186 23.0%	246 30.4%	111 13.7%

Table 3-9: Household Income in the Study Area for Income and Poverty

Geography	Median Household Income	Total Households	Less than $10,000	$10,000 to $14,999	$15,000 to $19,999	Less than $19,999	$20,000 to $24,999	$25,000 to $29,000	$30,000 to $34,999	$35,000 to $39,999	$40,000 to $44,999	$45,000 to $49,999	$50,000 to $59,999	$60,000 to $74,999	$75,000 to $99,999	$100,000 to $124,999	$125,000 to $149,999	$150,000 to $199,999	$200,000 or More
Tract 1918.08 Block Group 2	$58,214	350	0 0.0%	57 16.3%	0 0.0%	57 16.3%	0 0.0%	0 0.0%	0 0.0%	28 8.0%	0 0.0%	11 3.1%	109 31.1%	0 0.0%	58 16.6%	62 17.7%	11 3.1%	0 0.0%	14 4.0%
Tract 1918.10 Block Group 1	$60,571	1,130	98 8.7%	12 1.1%	46 4.1%	156 13.8%	10 0.9%	34 3.0%	58 5.1%	47 4.2%	89 7.9%	146 12.9%	17 1.5%	85 7.5%	136 12.0%	179 15.8%	82 7.3%	32 2.8%	59 5.2%
Tract 1918.14 Block Group 1	$70,750	614	20 3.3%	61 9.9%	8 1.3%	89 14.5%	21 3.4%	0 0.0%	48 7.8%	42 6.8%	0 0.0%	27 4.4%	32 5.2%	72 11.7%	45 7.3%	92 15.0%	67 10.9%	42 6.8%	37 6.0%
Tract 1918.14 Block Group 2	$101,048	664	0 0.0%	10 1.5%	18 2.7%	28 4.2%	0 0.0%	14 2.1%	9 1.4%	0 0.0%	33 5.0%	0 0.0%	19 2.9%	20 3.0%	196 29.5%	156 23.5%	21 3.2%	81 12.2%	87 13.1%
Tract 1918.17 Block Group 1	$84,909	2,251	39 1.7%	61 2.7%	99 4.4%	199 8.8%	75 3.3%	87 3.9%	51 2.3%	75 3.3%	73 3.2%	117 5.2%	128 5.7%	243 10.8%	339 15.1%	256 11.4%	172 7.6%	175 7.8%	261 11.6%
Tract 1918.17 Block Group 2	$117,782	1,057	0 0.0%	15 1.4%	24 2.3%	39 3.7%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	71 6.7%	45 4.3%	81 7.7%	74 7.0%	55 5.2%	221 20.9%	177 16.7%	166 15.7%	128 12.1%
Comal County Block Groups																			
Tract 3107.03 Block Group 1	$79,831	557	0 0.0%	50 9.0%	0 0.0%	50 9.0%	46 8.3%	0 0.0%	0 0.0%	0 0.0%	32 5.7%	47 8.4%	11 2.0%	58 10.4%	155 27.8%	46 8.3%	24 4.3%	70 12.6%	18 3.2%
Tract 3107.04 Block Group 4	$51,964	618	16 2.6%	0 0.0%	37 6.0%	53 8.6%	82 13.3%	19 3.1%	48 7.8%	15 2.4%	23 3.7%	47 7.6%	28 4.5%	30 4.9%	55 8.9%	32 5.2%	23 3.7%	148 23.9%	15 2.4%
Study Area for Income and Poverty																			
Study Area Total		15,398	233 1.5%	423 2.7%	401 2.6%	1,057 6.9%	352 2.3%	311 2.0%	467 3.0%	443 2.9%	424 2.8%	863 5.6%	895 5.8%	1,336 8.7%	2,403 15.6%	2,196 14.3%	1,567 10.2%	1,795 11.7%	1,289 8.4%

Source: US Census Bureau, American Community Survey 2006-2010 5-year Survey, Table B19001, Household Income in the Past 12 Months (In 2009 Inflation Dollars), June 2012.

Note: Red shading indicates low-income households.

There are no block groups in the Study Area for Income and Poverty with median household incomes less than $18,136 and therefore none meet the EJ definition for income. There are households in the Study Area for Income and Poverty that are low-income. As highlighted in red in **Table 3-10**, there are a total of 1,057 households that earn an annual income less than $19,999 of which 233 earn less than $10,000, 423 earn between $10,000 and $14,999 and 401 earn between $15,000 and $19,999. However, there are no block groups in the Study Area for Income and Poverty with a majority share of low-income households.

Table 3-10 shows the ratio of the incomes earned by individuals living in the Study Area for Income and Poverty relative to the national poverty threshold. Note, the poverty thresholds used by the US Census Bureau considered more factors than the poverty guidelines used by USDHHS and are therefore different. The USDHHS poverty guidelines are a simplified version of the US Census Bureau's poverty threshold. As highlighted in red, a ratio of less than 1.00 means that the income earned is less than the national poverty threshold. A ratio greater than 1.00 indicates that the income earned is greater than the poverty threshold.

Table 3-10: Ratio of Income to Poverty Threshold in the Study Area for Income and Poverty – American Community Survey 2006-2010 5-year Survey

Census Track and Block Group	Total Population	Under 0.50	0.50 to 0.99	Less than 1.00	1.00 to 1.49	1.50 to 1.99	2.00 and Over
Bexar County Block Groups							
Tract 1211.18 Block Group 1	1,639 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	119 7.3%	1,520 92.7%
Tract 1219.04 Block Group 1	937 100.0%	16 1.7%	48 5.1%	64 6.8%	0 0.0%	46 4.9%	827 88.3%
Tract 1219.05 Block Group 2	3,137 100.0%	8 0.3%	37 1.2%	45 1.4%	46 1.5%	128 4.1%	2,918 93.0%
Tract 1219.06 Block Group 1	2,666 100.0%	73 2.7%	0 0.0%	73 2.7%	76 2.9%	20 0.8%	2,497 93.7%
Tract 1219.06 Block Group 2	2,039 100.0%	39 1.9%	13 0.6%	52 2.6%	17 0.8%	185 9.1%	1,785 87.5%
Tract 1219.07 Block Group 2	6,767 100.0%	18 0.3%	167 2.5%	185 2.7%	267 3.9%	273 4.0%	6,042 89.3%
Tract 1219.08 Block Group 2	1,191 100.0%	9 0.8%	0 0.0%	9 0.8%	0 0.0%	0 0.0%	1,182 99.2%
Tract 1917.02 Block Group 2	2,146 100.0%	0 0.0%	29 1.4%	29 1.4%	33 1.5%	34 1.6%	2,050 95.5%
Tract 1918.04 Block Group 1	817 100.0%	0 0.0%	0 0.0%	0 0.0%	12 1.5%	14 1.7%	791 96.8%
Tract 1918.08 Block Group 1	2,663 100.0%	0 0.0%	35 1.3%	35 1.3%	61 2.3%	18 0.7%	2,549 95.7%
Tract 1918.08 Block Group 2	745 100.0%	0 0.0%	71 9.5%	71 9.5%	59 7.9%	0 0.0%	615 82.6%

Table 3-10: Ratio of Income to Poverty Threshold in the Study Area for Income and Poverty – American Community Survey 2006-2010 5-year Survey

Census Track and Block Group	Total Population	Under 0.50	0.50 to 0.99	Less than 1.00	1.00 to 1.49	1.50 to 1.99	2.00 and Over
Bexar County Block Groups							
Tract 1918.10 Block Group 1	3,007	147	47	194	149	358	2,306
	100.0%	4.9%	1.6%	6.5%	5.0%	11.9%	76.7%
Tract 1918.14 Block Group 1	1,714	21	38	59	271	164	1,220
	100.0%	1.2%	2.2%	3.4%	15.8%	9.6%	71.2%
Tract 1918.14 Block Group 2	2,184	0	37	37	29	102	2,016
	100.0%	0.0%	1.7%	1.7%	1.3%	4.7%	92.3%
Tract 1918.17 Block Group 1	5,696	104	60	164	198	410	4,924
	100.0%	1.8%	1.1%	2.9%	3.5%	7.2%	86.4%
Tract 1918.17 Block Group 2	3,390	12	114	126	0	107	3,157
	100.0%	0.4%	3.4%	3.7%	0.0%	3.2%	93.1%
Comal County Block Groups							
Tract 3107.03 Block Group 1	1,535	118	220	338	19	0	1,178
	100.0%	7.7%	14.3%	22.0%	1.2%	0.0%	76.7%
Tract 3107.04 Block Group 4	1,390	31	0	31	58	279	1,022
	100.0%	2.2%	0.0%	2.2%	4.2%	20.1%	73.5%
Study Area for Income and Poverty							
Total	43,663	596	916	1,512	1,295	2,257	38,599
	100.0%	1.4%	2.1%	3.5%	3.0%	5.2%	88.4%

Source: US Census Bureau, American Community Survey 2006-2010 5-year Survey, Table C17002 – Ratio of Income to Poverty Threshold in the Past 12 Months, June 2012.

Note: Red shading indicates income less than the national poverty level.

According to **Table 3-10**, there were 1,512 people in the Study Area for Income and Poverty in 2010 that earned an income less than the national poverty threshold.

Potential Effects to Minority and Low-Income Populations

Improvements to US 281 could potentially adversely affect EJ populations if ROW acquisition displaces or adversely affects the property where EJ populations live and/or work. An affected property is one where the ROW acquisition does not adversely affect a structure and/or does not reduce the economic viability of the remaining land. This type of ROW acquisition is generally acquired through an easement or purchased in fee-simple. A displacement occurs if a structure is impacted by the acquisition of ROW and/or the remaining land after ROW acquisition would not be useful for its intended use. A displacement could also occur is access to the property is permanently restricted. This type of ROW acquisition is generally purchased in fee-simple. All ROW acquisition will be conducted in compliance with the Uniform Relocation and Real Property Acquisition Polices Act of 1970 (Uniform Act).

The Uniform Act was established to ensure equitable treatment of all persons displaced as a direct result of federal actions and to maintain the economic and social well-being of the community. The policies of the Uniform Act ensure that displaced persons do not suffer disproportionate injuries as a result of a project designed for the benefit of the public as a whole. Relocation assistance must, to maximum extent feasible, assure that the unique circumstances of any displaced person are taken into account and that persons in essentially similar circumstances are afforded equal treatment. In addition, it mandates that available housing must be within the financial means of all displaced persons, including low-income families, and open to all persons regardless of race, color, sex, religion, or national origin (42 USC 4621).

Residential Displacements and Parcels Affected

The Expressway Alternative has the potential to:

- incorporate a portion of land from eight single-family residential parcels; all eight affected parcels are located in non-environmental justice blocks
- incorpotate a portion of land from one multi-family residential parcel; the affected parcel is located in an environmental justice block
- displace one single-family residence (including the parcel); it is located in a non-environmental justice block

The Elevated Expressway Alternative has the potential to:

- incorporate a portion of land from seven single-family residential parcels; all seven affected parcels are located in non- environmental justice blocks
- incorporate a portion of land from one multi-family residential parcel; the affected parcel is located in an environmental justice block
- no residences would be displaced

A displacement and relocation alternative analysis was conducted in accordance with the Uniform Act (see **Section 3.4.4**). Based on this analysis, comparable residential properties, in terms of location, amenities and cost, exist within the corridor and would likely be available to absorb the relocation of the potentially displaced residence.

Mitigation Strategies

If one of the Proposed Build Alternatives is identified as the Preferred Alternative for analysis in the Final EIS, the design would be further refined and a more detailed analysis of potential displacements and affected parcels would be conducted. While it does not appear that either of the Proposed Build Alternatives would cause disproportionately high and adverse affects to environmental justice populations as a result ofdisplaced or affected residential property, public outreach efforts will continue throughout the NEPA process. All reasonable efforts will be taken to avoid, minimize or mitigate the effects of displacement or to property of environmental justice populations.

Displaced Businesses

Improvements to US 281 have the potential to impact environmental justice populations through the displacement of businesses, thereby removing employment and/or services that may be relied upon by low-income and/or minority populations. According to a parcel level review of the businesses that could be displaced by the Proposed Build Alternatives:

- The Expressway Alternative has the potential to displace 26 businesses. Combined, businesses employ approximately 177 to 206 people. All 26

businesses are located in non-environmental justice blocks. None of the potentially displaced businesses provide for the basic needs of the community, such as a supermarket does. All of the potentially displaced businesses employ and provide goods and services for all people, environmental justice and non-environmental justice populations alike.

- The Elevated Expressway Alternative has the potential to displace 28 businesses. Combined, businesses employ approximately 169 to 194 people. All 28 businesses are located in non-environmental justice blocks. None of the potentially displaced businesses provide for the basic needs of the community. All of the potentially displaced businesses employ and provide goods and services for all people, environmental justice and non- environmental justice populations alike.

The displacements and relocations analysis conducted for the US 281 Corridor Project shows that a sufficient amount of commercial, retail, office and industrial space, appropriately zoned, would likely be available to absorb the relocation of the displaced businesses. It is possible that the displaced businesses may not wish to relocate in the US 281 project corridor and/or may discontinue business operations. As such, there is a potential for some lost employment opportunities. The loss of employment could adversely affect both environmental justice and non-environmental justice populations alike; as such these effects are unlikely to have a disproportionately high and adverse impact on environmental justice populations. The Alamo RMA will partner with the Texas Workforce Commission (TWC) to assist the potentially displaced businesses and their employees with relocation. TWC will be invited to participate in the Public Hearing and Public Meeting #4.

Financial Options

Toll roads have the potential to disproportionately affect low-income populations because a low-income person would have to use a larger percentage of his or her income to pay tolls when compared to the general population, given the same level of use. The Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane options. Therefore, consideration was given to determine if there would be a disproportionately high and adverse effect resulting from the operation of US 281 with toll and/or managed lanes.

By the year 2035, traffic conditions on the US 281 project corridor are expected to decline. Under the No Build Alternative the average speed of traffic in 2035 is expected to be 9 to 10 miles per hour (mph) during peak hours; these conditions will affect both EJ and non-EJ populations alike. If one of the Proposed Build Alternatives (Toll or Managed) were to be implemented, the new main lanes would be subject to tolls and the new frontage roads would provide a non-toll alternative for travel in the corridor. The SA-BC MPO traffic model projects that 2035 peak hour speed on the non-toll frontage roads would average 19 to 31 mph and, on the tolled main lanes, travel speeds would average 39 to 49 mph (see **Section 3.6.3**). All people could choose to travel along the frontage roads to avoid paying tolls or could choose to use the tolled main lanes; under the Proposed Build Alternatives, both of these options would offer improved traffic speeds over the No Build Alternative. As such, all motorist, EJ and non-EJ alike, stand to benefit from the creation of new capacity whether or not tolls were used to finance to improvements.

Appendix E provides a technical analysis at the project level of the effects of toll/managed lane options on EJ populations. The *Amended and Restated Polices for Toll*

Collection Operations on the Alamo RMA Turnpike System (April 2012) outlines the tolling policies for the US 281 Corridor Project as well as other proposed regional toll facilities. The updated toll prices range from $0.17 per mile to $0.50 per mile. The financial burden of the upper and lower values of this range, as well as a mid-range ($0.32 per mile) was analyzed for their effect on EJ populations (**Table 3-11**).

Table 3-11: Toll Cost Analysis

Toll Cost per mile	Daily Round Trip Cost	Yearly Cost*	Percent of Median Household Income		
			Bexar County ($45,315)	Comal County ($62,642)	Poverty Line ($18,136**)
$0.17	$2.72	$680	1.5%	1.1%	4.7%
$0.32	$5.12	$1,280	2.8%	2.0%	7.0%
$0.50	$8.00	$2,000	4.4%	3.2%	11.0%

Source: SA-BC MPO Traffic Model, 2009, US 281 EIS Team, 2012.
* Assumes 5 rounds trips per week for 50 weeks out of the year.
**$18,136 represents the 2012 USDHHS poverty guideline for a 3-person household, as adjusted to 2010 dollars using the Consumer Price Index.

Assuming that a motorist selects the toll facility for inbound and outbound trips, 5 days per week for 50 weeks out of the year, the financial burden of the tolling option could require a person with a household income at the 2012 USDHHS poverty guideline (as adjusted) to spend between 4.7 and 11.0 percent of their annual income on tolls. This financial burden to low-income populations is unlikely to be realized because a non-toll travel option would be provided in the US 281 project corridor that would offer better travel speeds than if no improvements were made. After considering the potential burdens and benefits of the toll/managed lanes options of the Proposed Build Alternatives, the project level toll analysis concludes that there would not be disproportionately high and adverse effects to EJ populations.

While there are no EJ block groups based on income in the Study Area for Income and Poverty or the demographic study area, EJ populations do exist in the larger region who use the US 281 project corridor; therefore, disproportionately high and adverse impacts are considered on the regional scale (see **Appendix F**). The regional level analysis concludes that there would likely be no adverse impacts to EJ populations resulting from the implementation of the toll/managed lane roadway system, in conjunction with the other non-toll facilities planned in *Mobility 2035*. As such, it is unlikely that low-income populations in the region would be disproportionately burdened under a toll/managed lane scenario.

Conclusion of Potential Effects for Minority and Low-Income Populations

In summary, no disproportionately high and adverse impacts to minority and/or low-income populations are likely to occur as a result of either of the Proposed Build Alternatives under consideration for the US 281 Corridor Project. EJ populations have been identified however they are not located in the area where residential displacements could occur. The Proposed Build Alternatives have the potential to displace businesses and could have the effect of displacing jobs within the US 281 project corridor, which could in turn have an adverse effect on the EJ population. However, these businesses provide employment and services for both EJ and non-EJ populations alike. None of the potentially displaced businesses are major employers nor do they provide for the basic

needs of the community overall. The displacement and relocation analysis conducted for the US 281 Corridor Project shows there is likely a sufficient amount of commercial, retail, office and industrial space, appropriately zoned, that would be available to absorb the relocation of the displaced businesses.

As described in **Chapter 2 - Alternatives Analysis**, the Proposed Build Alternatives are being considered for non-toll, toll and managed lanes options. The effects of the toll/managed lanes options on the EJ population were analyzed in two technical memos (**Appendix E** at the project level and **Appendix F** at the regional level). The project level analysis concludes that both the Expressway and Elevated Expressway Alternatives (Toll/Managed Lanes) offer a net benefit to all people when compared to the No Build Alternative, regardless of whether a person chooses a toll or non-toll route. And, the regional level analysis concludes that no disproportionately high and adverse impacts to EJ populations would likely result from the implementation of the regional toll/managed lane roadway system, in conjunction with the non-toll facilities and other regional transportation alternatives, as planned in *Mobility 2035*.

No disproportionately high and adverse effects are anticipated to result from implementation of either of the Proposed Build Alternatives. Public outreach efforts will continue throughout the NEPA process to ensure the full and fair participation of all people, including EJ populations, in the decision-making process.

Under the No-Build Alternative it is unlikely that low-income or minority populations would experience disproportionately high and adverse impacts. The No-Build Alternative could result in reduced mobility along the US 281 project corridor, as discussed in **Section 3.6** . A reduction in mobility could, in turn, result in adverse effects to all people, including EJ populations. For example, slow travel speeds could require more time to commute to and from work.

Limited English Proficiency

NEPA requires that projects undergoing scoping and environmental analysis and review communicate with local residents who could be affected by the construction and operations of a proposed project. Meaningful communication includes conveying messages, reports, and other materials in language(s) that local citizens can understand to the greatest extent practical. LEP is defined as having "limited ability to read, write, speak, or understand English" (67 Federal Register (FR) 41459). Data from the American Community Survey 2006-2010 5-year survey was gathered at the county and Census tract level to identify if there are LEP populations in the demographic study area that could be affected by the US 281 Corridor Project (see **Figure 3-3**). As Census data is self-reported, an individual's ability to speak English represents the respondent's own perception about his/her ability to speak English.

As shown in **Table 3-12**, the people living within the demographic study area speak many languages. Two approaches were taken to determine if those that speak languages other than English have limited ability to read, write or speak English. The first approach looks at the languages spoken in the demographic study area and identifies individuals living in the demographic study area that speak English less than very well, as highlighted in Table 3-13. The second approach focuses on identifying households within the demographic study area that are linguistically isolated (Table 3-13). See Appendix G-1 for detailed tables by Census tract.

Table 3-12: Languages Spoken within the Demographic Study Area

Language	Number of Speakers
English	77,277
Spanish or Spanish Creole	18,414
Chinese	645
Hindi	519
Tagalog	457
German	426
Urdu	355
Korean	291
Other Asian Languages	279
African Languages	263
Russian	251
Arabic	229
Gujarti	214
French (including Patois and Creole)	163
Vietnamese	153
Portuguese or Portuguese Creole	116
Other Indic Languages	115
Persian	107
Greek	79
Hebrew	72
Thai	57
Other West Germanic Languages	41
Other Pacific Island Languages	35
Hungarian	29
Japanese	26
Italian	23
Polish	20
Serbo-Croatian	10
Other Slavic Languages	9

Source: US Census Bureau, 2006-2010 American Community Survey, Languages Spoken at home.

Table 3-13: Population within the Demographic Study Area that Speak English Less than Very Well

Language		Bexar & Comal counties Total	Demographic Study Area Total
Total Population		1,618,832 100.0%	100,675 100.0%
English	Only	944,592 58.4%	77,277 76.8%
Spanish or Spanish Creole	Total Speakers	618,909 38.2%	18,414 18.3%
	Speaks English Very Well	435,384 70.3%	14,071 76.4%
	Speaks English Less than Very Well	183,525 29.7%	4,343 23.6%
Chinese	Total Speakers	4,649 0.3%	645 0.6%
	Speaks English Very Well	2,310 49.7%	392 60.8%
	Speaks English Less than Very Well	2,339 50.3%	253 39.2%
Hindi	Total Speakers	2,374 0.1%	519 0.5%
	Speaks English Very Well	1,698 71.5%	356 68.6%
	Speaks English Less than Very Well	676 28.5%	163 31.4%
Tagalog	Total Speakers	5,354 0.3%	457 0.5%
	Speaks English Very Well	4,056 75.8%	356 77.9%
	Speaks English Less than Very Well	1,298 24.2%	101 22.1%
German	Total Speakers	8,615 0.5%	426 0.4%
	Speaks English Very Well	7,526 87.4%	362 85.0%
	Speaks English Less than Very Well	1,089 12.6%	64 15.0%
Urdu	Total Speakers	1,342 0.1%	355 0.4%
	Speaks English Very Well	965 71.9%	210 59.2%
	Speaks English Less than Very Well	377 28.1%	145 40.8%
Korean	Total Speakers	2,900 0.2%	291 0.3%
	Speaks English Very Well	1,380 47.6%	118 40.5%

Table 3-13: Population within the Demographic Study Area that Speak English Less than Very Well

Language		Bexar & Comal counties Total	Demographic Study Area Total
	Speaks English Less than Very Well	1,520 52.4%	173 59.5%
Other Asian Languages	Total Speakers	2,975 0.2%	279 0.3%
	Speaks English Very Well	2,361 79.4%	238 85.3%
	Speaks English Less than Very Well	614 20.6%	41 14.7%
African Languages	Total Speakers	1,886 0.1%	263 0.3%
	Speaks English Very Well	955 50.6%	217 82.5%
	Speaks English Less than Very Well	931 49.4%	46 17.5%
Russian	Total Speakers	1,469 0.1%	251 0.2%
	Speaks English Very Well	1,009 68.7%	213 84.9%
	Speaks English Less than Very Well	460 31.3%	38 15.1%
Arabic	Total Speakers	2,943 0.2%	229 0.2%
	Speaks English Very Well	1,973 67.0%	198 86.5%
	Speaks English Less than Very Well	970 33.0%	31 13.5%
Gujarti	Total Speakers	1,283 0.1%	214 0.2%
	Speaks English Very Well	754 58.8%	103 48.1%
	Speaks English Less than Very Well	529 41.2%	111 51.9%
French (including Patois and Cajun)	Total Speakers	4,138 0.3%	163 0.2%
	Speaks English Very Well	3,591 86.8%	105 64.4%
	Speaks English Less than Very Well	547 13.2%	58 55.2%
Vietnamese	Total Speakers	3,488 0.2%	153 0.2%
	Speaks English Very Well	1,357 38.9%	52 34.0%

Table 3-13: Population within the Demographic Study Area that Speak English Less than Very Well

Language		Bexar & Comal counties Total	Demographic Study Area Total
	Speaks English Less than Very Well	2,131 61.1%	101 66.0%
Portuguese/ Portuguese Creole	Total Speakers	761 0.0%	116 0.1%
	Speaks English Very Well	676 88.8%	97 83.6%
	Speaks English Less than Very Well	85 11.2%	19 16.4%
Other Indic Languages	Total Speakers	1,071 0.1%	115 0.1%
	Speaks English Very Well	704 65.7%	80 69.6%
	Speaks English Less than Very Well	367 34.3%	35 30.4%
Thai	Total Speakers	855 0.1%	57 0.1%
	Speaks English Very Well	533 62.3%	33 57.9%
	Speaks English Less than Very Well	322 37.7%	24 42.1%
Other West Germanic Languages	Total Speakers	227 0.0%	41 0.0%
	Speaks English Very Well	211 93.0%	36 87.8%
	Speaks English Less than Very Well	16 7.0%	5 12.2%
Other Pacific Island Languages	Total Speakers	987 0.1%	35 0.0%
	Speaks English Very Well	566 57.3%	8 22.9%
	Speaks English Less than Very Well	421 42.7%	27 77.1%
Japanese	Total Speakers	1,565 0.1%	26 0.0%
	Speaks English Very Well	1,003 64.1%	12 46.2%
	Speaks English Less than Very Well	562 35.9%	14 53.8%

Source: U.S Census Bureau, American Community Survey 2006-2010 5-year survey, Table B16001, Age by Language Spoken at Home by Ability to Speak English for Population 5 Years and Over, June 2012.

As **Table 3-13** shows, approximately 76.8 percent of the people who live in the demographic study area speak English only. Of those that speak a language other than English and speak English less than very well, most speak Spanish or Spanish Creole (4,343 people), followed by: Chinese (253 people); Korean (173 people); Hindi (163 people); Urdu (145 people); Gujarti (111 people); Tagalog (101 people); Vietnamese (101 people); German (64 people); French (58 people); African languages (46 people); other Asian languages (41 people); Russian (38 people); other Indic languages (35 people); Arabic (31 people); other Pacific Island languages (27 people); Thai (24 people); Portuguese (19 people); Japanese (14 people); and other West Germanic languages (5 people).

Table 3-14: Linguistically Isolated Households in the Demographic Study Area

Geography	Total Households	English Only	Spanish			Other Indo-European Languages			Asian and Pacific Island Languages			Other Languages		
			Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated
Bexar & Comal counties Total	619,208 100.0%	318,224 51.4%	272,516 44.0%	41,042 15.1%	231,474 84.9%	14,656 2.4%	1,313 9.0%	13,343 91.0%	11,551 1.9%	2,440 21.1%	9,111 78.9%	2,261 0.4%	313 13.8%	1,948 86.2%
Bexar County Tract 1219.03	1,627 100.0%	1,195 73.4%	365 22.4%	12 3.3%	353 96.7%	14 0.9%	0 0.0%	14 100.0%	53 3.3%	0 0.0%	53 100.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1219.04	1,242 100.0%	956 77.0%	219 17.6%	14 6.4%	205 93.6%	29 2.3%	0 0.0%	29 100.0%	18 1.4%	8 44.4%	10 55.6%	20 1.6%	0 0.0%	20 100.0%
Bexar County Tract 1219.05	1,430 100.0%	962 67.3%	284 19.9%	16 5.6%	268 94.4%	86 6.0%	18 20.9%	68 79.1%	85 5.9%	12 14.1%	73 85.9%	13 0.9%	0 0.0%	13 100.0%
Bexar County Tract 1219.06	1,834 100.0%	1,151 62.8%	593 32.3%	42 7.1%	551 92.9%	55 3.0%	14 25.5%	41 74.%	14 0.8%	0 0.0%	14 100.0%	21 1.1%	0 0.0%	21 100.0%
Bexar County Tract 1219.07	2,420 100.0%	1,626 67.2%	582 24.0%	47 8.1%	535 91.9%	65 2.7%	0 0.0%	65 100.0%	91 9.9%	9 9.9%	82 90.1%	56 2.3%	0 0.0%	56 100.0%
Bexar County Tract 1219.08	695 100.0%	528 76.0%	160 23.0%	10 6.3%	150 93.8%	7 1.0%	0 0.0%	7 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1219.09	1,131 100.0%	621 54.9%	470 41.6%	15 3.2%	455 96.8%	19 1.7%	0 0.0%	19 100.0%	21 1.9%	7 33.3%	14 66.7%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1219.10	1,430 100.0%	1,065 74.5%	286 20.0%	13 4.5%	273 95.5%	47 3.3%	0 0.0%	47 100.0%	12 0.8%	0 0.0%	12 100.0%	20 1.4%	0 0.0%	20 100.0%

Table 3-14: Linguistically Isolated Households in the Demographic Study Area

Geography	Total Households	English Only	Spanish			Other Indo-European Languages			Asian and Pacific Island Languages			Other Languages		
			Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated
Bexar County Tract 1918.04	1,936 100.0%	1,392 71.9%	418 21.6%	0 0.0%	418 100.0%	36 1.9%	0 0.0%	36 100.0%	39 2.0%	0 0.0%	39 100.0%	51 2.6%	0 0.0%	51 100.0%
Bexar County Tract 1918.08	1,160 100.0%	867 74.7%	268 23.1%	24 9.0%	244 91.0%	25 2.2%	0 0.0%	25 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.09	1,460 100.0%	1,159 79.4%	266 18.2%	38 14.3%	228 85.7%	22 1.5%	0 0.0%	22 100.0%	13 0.9%	0 0.0%	13 100.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.10	1,632 100.0%	1,073 65.7%	518 31.7%	82 15.8%	436 84.2%	0 0.0%	0 0.0%	0 0.0%	41 2.5%	0 0.0%	41 100.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.11	1,069 100.0%	653 61.1%	349 32.6%	26 7.4%	323 92.6%	15 1.4%	0 0.0%	15 100.0%	52 4.9%	0 0.0%	52 100.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.12	1,067 100.0%	706 66.2%	265 24.8%	23 8.7%	242 91.3%	61 5.7%	0 0.0%	61 100.0%	35 3.3%	2 5.7%	33 94.3%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.13	2,105 100.0%	1,434 68.1%	519 24.7%	26 5.0%	493 95.0%	18 0.9%	13 72.2%	5 27.8%	67 3.2%	26 38.8%	41 61.2%	67 3.2%	0 0.0%	67 100.0%
Bexar County Tract 1918.14	1,278 100.0%	801 62.7%	331 25.9%	64 19.3%	267 80.7%	55 4.3%	0 0.0%	55 100.0%	66 5.2%	51 77.3%	15 22.7%	25 2.0%	0 0.0%	25 100.0%
Bexar County Tract 1918.15	1,686 100.0%	1,020 60.5%	481 28.5%	10 2.1%	471 97.9%	132 7.8%	51 38.6%	81 61.4%	53 3.1%	0 0.0%	53 100.0%	0 0.0%	0 0.0%	0 0.0%

Table 3-14: Linguistically Isolated Households in the Demographic Study Area

Geography	Total Households	English Only	Spanish			Other Indo-European Languages			Asian and Pacific Island Languages			Other Languages		
			Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated	Total	Isolated	Not Isolated
Bexar County Tract 1918.16	1,042 100.0%	656 63.0%	262 25.1%	39 14.9%	223 85.1%	91 8.7%	0 0.0%	91 100.0%	33 3.2%	0 0.0%	33 100.0%	0 0.0%	0 0.0%	0 0.0%
Bexar County Tract 1918.17	3,308 100.0%	2,288 69.2%	745 22.5%	69 9.3%	676 90.7%	168 5.1%	31 18.5%	137 81.5%	92 2.8%	11 12.0%	81 88.0%	15 0.5%	0 0.0%	15 100.0%
Comal County Tract 3107.01	1,832 100.0%	1,587 86.6%	222 12.1%	0 0.0%	222 100.0%	23 1.3%	0 0.0%	23 100.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%
Comal County Tract 3107.02	1,600 100.0%	1,314 82.1%	240 15.0%	9 3.8%	231 96.3%	33 2.1%	0 0.0%	33 100.0%	0 0.0%	0 0.0%	0 0.0%	13 0.8%	0 0.0%	13 100.0%
Comal County Tract 3107.03	1,837 100.0%	1,397 76.0%	368 20.0%	89 24.2%	279 75.8%	48 2.6%	0 0.0%	48 100.0%	0 0.0%	0 0.0%	0 0.0%	24 1.3%	0 0.0%	24 100.0%
Comal County Tract 3107.04	1,983 100.0%	1,551 78.2%	368 18.6%	48 13.0%	320 87.0%	48 2.4%	15 31.3%	33 68.8%	16 0.8%	0 0.0%	16 100.0%	0 0.0%	0 0.0%	0 0.0%
Demographic Study Area Total	36,804 100.0%	26,002 70.6%	8,579 23.3%	716 8.3%	7,863 91.7%	1,097 3.0%	142 12.9%	955 87.1%	801 2.2%	126 15.7%	675 84.3%	325 0.9%	0 0.0%	325 100.0%

Source: U.S Census Bureau, American Community Survey 2006-2010 5-year survey, Table B16002, Household Language by Linguistic Isolation, June 2012.

The US Census Bureau uses the term "linguistically isolated" to refer to those households where all members, 14 years of age and older "have at least some difficulty with English." These data are important to understand as they reveal the need for translation services to ensure LEP populations are offered full and fair participation in the decision-making process for the US 281 Corridor Project.

Table 3-14 shows that there are linguistically isolated households in the demographic study area; 716 households or 1.9 percent of all households in the demographic study area, speak Spanish; 142 households (0.4 percent) speak an Indo-European language; and 126 households (0.3 percent) speak an Asian or Pacific Islands language.

Conclusion of Potential Effects to LEP Populations

In order to provide meaningful communication to the people living in the demographic study area and Bexar and Comal counties, project materials were made available in the dominant languages spoken (English and Spanish), and translation services were available for speakers of other languages, as detailed in **Chapter 6 - Public and Agency Coordination**. In compliance with EO 13166, the public involvement activities and communications for the US 281 Corridor Project are conducted to ensure full and fair participation.

Household Occupancy

As stated above, the Uniform Act requires that available housing must be within the financial means of all displaced persons, including low-income families, and open to all persons regardless of race, color, sex, religion, or national origin.

A summary of housing and vacancy data from the American Community Survey 2006-2010 5-year Survey for Bexar and Comal counties, and the Census tracts in the demographic study area are shown in **Table 3-15**. Housing occupancy details at the Census block group level can be found in **Appendix G.** Within the demographic study area approximately 91.6 percent of the total housing units are occupied leaving 8.4 percent of the total housing units vacant and available. According to a MLS search conducted in June 2012, housing prices within the demographic study area range from $130,000 to over $5.5 million.

Table 3-15: Housing Occupancy in Demographic Study Area

Geographic Area	Total Housing Units	Housing Unit: Occupied	Housing Unit: Vacant
Bexar & Comal Counties Total	687,953 100.0%	619,208 90.0%	68,745 10.0%
Bexar County Census Tracts			
Tract 1219.03	1,695 100.0%	1,627 96.0%	68 4.0%
Tract1219.04	1,285 100.0%	1,242 96.7%	43 3.3%
Tract 1219.05	1,598 100.0%	1,430 89.5%	168 10.5%
Tract 1219.06	2,067 100.0%	1,834 88.7%	233 11.3%

Table 3-15: Housing Occupancy in Demographic Study Area

Geographic Area	Total Housing Units	Housing Unit: Occupied	Housing Unit: Vacant
Tract 1219.07	2,580 100.0%	2,420 93.8%	160 6.2%
Tract 1219.08	815 100.0%	695 85.3%	120 14.7%
Tract 1219.09	1,159 100.0%	1,131 97.6%	28 2.4%
Tract 1219.10	1,566 100.0%	1,430 91.3%	136 8.7%
Tract 1918.04	2,155 100.0%	1,936 89.8%	219 10.2%
Tract 1918.08	1,234 100.0%	1,160 94.0%	74 6.0%
Tract 1918.09	1,802 100.0%	1,460 81.0%	342 19.0%
Tract 1918.10	1,752 100.0%	1,632 93.2%	120 6.8%
Tract 1918.11	1,127 100.0%	1,069 94.9%	58 5.1%
Tract 1918.12	1,088 100.0%	1,067 98.1%	21 1.9%
Tract 1918.13	2,209 100.0%	2,105 95.3%	104 4.7%
Tract 1918.14	1,455 100.0%	1,278 87.8%	177 12.2%
Tract 1918.15	1,840 100.0%	1,686 91.6%	154 8.4%
Tract 1918.16	1,407 100.0%	1,042 74.1%	365 25.9%
Tract 1918.17	3,515 100.0%	3,308 94.1%	207 5.9%
Comal County Census Tracts			
Tract 3107.01	2,040 100.0%	1,832 89.8%	208 10.2%
Tract 3107.02	1,660 100.0%	1,600 96.4%	60 3.6%
Tract 3107.03	1,985 100.0%	1,837 92.5%	148 7.5%
Tract 3107.04	2,133 100.0%	1,983 93.0%	150 7.0%

Table 3-15: Housing Occupancy in Demographic Study Area

Geographic Area	Total Housing Units	Housing Unit: Occupied	Housing Unit: Vacant
Demographic Study Area			
Total	40,167 100.0%	36,804 91.6%	3,363 8.4%

Source: US Census Bureau, American Community Survey 2006-2010 5-year Survey, Table B25002 Occupancy Status, June 2012.

Community and Public Resources

This section contains a brief discussion of the existing schools, neighborhoods, sensitive social and community facilities and resources that are located within one-half mile or within close proximity to the US 281 project corridor. There are no parks located within one-half mile of the US 281 project corridor.

Schools

The proposed US 281 Corridor Project is located within the boundaries of the North East Independent School District (NEISD) and Comal Independent School District (CISD). Various private schools and education centers are also located in the vicinity of the US 281 project corridor.

As shown in **Figure 3-8**, the public and private educational/school properties located within one-half mile of the US 281 project corridor, from south to north, include: St. Thomas Episcopal School, Harvest Schools, San Antonio Christian School, La Petite Academy, NEISD Transportation North Bus Satellite Facility, Tuscany Heights Elementary, Kiddie Koop Children's Enrichment Center, and M.H. Specht Elementary School.

Neighborhoods

There are 20 named residential neighborhoods adjacent to the US 281 project corridor (shown in **Figure 3-8**). The named residential areas include: Big Springs, Cavalo Creek Estates, Encino Park, Redland Ridge, Villages at Encino Park, Summerglen, The Estates at Stonegate, Lookout Canyon, Encino Ridge, Oakridge Heights, Evans Ranch, The Oaklands, Mountain Lodge, Winchester Hills, Stone Oak, Sendero Ranch, Belterra, Tuscan Oaks, Trinity Oaks, and Classen Crest.

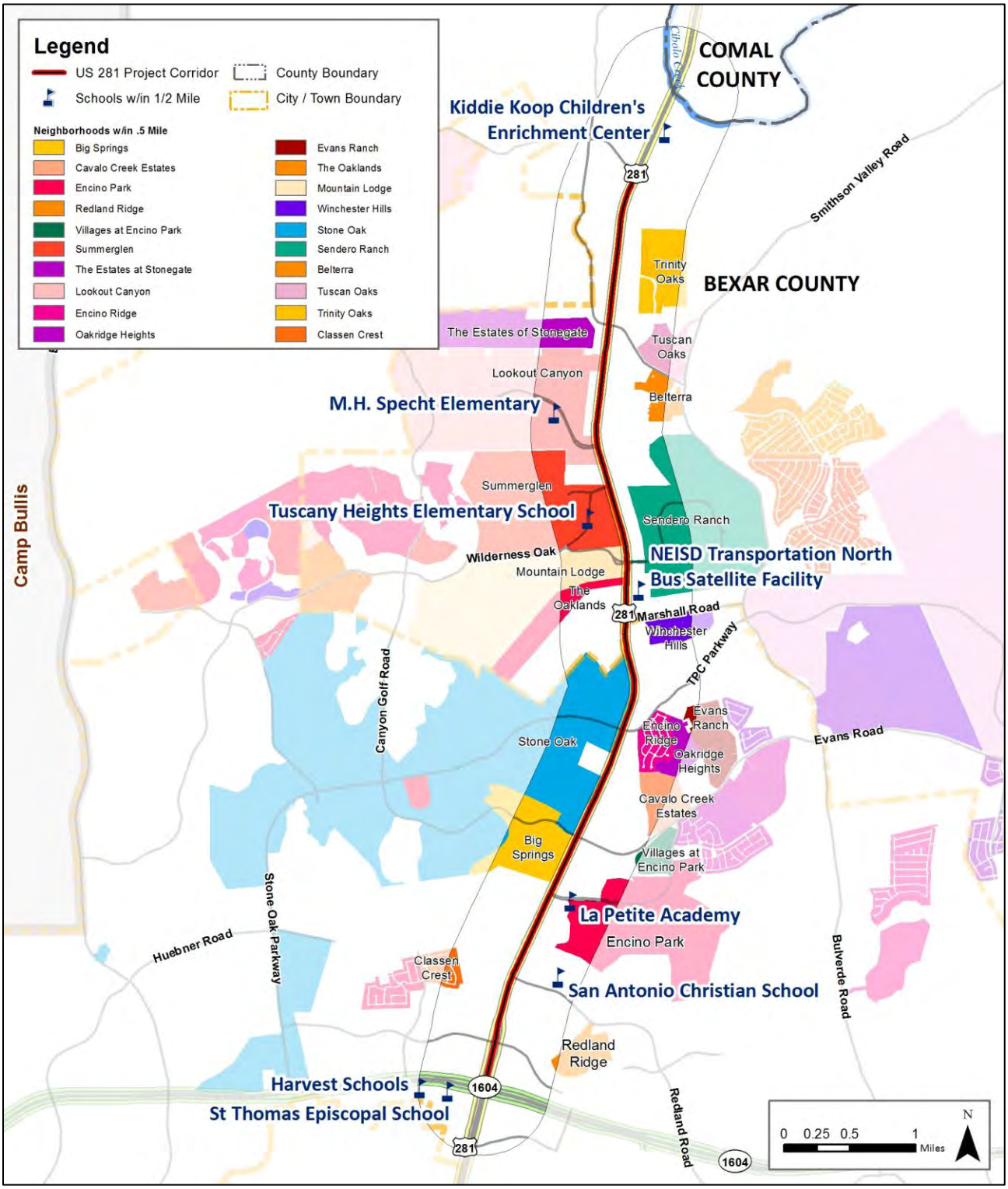
Police Protection, Fire Protection, and Medical Services

Several local, county, and elected law enforcement agencies, city and volunteer fire departments, and emergency medical facilities provide the emergency response services to the US 281 project corridor. Law enforcement services are provided by the San Antonio Police Department's North Substation, the Bexar County Sherriff's Office, and the Bexar County Constable's Department - Precinct 3. The City of San Antonio Fire Department (SAFD), Fire Stations 46 and 48, and the Bexar-Bulverde Volunteer Fire Department (VFD), which operates under the Bexar County Fire Marshal, provide fire and emergency medical services within the US 281 project corridor. Two hospitals are located near the US 281 project corridor; Methodist Stone Oak Hospital is located on East Sonterra Boulevard, and North Central Baptist Hospital is located on Madison Oak Drive and Stone Oak Parkway. **Figure 3-9** highlights the emergency and medical service providers located near the US 281 project corridor.

Places of Worship and Cemeteries

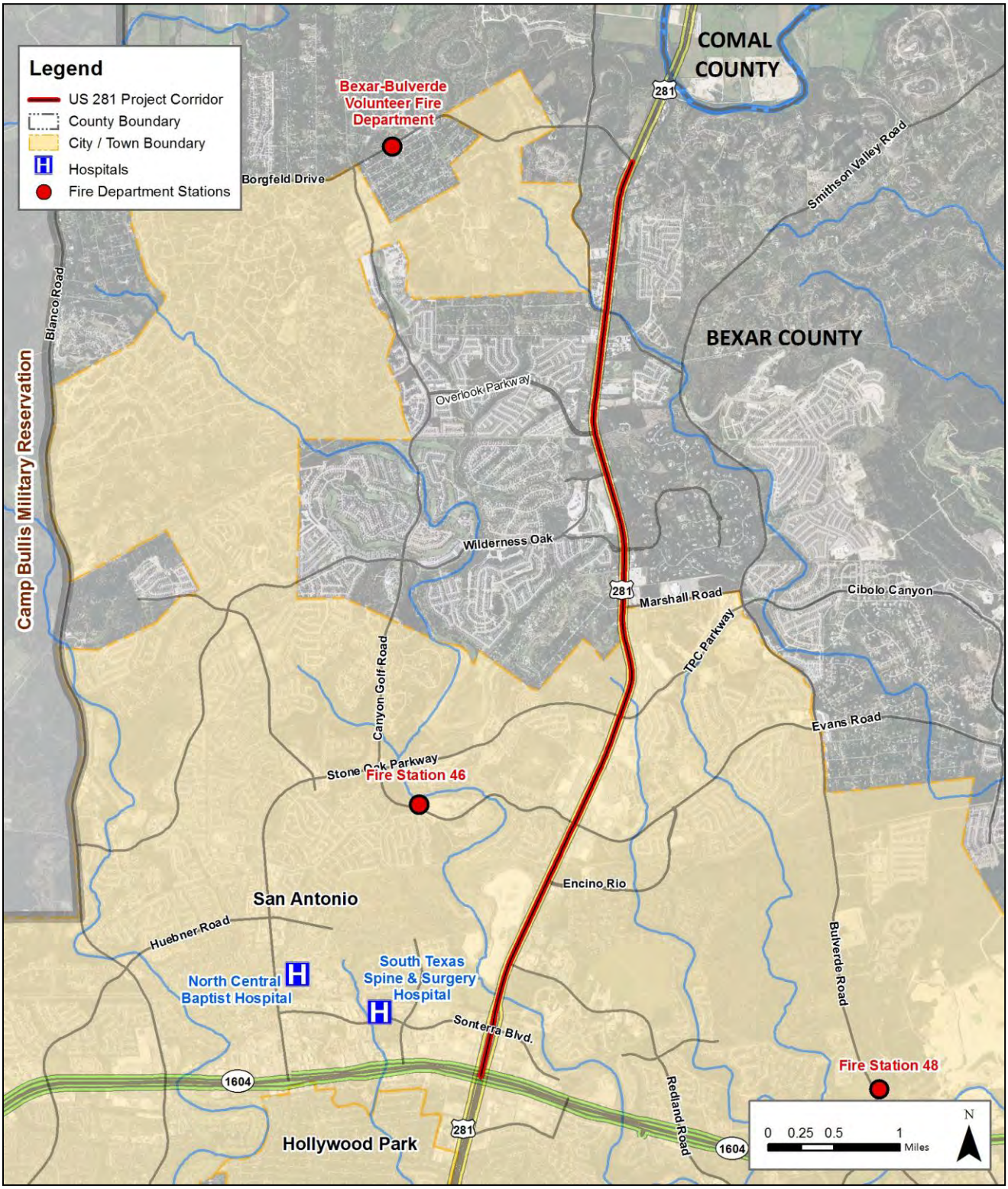
Fourteen places of worship and two cemeteries were identified along the US 281 project corridor. The churches identified include: Bulverde United Methodist Church, North Central Christian Church, St. Thomas Episcopal School, Summit Christian Center, Harvest Fellowship Community Church, Park Hills Baptist Church, Community Bible Church, Now World Christian Church, Church Alive, Calvary Chapel, Northern Hills United Methodist Church, Crossbridge Community Church of San Antonio, Vineyard Hills Church, and Northside Church of Christ (all shown in **Figure 3-10**).

Figure 3-8: Neighborhoods and schools located within ½ mile of US 281



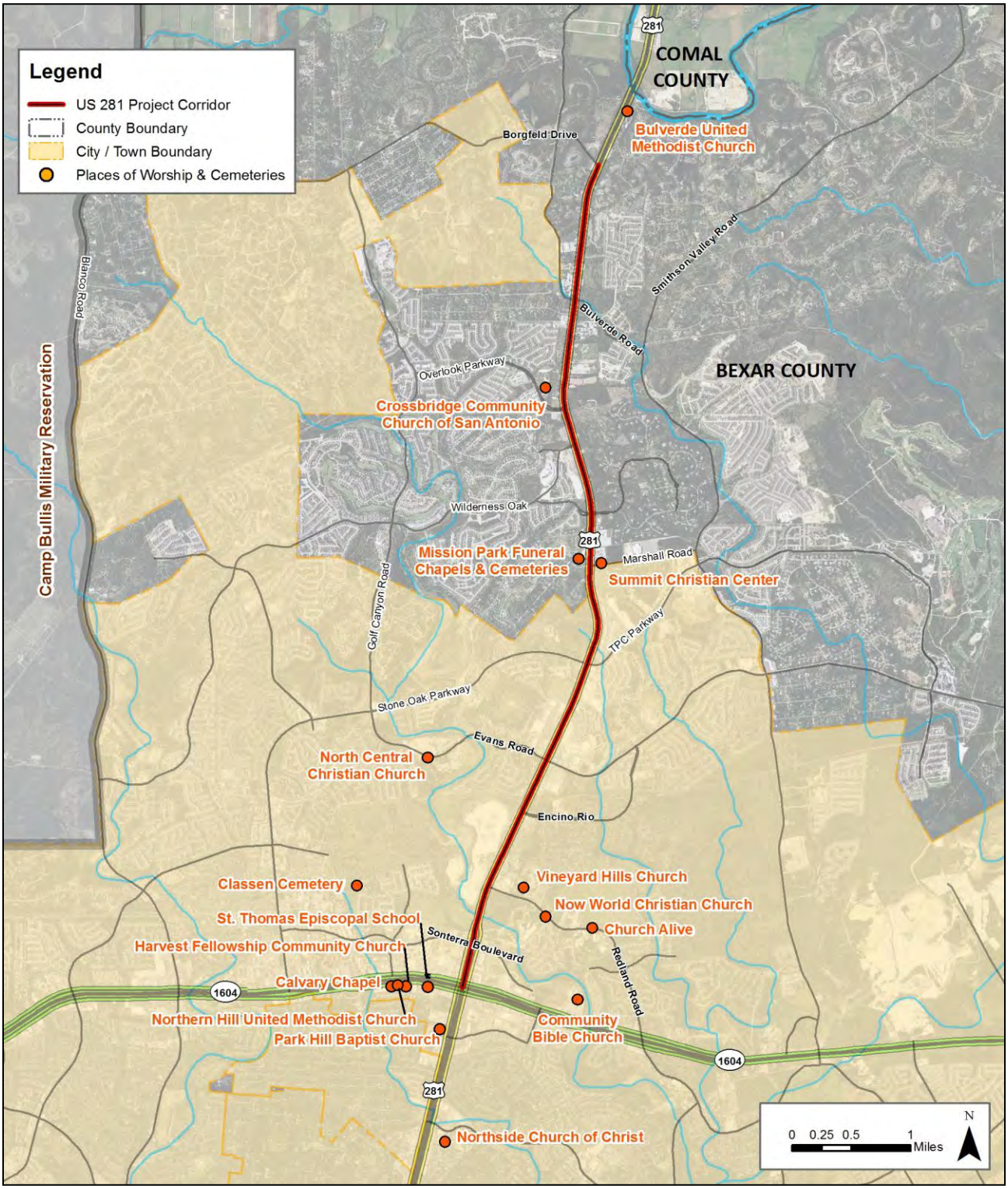
Source: US 281 EIS Team, July 2011.

Figure 3-9: Fire protection, and medical services



Source: US 281 EIS Team, July 2011.

Figure 3-10: Places of worship and cemeteries



Source: US 281 EIS Team, July 2011.

Economic Characteristics

Economic Activity

As of March 2011, and according to the Labor Market and Career Information (LMCI) department of the Texas Workforce Commission (TWC), the total civilian labor force (CLF) for Bexar County was 788,084 people, which is an increase of 6,104 people from September 2010. The total CLF for Comal County was 59,045 people in March of 2011, which was an increase of 687 people from March 2010. Relative to the economy of Texas, the LMCI economic diversification index measures "the degree to which a county economy is diversified. Significant concentrations of employment in only one or two industrial sectors makes an area less diversified and more susceptible to widespread economic decline should a key sector suffer a significant loss." In terms of economic diversity and of the three levels of diversification, ranging from below average, average and above average, both Bexar and Comal County had an economic base which is of average diversity.

According to the American Community Survey 2006-2010 5-year Survey, the total number of people, 16 years of age or older, employed in Bexar and Comal counties, was 738,564 and 48,439 people respectively. **Table 3-16** shows that educational and health care services provide the most number of jobs in Bexar and Comal counties, followed by the retail trade industry. According to the Texas Comptroller's Office, the top three industries for the San Antonio Metropolitan Statistical Area (MSA) include: government, education and health services, and professional and business services (2010).

Table 3-16: Employment by Industry

Industry	Bexar County	Comal County
Total Employed Population 16 Years of Age and Older	738,564 (100.0%)	48,439 (100.0%)
Agriculture, Forestry, Fishing & Hunting, and Mining	4,864 (0.7%)	633 (1.4%)
Construction	60,387 (8.2%)	5,387 (11.1%)
Manufacturing	44,307 (6.0%)	3,833 (7.9%)
Wholesale Trade	21,801 (3.0%)	1,684 (3.5%)
Retail Trade	87,948 (11.9%)	6,441 (13.3%)
Transportation & Warehousing, and Utilities	35,297 (4.8%)	2,353 (4.9%)
Information	18,424 (2.5%)	1,013 (2.1%)
Finance & Insurance, Real Estate and Rental & Leasing	71,493 (9.7%)	3,574 (7.4%)
Professional, Scientific, Management, Administrative and Waste Management Services	79,856 (10.8%)	5,281 (10.9%)
Educational Services, Health Care and Social Assistance	163,102 (22.1%)	9,816 (20.3%)
Arts, Entertainment, Recreation, and Accommodation & Food Services	73,044 (9.9%)	4,059 (8.4%)
Other Services Except Public Administration	37,264 (5.0%)	2,274 (4.7%)
Public Administration	40,777 (5.5%)	2,061 (4.3%)

Source: US Census Bureau, American Community Survey 2006-2010 5-year Survey, Table S2405, Industry by Occupation, January 2012.

Table 3-17 shows the commute characteristics for workers 16 years and over for Bexar and Comal counties. The majority of commuters in Bexar and Comal counties drives their cars to work alone or car-pooled. However, a greater share of people worked from home in Comal County, while a greater share of people used public transportation in Bexar County.

Table 3-17: Commute Characteristics for Bexar and Comal Counties

Commute Characteristics	Bexar County	Comal County
Total Commuters	744,062 (100.0%)	47,363 (100.0%)
Car, Truck or Van	587,734 (79.0%)	37,329 (78.8%)
Carpool	83,988 (11.3%)	5,797 (12.2%)
Public Transportation	20,577 (2.8%)	33 (0.1%)
Bicycle	877 (0.1%)	84 (0.2%)
Walk	16,372 (2.2%)	673 (1.4%)
Taxi, Motorcycle or Other	11,607 (1.6%)	813 (1.7%)
Work at Home	22,907 (3.1%)	2,634 (5.6%)

Source: US Census Bureau, American Community Survey 2006-2010 5-year Survey, Table B08006, Sex of Workers by Means of Transportation to Work, January 2012.

Employment

Table 3-18 presents TWC and the US Department of Labor's Bureau of Labor Statistics data describing the civilian labor force, total employment, and the unemployment rate in Bexar and Comal Counties for the three-year period from October 2008 to October 2010. The data show that employment in both counties has increased by 0.8 and 4.7 percent, respectively, from 2008 to 2010. The unemployment rate showed a marked increase from 5.2 percent in 2008 to 7.4 percent in Bexar County and from 4.6 percent to 6.6 percent in Comal County, over the same period.

Table 3-18: Civilian Labor Force, Total Employment, and Unemployment Rate

Data Set	Employment Data*			
	October 2008	October 2009	October 2010	Percent change 2008-2010
Bexar County				
Labor Force	757,943	775,266	782,385	3.2%
Employment	718,587	720,580	724,465	0.8%
Unemployment Rate	5.2	7.1	7.4	2.2%

Table 3-18: Civilian Labor Force, Total Employment, and Unemployment Rate

Data Set	Employment Data*			
	October 2008	October 2009	October 2010	Percent change 2008-2010
Comal County				
Labor Force	53,316	55,409	57,010	6.9%
Employment	50,857	51,724	53,253	4.7%
Unemployment Rate	4.6	6.7	6.6	2.0%

*Estimates that reflect actual (not seasonally adjusted) data
Source: Texas Workforce Commission and the Bureau of Labor Statistics, US Department of Labor, July 2011.

Income

Household income for the demographic study area is discussed in **Section 3.4.3** .

Property Tax Revenues

Table 3-19 shows the major taxing jurisdictions within the US 281 project corridor where additional ROW may be required for the Proposed Build Alternatives. Potential economic effects that result from ROW acquisition for the Proposed Build Alternatives would include the permanent removal of taxable property in Bexar County from the tax rolls of the County, the City of San Antonio, North East ISD, and Comal ISD.

Table 3-19: Property Tax Revenues and Rates for Major Taxing Jurisdictions

Taxing Jurisdiction	Net Property Tax Revenues FY 2011	FY 2011 Tax Rate (per $100 valuation)
City of San Antonio	$511,422,515	0.56569
North East ISD	$382,562,485	1.4029
Bexar County	$277,046,005	0.296197
Comal ISD	$21,120,703	1.43

Source: Texas Comptroller of Public Accounts and Bexar County Appraisal District, 2011

3.4.4 Environmental Consequences

Displacements and Relocations

Legal and Regulatory Context

The *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970* (42 United States Code (USC) 4601 ET SEQ., P.L. 91-646), as amended by the *Uniform Relocation Act Amendments of 1987* (P.L. 100-17), known as the Uniform Act, contains specific requirements that determine the manner in which a government entity acquires private property for public use when federal funds are used for any phase of a project. The purpose of this act is to provide a uniform policy for fair and equitable treatment of persons and businesses displaced as a result of federal and federally assisted programs in accordance with the following objectives:

A. To ensure that owners of real property to be acquired for federal and federally-assisted projects are treated fairly and consistently, to encourage and expedite acquisition by agreements with such owners, to minimize litigation and relieve congestion in the courts, and to promote public confidence in federal and federally assisted land acquisition programs.
B. To ensure that persons displaced as a direct result of federal or federally assisted projects are treated fairly, consistently, and equitably so that such persons will not suffer disproportionate injuries as a result of projects designed for the benefit of the public as a whole.
C. To ensure that agencies implement these regulations in a manner that is efficient and cost effective.

Methodology

Potential residential and commercial displacements and relocations for the Proposed Build Alternatives are based on a review of high-resolution aerial imagery (USDA's National Aerial Imagery Program, (NAIP) photographs, 2010), Bexar Appraisal District records, and field reconnaissance in July 2010 and October 2010.

The number of single-family and commercial displacements was counted based on the following criteria: (1) Single-family residential displacements were counted if a house is within the proposed ROW and/or if more than 50 percent of the property of a residence is within proposed ROW to be acquired; (2) Business displacements were counted if a building structure was located within the proposed ROW to be acquired or if more than 50 percent of the business's parking lot is within the proposed ROW to be acquired. Sheds, out buildings and carports were not counted.

No-Build Alternative

As the No-Build Alternative would not require additional ROW, there would be no direct impacts to area housing or housing availability.

At Risk ROW Acquisition

Although improvements for the US 281 Corridor Project would require additional ROW, no "at risk" early ROW acquisitions have been identified. "Early acquisition" is defined in 23 Code of Federal Regulations (CFR) 710.105(b) as acquisition in advance of any FHWA authorization or agreement. The term "at risk" is used to explain that the states bear the risk associated with acquiring parcels that may not be required for the project if not within the approved alignment following the environmental process. ROW acquisition would be performed in accordance with the Uniform Act, as amended.

Potential Displacement and Relocation Effects

Potential single-family, commercial, and utility relocations and displacements for both of the Proposed Build Alternatives are shown in **Table 3-20** and a description of the potentially displaced commercial properties is found in **Table 3-21**. All relocations and displacements are shown in **Figure 3-11a** through **Figure 3-11j**.

Neither of the Proposed Build Alternatives requires ROW that would result in the displacement of a school, fire or police station, hospital, library, or place of worship. Implementation of the Expressway Alternative would require the relocation of one single-family residences; whereas, the Elevated Expressway Alternative would not

require the relocation of any residence. Potential displacements are shown in **Figure 3-11a** through **Figure 3-11j**. Both of the proposed US 281 Build Alternatives would result in the displacement of businesses. The Elevated Expressway Alternative would require the greatest number of commercial relocations, 28. A majority of the commercial displacements would occur on the west side of the US 281 project corridor and north of Stone Oak Parkway where most of the ROW would be required.

Table 3-20: Displacements and Relocations per Proposed Build Alternative

Proposed Build Alternative	Single-Family	Commercial	Utilities
Expressway Alternative	1	26	1
Elevated Expressway Alternative	0	28	0

Source: US 281 EIS Team, July 2011.

Table 3-21: Description of Potentially Displaced Commercial Properties

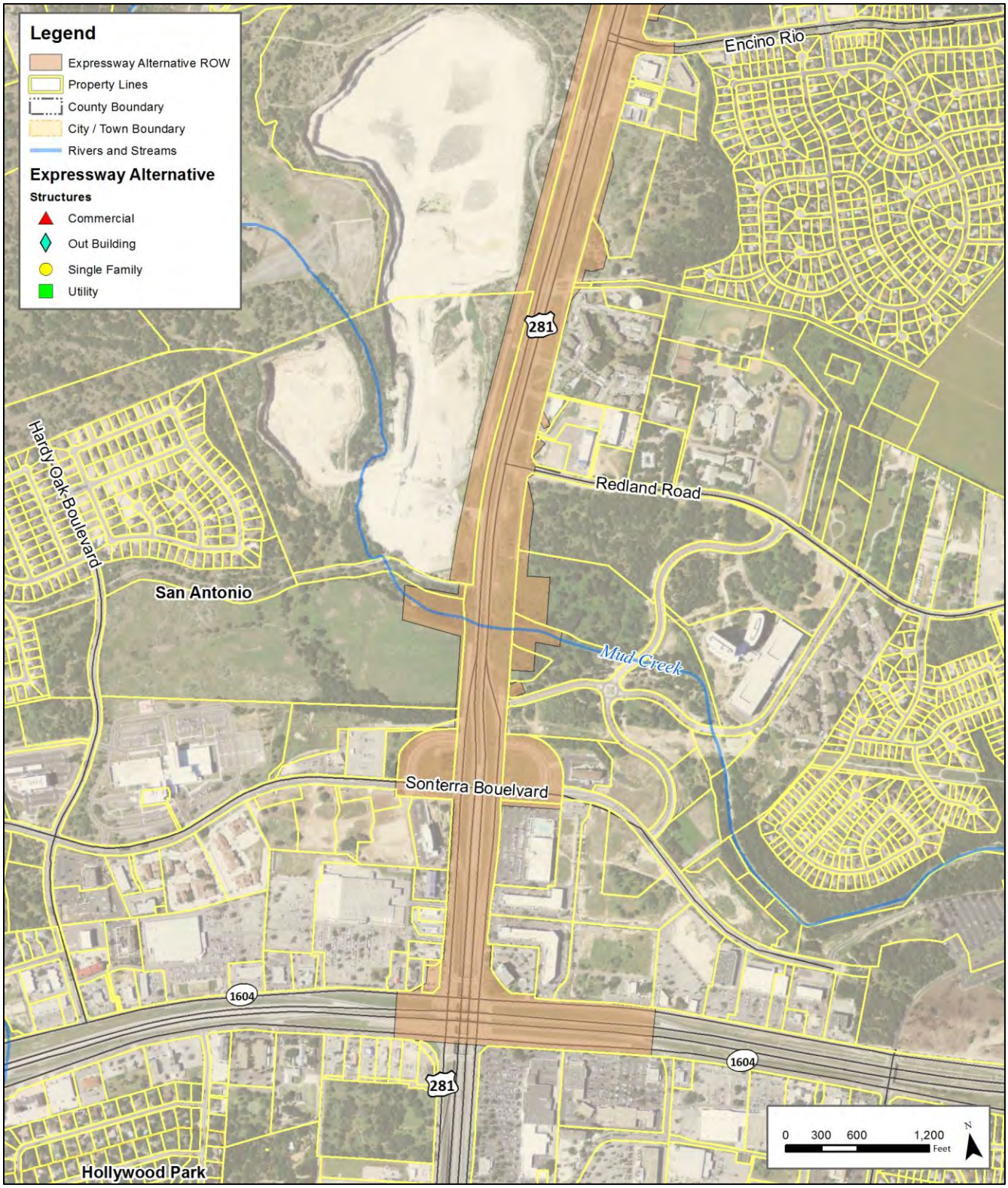
Potentially Displaced Commercial Properties	Approximate Number of Employees	Expressway Alternative	Elevated Expressway Alternative
Cactus Jack's Tacos & Subs Restaurant	0 (closed)	X	
DRB Aviation Consultants Design, program management and certification of aircraft interiors, avionics and structural repairs	12-16	X	
Mouse's BBQ Restaurant (closed)	0 (closed)		X
Horizons Building Unknown	N/A		X
Stone House Imports House ware, pottery and glass	2		X
Fireworks Fireworks	2		X
Advance Turf Service Commercial and residential landscaping	3	X	X
H&H Auto Sales Used car dealership	5	X	X
Bulverde Vet Clinic Veterinarian	6	X	X
Mark Drogin, MD Psychiatrist	2 to 5	X	X
RT Leasing Property Management	2 to 5	X	X
Mission Park Funeral Chapels Funeral and burial services	2 to 5	X	X
Alamo Fireworks – Location 183 Fireworks	2	X	X

Table 3-21: Description of Potentially Displaced Commercial Properties

Potentially Displaced Commercial Properties	Approximate Number of Employees	Expressway Alternative	Elevated Expressway Alternative
Alamo Fireworks – Location 082 Fireworks	2	X	X
LMD Architects Architects	6	X	X
Daily Car Wash Car wash	2	X	X
Ace Lawn & Garden Landscaping equipment & repair	2 to 5	X	X
Southwest Farm & Home Center Hardware store and home & farm center	10	X	X
Weekley Homes LP - Model Home Home builder & general contractor	2	X	X
Ferrell Gas, Inc. Propane, natural gas and gasoline	15	X	X
Bracken Auto Body Auto body repair and paint	10	X	X
Powerhouse Cycle Motorcycle dealer	8	X	X
North Central Boat & RV Storage Storage Facility	2 to 5	X	X
Texas Soil & Stone Outfitters Bulk landscaping materials	4	X	X
Parrish & Company Residential homebuilder/remodeler, cabinet making, countertop and appliance vendor	43	X	X
Carlson's Carpets Carpet and flooring	15-25	X	X
Hanson Brick Brick manufacturer	7	X	X
AAA Storage Storage Facility	5	X	X
Fireworks Fireworks	2	X	X
BuiltSmart Resources Center Green Homebuilder	8	X	X
TOTAL		26 businesses 177 – 206 jobs	28 businesses 169 – 194 jobs

Source: US 281 EIS Team, 2012.

Figure 3-11a: Relocations and displacements – Expressway Alternative

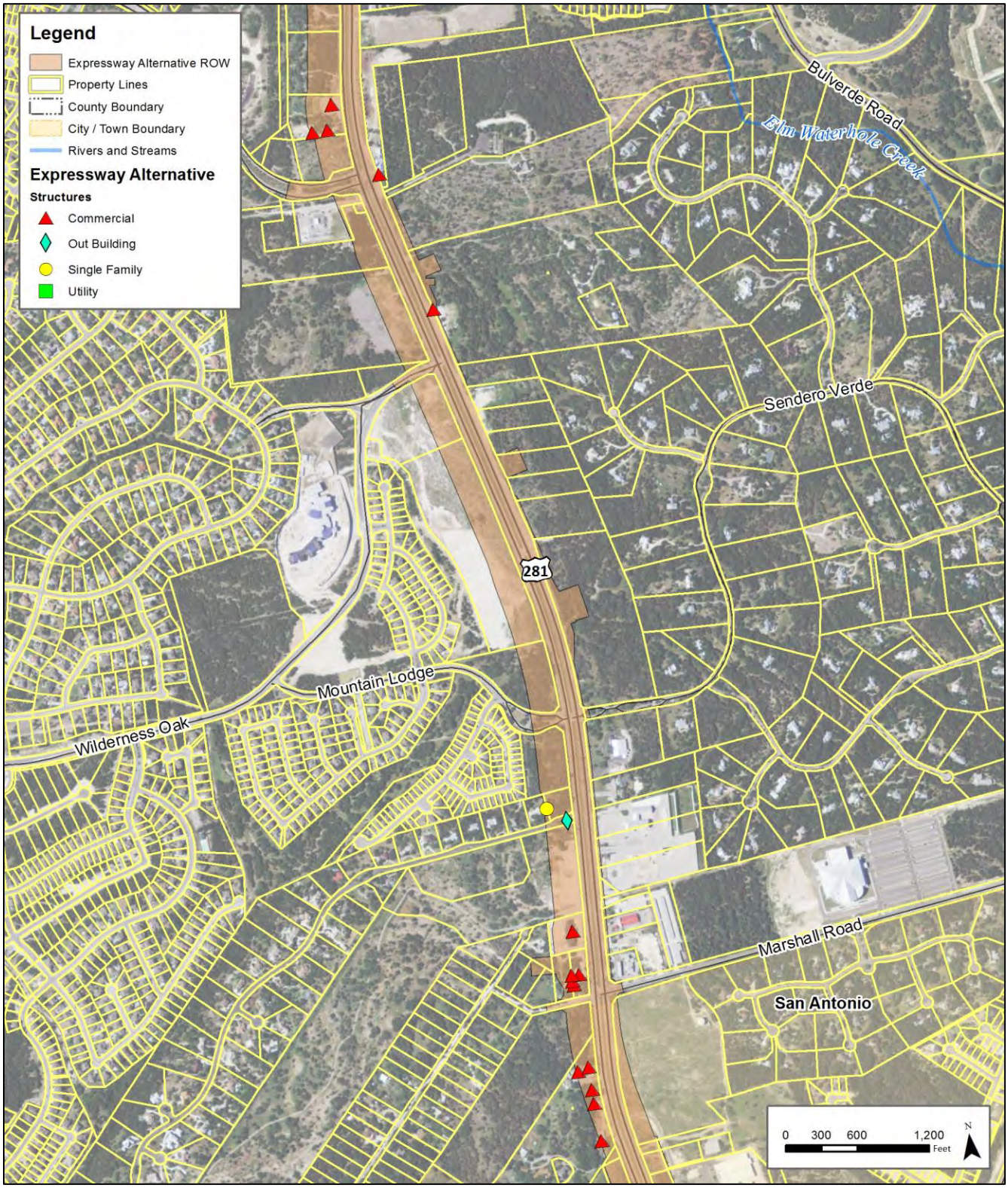


Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11b: Relocations and displacements – Expressway Alternative

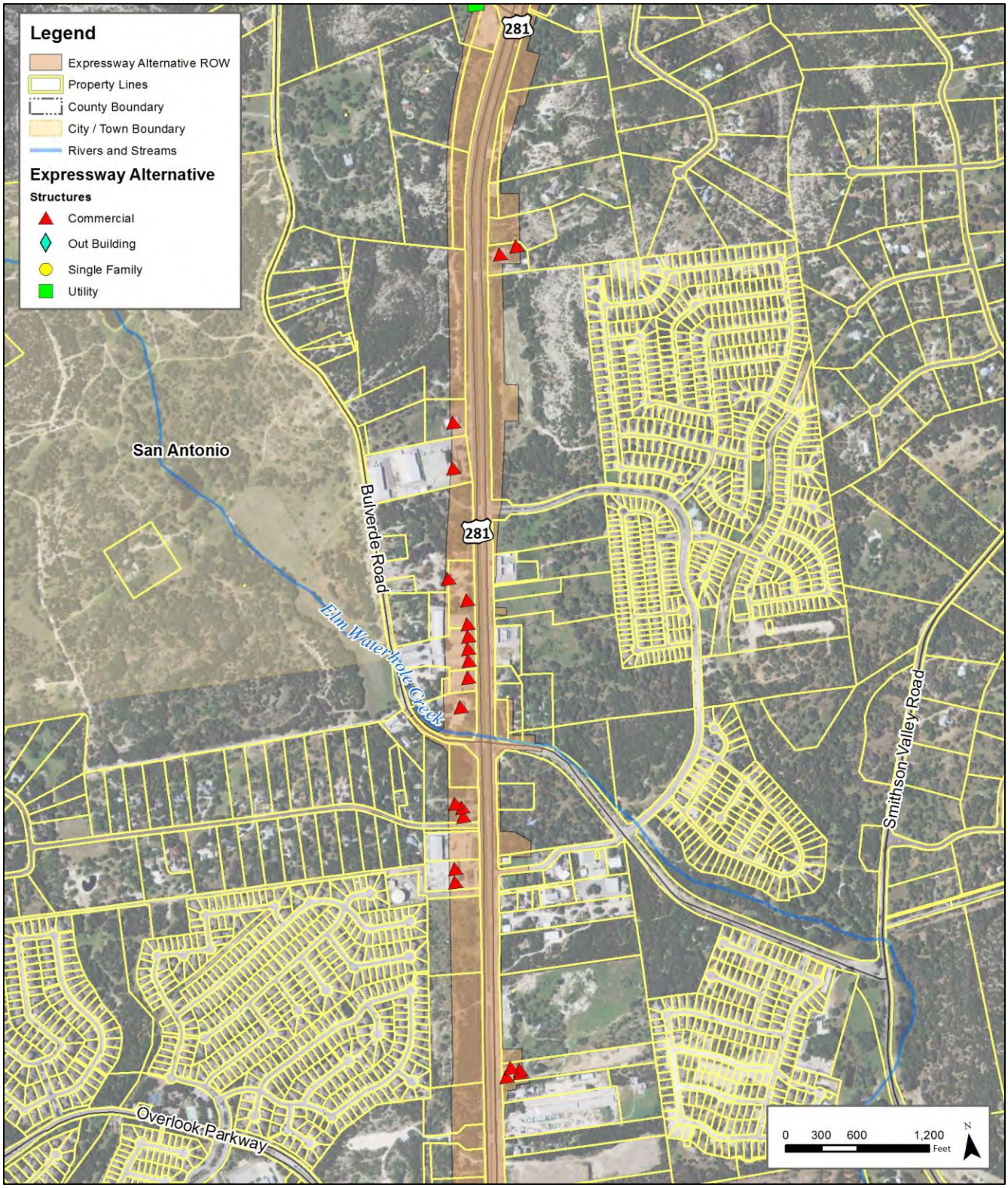
Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11c: Relocations and displacements – Expressway Alternative



Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11d: Relocations and displacements – Expressway Alternative



Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11e: Relocations and displacements – Expressway Alternative

Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

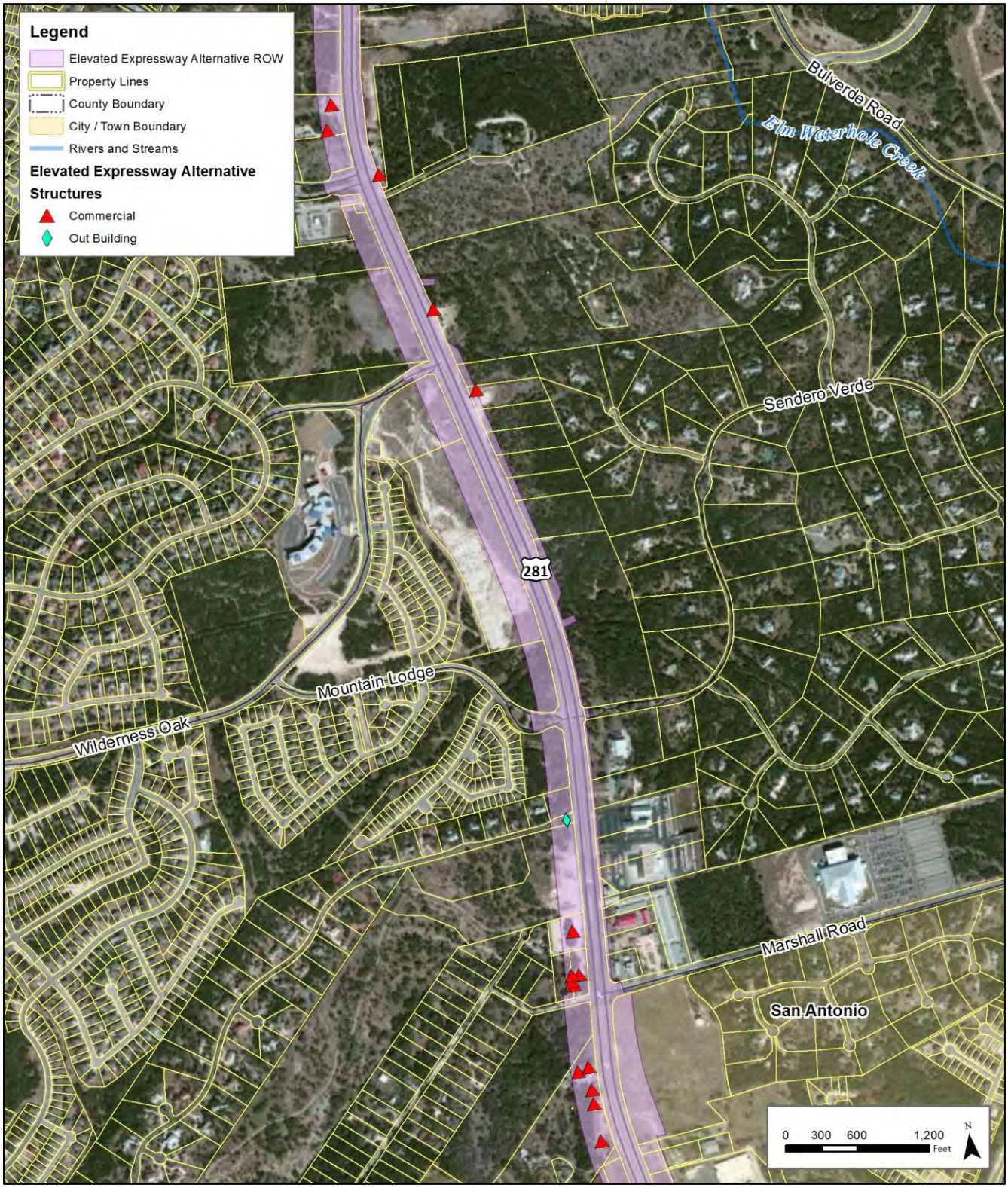
Figure 3-11f: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11g: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11h: Relocations and displacements – Elevated Expressway Alternative



Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11i: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Figure 3-11j: Relocations and displacements – Elevated Expressway Alternative

Source: Bexar Appraisal District, 2010, US 281 EIS Study Team (October 2010).

Table 3-22 shows the anticipated ROW acreage needed for the Proposed Build Alternatives and number of parcels affected. The total ROW required for the Expressway Alternative would be 128 acres and the Elevated Expressway Alternative would be 99 acres. Of the parcels affected by all Proposed Build Alternative, range land and commercial office-retail business parcels are affected the greatest, with the Expressway Alternative affecting the greatest number of parcels overall.

Table 3-22: ROW Impacts

Proposed Build Alternatives	Acreage of Impacts	Number of Parcels Affected												
		Range Land	Open space/Park	Single-Family	Multi-Family	Commercial-Retail	Commercial-Office	Commercial-Mixed	Industrial	House of Worship	Transportation	Utility	Forest	Total Parcels
Expressway Alternative	128	60	6	9	1	40	8	3	0	1	3	6	1	138
Elevated Expressway Alternative	99	37	6	7	1	23	5	3	2	0	4	3	2	93

Source: US 281 EIS Team, July 2011.

A Multiple Listing Service (MLS) availability search was conducted using the zip codes located within the US 281 project corridor for available commercial, industrial, and agricultural (ranch land and forested areas) properties that are comparable and suitable to the properties potentially being displaced. The number of properties for lease or sale within the identified zip code locations of the project area is presented in **Table 3-23** below.

Table 3-23: Commercial, Industrial, and Agriculture MLS Availability by City Zip Codes

	Zip Codes				Surrounding City*	Total
	78258	78260	78261	78259		
Commercial for Lease	3	0	0	0	22	25
Commercial for Sale	9	4	4	5	193	215
Industrial for Lease	0	0	0	0	1	1
Industrial for Sale	0	0	0	0	2	2
Agricultural (Land) for Lease	0	0	0	0	0	0
Agricultural for Sale	0	0	0	0	1	1
Total	**12**	**4**	**4**	**5**	**219**	**244**

Source: http://www.loopnet.com, June 2012.
*Surrounding City means within 10 miles of the US 281 project corridor

The square footage of commercial and industrial facilities that could be displaced ranges from approximately 250 square feet to 125,000 square feet. A MLS search of available commercial and industrial properties ranging from 300 square feet to 560,000 square feet was conducted by city zip code location and surrounding city. The acreage of

agricultural properties to be displaced ranges from 0.151 acre to 2 acres. A MLS search of available agricultural (farmland and ranch) properties ranging from 0.03 acre to 14 acres was conducted by city zip codes in the US 281 project corridor and surrounding city. The estimated appraised values of business (commercial, industrial, and agricultural) displacements ranged from $100 to $4,125,000.

Availability of Comparable Housing/Real Estate

Multiple Listing Services

To assess availability of replacement property within the US 281 project corridor for the one identified residential property, a search of the MLS was conducted at the following website in June 2012: http://www.realestate.sabor.com

The potentially displaced residential property is a 4-bedroom single family home located on 1 acre of land; this property was appraised at approximately $300,000 in 2011. **Table 3-24** presents the number of 4-bedroom single-family homes located on 1 acre of land or more, within the $250,000 to $350,000 price range, that are for sale within the zip codes located in and around the US 281 project corridor.

Table 3-24: MLS Housing Availability by City Zip Codes within the US 281 Project Corridor

Price Range	Metric	Zip Codes				Total
		78258	78260	78261	78259	
$250,000 - $300,000	Total number of 4-bedroom homes for sale	51	38	118	11	218
	4-bedroom homes for sale on 1 acres of land or more	0	1	0	1	2
$300,000 - $350,000	Total number of 4-bedroom homes for sale	44	26	27	12	109
	4-bedroom homes for sale on 1 acres of land or more	0	0	2	0	2
Total	Total number of 4-bedroom homes for sale	95	64	145	23	327
	4-bedroom homes for sale on 1 acres of land or more	0	1	2	1	4

Source: San Antonio Board of Realtors, June 2012.

Based on the number of available housing units identified, it is expected that comparable and suitable relocation of the one residence identified for potential displacement and relocation could be accomplished. Should this single residential acquisition become necessary, a more refined relocation analysis would be conducted to ensure that the proposed relocation site is adequate in size and location. Neither of the Proposed Build Alternatives would displace apartments, condominiums or other multi-family residential structures.

Relocation Assistance

The Uniform Act, as amended (49 CFR Part 24) ensures that displaced persons are relocated to a property that is comparable in size, features, and location; is decent, safe, and sanitary; and is within the financial means of the displaced person(s) (49 CFR Part 24.204). Relocation assistance would be available to all individuals, families, businesses, farmers, and nonprofit organizations displaced as a result of the project. This assistance applies to tenants as well as owners occupying the real property needed for the project. Replacement structures must be located in the same type of neighborhood and be equally accessible to public services and places of employment. Alamo RMA in coordination with the Texas Department of Transportation (TxDOT) would also provide assistance to displaced businesses and non-profit organizations to aid in their satisfactory relocation with a minimum of delay and loss in earnings. The US 281 Corridor Project would proceed to construction only when all displaced families and businesses have been provided the opportunity to be relocated to adequate replacement sites.

Consistent with US DOT policy as mandated by the Uniform Act, as amended, the Alamo RMA in coordination with TxDOT would provide relocation resources to all displaced persons without discrimination. All property owners from whom property is needed are entitled to receive just compensation for their land and property. Just compensation is based upon the fair market value of the property. Alamo RMA in coordination with TxDOT would also provide, through its Relocation Assistance Program, payment and services to aid in movement to a new location.

In addition, aerial and/or underground utilities would be adjusted and the required utilities would be handled so that no significant disruption of service would take place while the adjustments are being made. Utility adjustments would occur according to standard TxDOT and Alamo RMA procedures.

Potential Effects on Neighborhoods and Community Cohesion

As defined in FHWA Technical Advisory T6640.8A, changes in community cohesion resulting from highway construction and improvements may be beneficial or adverse. An adverse impact to community cohesion occurs when an alternative severs or alters social interaction among groups or individual members of a community. This includes dividing or displacing a functioning neighborhood, or displacing that which allows for the members of the community to assemble and interact (such as an impact to a local place of worship or community recreational facility).

No-Build Alternative

The No-Build Alternative would not directly affect neighborhoods or community cohesion within the general study area. However, as the population increases in neighborhoods adjacent to the US 281 project corridor, traffic would increase in these neighborhoods and could result in increased congestion and reduced mobility.

Proposed Build Alternatives

Both of the Proposed Build Alternatives have the potential to cause the following effects on community cohesion:

- Overall improved mobility of vehicles by relieving congestion
- Potential changes in property values adjacent to the project corridor
- A temporary increase in noise, dust, and traffic congestion during construction

- Potential increase in traffic noise after construction is complete
- Changes in access in some of the areas where an access ramp would be located

There are several single- and multi-family residential communities (as shown in **Figure 3-2a** through **Figure 3-2e**) in proximity to the US 281 project corridor. Community groups in the City of San Antonio and unincorporated areas, neighborhoods, and smaller communities such as apartment communities could be impacted by the Proposed Build Alternatives due to construction delays and changes in travel access, in the short term. However, in the long term, both of the Proposed Build Alternatives for the US 281 Corridor Project would provide more travel lanes, improve traffic flow to these communities, and would not restrict access to any existing public or community services, businesses, or commercial areas. Moreover, neither of the Proposed Build Alternatives would divide, separate, nor isolate any neighborhood or community; therefore, community cohesion would likely remain intact.

Potential Effects to Community and Public Resources

This section contains a brief discussion of the potential impacts to existing schools, police and fire protection, medical services, fire stations, places of worship, cemeteries and public resource facilities, within one-half mile of the US 281 Corridor Project boundaries.

Schools

No-Build Alternative

The No-Build Alternative would not require additional ROW and therefore would not result in direct impacts to schools.

Proposed Build Alternatives

Neither of the Proposed Build Alternatives requires ROW in areas where schools are located and therefore would not interrupt or sever existing school bus routes. As such no direct impacts to the schools within one-half mile of the US 281 project corridor are expected. In the long term, the implementation of either of the Proposed Build Alternatives would improve access and mobility along the US 281 project corridor; however, traffic patterns and flow would change (see **Changes to Traffic Patterns** below).

Police/Fire Protection and Medical Services

No-Build Alternative

The No-Build Alternative would not change current roadway routes and, therefore, would not affect routes currently taken by emergency responders that service the area along the US 281 project corridor. In the long term, however, the No-Build Alternative could result in declining Level of Service (LOS) on the US 281 project corridor and on the parallel corridors, such as Blanco Road and Bulverde Road during peak travel times, as discussed in **Chapter 2 - Alternatives Considered**. Continuing development within the corridor and the reduction of LOS could result in increased response times of emergency management personnel and delayed evacuation during emergencies.

Proposed Build Alternatives

No police stations, fire stations or medical service facilities would be displaced as a result of either of the Proposed Build Alternatives. In the short term, there could be an

increase in traffic congestion and potential changes in traffic patterns in the vicinity of the US 281 project corridor during construction, which may cause temporary delays for emergency responders. Emergency service providers (police protection, fire protection, and Emergency Medical Services) would receive notification and accommodations prior to roadway construction or ramp closings. With this information, emergency responders would be able to plan their routes in advance of an emergency situation.

In the long term, the implementation of either of the Proposed Build Alternatives would improve access and mobility along the US 281 project corridor; however, traffic patterns and flow would change (see Changes to Traffic Patterns below).

Places of Worship and Cemeteries

No-Build Alternative

There would be no direct impact to places of worship or cemeteries as a result of the implementation of the No-Build Alternative.

Proposed Build Alternatives

Neither of the Proposed Build Alternatives would displace nor result in the relocation of any place of worship or cemetery located within one-quarter mile of the US 281 project corridor (**Figure 3-10**). However, the ROW requirements for each Proposed Build Alternative could directly affect portions of several properties owned by places of worship as identified in **Table 3-25.** In the long term, the implementation of either of the Proposed Build Alternatives would improve access and mobility along the US 281 project corridor; however, traffic patterns and flow would change (see **Changes to Traffic Patterns** below).

Table 3-25: ROW Acquisition for Place of Worship Properties

Property Name	Property Address	Total Acreage of Parcel	Acres Impacted	Percentage of Parcel Impacted	Land use	Appraised Value
ROW Acquisitions for Expressway Alternative						
Northside Church of Christ	16318 San Pedro, San Antonio, TX 78232	25.36	1.25	5%	Range Land	$2,390,000
Crossbridge Community Church of San Antonio	14650 N US Highway 281 San Antonio, TX 78260	24.82	0.90	4%	Range Land	$3,627,820
Bulverde United Methodist Church	28300 Highway 281 N San Antonio, TX 78260	4.66	0.28	6%	Place of Worship	$1,421,170
ROW Acquisitions for Elevated Expressway Alternative						
Crossbridge Community Church of San Antonio	14650 N US Highway 281 San Antonio, TX 78260	24.82	0.79	3%	Range Land	$3,627,820

Source: Bexar County Appraisal District and US 281 EIS Team, July 2011.

Changes to Traffic Patterns

No-Build Alternative

The No-Build Alternative would not reconfigure the existing US 281 roadway and therefore would not change the traffic patterns. Under the No-Build Alternative, the 2035 forecasted travel demand would not be met, travel times would increase, travel speeds would decrease, and the existing conflicts between local and through traffic would remain.

Expressway Alternative

The Expressway Alternative would consist of three access-controlled main lanes in each direction and two to three partially access-controlled frontage road lanes on the west and east sides of the main lanes. Grade separations would be provided at Sonterra Boulevard, Redland Road, Encino Rio, Evans Road, Stone Oak Parkway, Marshall Road, Wilderness Oaks, Overlook Parkway, Bulverde Road, and Borgfeld Drive to allow the main lanes to pass uninterrupted over the cross streets; thus, the main lanes would not intersect directly with any local streets. Four direct connector ramps would be provided at Loop 1604 to provide main lane to main lane connections for US 281 motorists travelling westbound Loop 1604 to northbound US 281; southbound US 281 to eastbound Loop 1604; eastbound Loop 1604 to northbound US 281; and southbound US 281 to westbound Loop 1604. As a result of these changes, all cross streets and driveways that currently intersect the existing US 281 roadway would not have direct access to the main lanes, and would be accessible only from the frontage road lanes. Left turns from cross streets would be restricted to signalized intersections at the overpasses; this change would require some motorists to travel to the closest grade separated intersection to make a u-turn. The main lane on and off ramps would be accessed to and from the frontage road lanes at several locations along the corridor; this change means that motorists would have to use the one-way frontage roads to reach their destination after exiting the main lanes from an off ramp and would have to use the frontage roads to reach the on ramps to the main lanes (both of these actions may require passing through signalized intersections on the frontage roads and/or making u-turns to reach the desired location). Overall, these changes to traffic flow would improve mobility and accessibility along the US 281 project corridor. There would likely be a transition period whereby roadway users would have to adjust to the changes. The potential changes would be communicated to the public and affected businesses, and would be coordinated with emergency responders and other public service providers.

Elevated Expressway Alternative

The Elevated Expressway Alternative would consist of two-to-three access-controlled main lanes that would be elevated for the length of the US 281 project corridor. The elevated main lanes would pass uninterrupted over Sonterra Boulevard, Redland Road, Encino Rio, Evans Road, Stone Oak Parkway, Marshall Road, Wilderness Oaks, Overlook Parkway, Bulverde Road, and Borgfeld Drive. The existing US 281 roadway, including a portion of the US 281 Super Street, would remain in place as partially access-controlled lanes, crossing local streets at grade via signalized intersections for the length of the corridor. At Loop 1604, the northbound and southbound elevated main lanes would connect directly to eastbound and westbound Loop 1604. From Loop 1604 north to Stone Oak Parkway, the elevated main lanes would be built on the outside of the existing US 281 roadway and would transition to the west side of the existing US 281 roadway north of Stone Oak Parkway to Borgfeld Drive. Like the Expressway

Alternative, all cross streets and driveways that currently intersect the existing US 281 roadway would not have direct access to the main lanes. Unlike the Expressway Alternative, the Elevated Expressway Alternative contemplates using the existing US 281 roadway and some new access roads, where needed, to serve local traffic and to provide direct access to businesses, neighborhoods and connecting streets. The main lane on and off ramps would be accessed to and from the existing US 281 roadway at several locations along the corridor; this change means that motorists may have to pass through signalized intersections on the existing roadway and/or make u-turns to reach their desired location. Overall, these changes to traffic flow would improve mobility and accessibility along the US 281 project corridor. There would likely be a transition period whereby roadway users would have to adjust to the changes. The potential changes would be communicated to the public and affected businesses, and would be coordinated with emergency responders and other public service providers.

Potential Economic Effects

This section addresses the potential effects to the local economy, as well as employment growth and property tax revenues. This section also includes direct and indirect effects on local, regional and state employment output and income, as well as temporary impacts from the construction of the US 281 Corridor Project and additional long-term impacts that would result from the operation of either of the Proposed Build Alternatives.

To isolate the potential economic effects of the US 281 Corridor Project on the local economy, it is necessary to distinguish those resources that are new to the economy from local resources that would still be spent in the region. **Table 3-26** describes the funding sources and expenditure percentages that are planned for the US 281 Corridor Project, in addition to which funds represent new resources that are being invested in the region because of the US 281 Corridor Project. The federal and state funds originate from outside the local economy; therefore, these funds represent new resources. The local funds originate within the SA-BC MPO; therefore, they are considered existing revenue sources. **Table 3-26** provides a breakdown of funding categories, estimated costs, and funding shares by percentages.

Table 3-26: Summary of Funding Sources

Source	Categories	Funding	Funding Share
Federal/State	Category 2 Metro Corridor Texas Mobility Fund (TMF) and Proposition 12	$92,000,000	17.6%
Local	Bonds, Transportation Infrastructure Finance and Innovation Act , Advanced Transportation District and Local Contribution	$429,513,685	82.4%
Total Project Cost		$521,513,685	

Source: SA-BC MPO TIP, January 28, 2013

Funding mechanisms identified for the construction of the US 281 Corridor Project would be authorized under the various categories identified in **Table 3-26** and are defined as follow:

- Category 2 Metro Corridor (large MPOs) is addressed in the "Mobility Plan" Statewide Mobility Program (SMP), which is the statewide 'Build It' plan

adopted by the Texas Transportation Commission (the Commission). The SMP outlines funding levels and projects for a ten year time period and allows for development authority up to a certain amount for other projects. Texas voter approval in 2001 of Proposition 15 and enactment of legislation by the 77th Legislature in 2001 created the Texas Mobility Fund (TMF). The creation of the Mobility Fund allows TxDOT to issue bonds secured by future revenue. This allows the acceleration of mobility projects throughout the state. The Mobility Fund is to be administered by the Commission as a revolving fund to provide a method of financing for the construction, reconstruction, acquisition and expansion of state highways, including costs of any necessary design and costs of acquisition of ROW, as determined by the Commission in accordance with standards and procedures established by law.

- Bonds can be described as debt instruments issued for a period of more than one year, with the purpose of raising capital by borrowing with a promise to repay the principal along with interest (coupons) on a specified date of maturity. Municipality bonds, issued by a state, city, or local government, are generally used to raise capital for day-to-day activities and/or for specific projects proposed, usually pertaining to the development of local infrastructure such as roadways, drainage/sewerage, etc.
- An additional funding category considered for the US 281 Corridor Project is the Transportation Infrastructure Finance and Innovation Act (TIFIA) program. The TIFIA program provides federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. TIFIA credit assistance provides improved access to capital markets, flexible repayment terms, and potentially more favorable interest rates than can be found in private capital markets for similar instruments. TIFIA can help advance qualified, large-scale projects that otherwise might be delayed or deferred because of size, complexity, or uncertainty over the timing of revenues. Many surface transportation projects—highway, transit, railroad, intermodal freight, and port access—are eligible for assistance. Each dollar of federal funds can provide up to $10 in TIFIA credit assistance and leverage $30 in transportation infrastructure investment.
- Another funding category for the US 281 Corridor Project is the Advanced Transportation District (ATD) fund. On November 2, 2004, the voters of San Antonio approved the creation of an ATD for mobility enhancement and advanced transportation. The ATD authorized a sales and use tax of one-fourth of one percent (0.25%) to be allocated in the following percentages: 50 percent to VIA, 25 percent to the TxDOT and 25 percent to the City of San Antonio.

Potential Effects to Employment and Income

No-Build Alternative

Under the No-Build Alternative, employment at currently established businesses would be expected to remain the same or change based on market factors.

Proposed Build Alternatives

The proposed US 281 Corridor Project would help generate both short-term (construction-related) and long-term economic benefits. Construction of the project

would be a multi-year effort, which would help provide opportunities for short-term employment within the City of San Antonio, Bexar County, and the immediate region. In addition, a large portion of jobs generated by wage expenditures (wages paid for construction jobs) is also likely to be based in the region. Based on an estimated construction cost (see **Table 3-26**) and multi-year construction duration, the proposed project could generate up to 11,000 jobs in the region. These jobs would include construction and manufacturing/vending jobs, as well as jobs created to meet the demand for goods and services by those employed to construct the proposed project. The US 281 Corridor Project is listed in the TxDOT's *Statewide Transportation Improvement Program FY 2011-2014* as a 6-lane toll expressway with non-toll frontage road lanes. The total cost breakdown estimated for the proposed project in this plan is included in **Table 3-27**.

Table 3-27: Total Project Cost Breakdown

Project Cost Description	Cost	Percentage of Total
Preliminary Engineering	$16,956,744	3.2%
ROW Purchase	$92,023,583	17.6%
Construction Engineering	$16,437,660	3.2%
Construction Cost	$346,056,000	66.4%
Contingencies	$32,390,841	6.2%
Indirect Costs	$17,648,857	3.4%
Total Project Cost	**$521,513,685**	**100%**

Source: TxDOT, *Statewide Transportation Improvement Program FY 2013-2016*, updated Febuary 2013
Note: The US 281 Project is two separate entries - CSJ 0253-04-138 and 0253-04-146.

Roadway construction activities resulting from the implementation of either of the Proposed Build Alternatives are expected to generate a temporary direct increase in construction-related and other employment as well as local and statewide income. In addition, indirect increases in local income could result from spending by construction employees at businesses and restaurants along the US 281 project corridor. There is the potential for jobs losses due to the relocation of businesses along the US 281 project corridor, as discussed in **Section 3.4.4** ; the Expressway Alternative could displace 26 businesses and 177 to 206 jobs and the Elevated Expressway Alternative could displace 28 businesses and 169 to 194 jobs. However, the US 281 Corridor Project is not expected to have a substantial adverse impact on local employment in the vicinity of the corridor. The number of construction-related jobs could vary depending on the phasing of the project construction.

Regional Economic Effects of the Proposed Build Alternatives

The Regional Input-Output Modeling System (RIMS II), produced by the Bureau of Economic Analysis, was used to analyze the effects that the Proposed Build Alternative could have on the regional economy and on employment and earnings. This input-output analysis uses two inputs, the projected cost required for the construction of the Proposed Build Alternatives, and a set of regional multipliers sourced from the RIMS II model that measure the economic effects of the construction industry in the San Antonio Metropolitan Statistical Area (MSA) which includes: Atascosa, Bandera, Bexar, Comal, Guadalupe, Kendall, Medina, and Wilson counties.

For the purposes of comparing the Proposed Build Alternatives, the US 281 EIS team developed cost estimates based on 2010-2011 bid history data from TxDOT. The

construction costs used in this analysis include the costs for earthwork, pavement, retaining walls, bridges, traffic signals and controls, drainage, signage and striping, illumination, pedestrian amenities and context sensitive solutions, stormwater management, utilities, as well as a 30 percent contingency factor and a 10 percent mobilization fee (See **Appendix K2** for more information on cost estimates). To estimate the cost for the tolling elements of the Proposed Build Alternatives it was assumed that four toll gantries would be built for the Expressway Toll and Expressway Managed Lanes Alternatives, and three toll gantries would be built for the Elevated Expressway Toll and Elevated Expressway Managed Lane Alternatives. The estimated tolling cost includes equipment costs and installation as well as a 5 percent mobilization fee.

The RIMS II model provides multipliers for the construction sector overall, as such the multipliers used in this analysis are not specific to highway construction. The construction sector multipliers include the following activities: construction of buildings and other structures, heavy construction such as highways, power plants and pipelines, and construction activities conducted by special trade contractors. (BEA 2011). The output of the type II multipliers is total economic effect of the input or cost including direct, indirect and cumulative effects. The potential regional economic effects of the Proposed Build Alternatives are therefore general estimates and should be only used for the purpose of comparing the Proposed Build Alternatives.

The direct and indirect impacts of the Proposed Build Alternatives on output, earnings, employment and value added are shown in **Table 3-28**.

- Output is the estimated value of the Proposed Build Alternatives, as constructed, on the San Antonio MSA economy overall
- Earnings are the total increase in profits that could be generated in the San Antonio MSA economy as a result of the construction of the Proposed Build Alternatives
- Employment represents the total number of jobs that could be created as a result of constructing the Proposed Build Alternatives. Employment supported by construction activities include: new jobs (unemployed labor is hired), better jobs (currently employed workers that move into jobs with better compensation and/or full-time positions), and sustained jobs (current employees are retained with the expenditure)
- Value Added is the potential contribution of the construction of the Proposed Build Alternatives to the regional gross domestic product (GDP)

Table 3-28: Estimated Economic Effects per US 281 Proposed Build Alternative

Alternative	Option	Cost[1] (2010 dollars)	Total Effect			
			Output	Earnings	Employment	Value Added
Expressway Alternative	Non-Toll	$376,871,641	$846,152,208	$281,749,239	7,053	$462,609,939
	Toll	$390,871,641	$877,585,008	$292,215,639	7,315	$478,794,939
	Managed	$390,871,641	$877,585,008	$292,215,639	7,315	$478,794,939
Elevated Expressway Alternative	Non-Toll	$581,610,061	$1,305,830,909	$434,811,682	10,885	$713,926,350
	Toll	$590,610,061	$1,326,037,709	$441,540,082	11,054	$724,973,850
	Managed	$590,610,061	$1,326,037,709	$441,540,082	11,054	$724,973,850

Source: Bureau of Economic Analysis, 2002 Input-Output National Benchmark and 2008 Input-Output San Antonio MSA multipliers and US 281 EIS Team

[1] Preliminary Cost Estimates include: Construction, Utilities, and a Contingency factor (2010 dollars).

Conclusion

The US 281 Corridor Project has the potential to contribute to the regional economy as well as increase employment in the short term. A total economic output of between $846 and $1,326 million could be generated, and between 7 and 11 thousand jobs could be generated. Because the Expressway Alternative (Non-toll) would cost the least to construct, of the Proposed Build Alternatives, it is expected to generate the lowest total economic effect while the Elevated Expressway (Toll and Managed), with a highest construction cost is expected to generate the most economic effects.

Potential Effects to Property Tax Revenues

No-Build Alternative

Under the No-Build Alternative, there would be no ROW acquisition and private and public property would not be removed from the tax rolls of local government entities and both Comal and North East ISDs.

Proposed Build Alternatives

Long-term economic effects under either of the Proposed Build Alternatives would include the permanent removal of taxable property in Bexar County from the tax rolls of the County, the City of San Antonio, North East ISD, and Comal ISD where additional ROW would be required. **Table 3-19** in **Section 3.4.3** shows major taxing jurisdictions, net property tax revenues, and the associated tax rate per $100 valuation for fiscal year 2011. These taxing jurisdictions are within the proposed project corridor where additional ROW may be acquired for the Proposed Build Alternatives.

Table 3-29 shows the required additional ROW acreage and the total estimated value of the ROW to be acquired for the Proposed Build Alternatives. The total value estimates are calculated based on the total 2010 land and improvement (structure) market value for each potentially acquired ROW parcel and the percentage of each parcel necessary for each Proposed Build Alternative. The Expressway Alternative would require 128 acres of ROW with an estimated value of $30,732,477 and the Elevated Expressway Alternative would require 99 acres of ROW with an estimated value of $23,861,270.

Table 3-29: Estimated Value of ROW to be Acquired

Proposed Build Alternative	Required Additional ROW (in acres)	Total Est. Value of ROW to be Acquired
Expressway	128	$30,732,477
Elevated Expressway	99	$23,861,270

Sources: Bexar Appraisal District, 2010, US 281 EIS Team, July 2011.

Table 3-30 shows the potential loss in tax revenue for the four major taxing jurisdictions that could be affected by the Proposed Build Alternatives. Potential tax revenue loss was calculated by multiplying the 2011 tax rates used by each jurisdiction (tax rates shown in **Table 3-19**) by the total value of each parcel that could be potentially be acquired.

Table 3-30: Potential Annual Loss in Tax Revenue per Proposed Build Alternative

Proposed Build Alternative	Major Taxing Jurisdiction				Total
	City of San Antonio	Bexar County	North East ISD	Comal ISD	
Expressway	$29,249	$135,469	$135,489	$233,945	$534,152
Elevated Expressway	$22,034	$105,180	$48,884	$171,158	$347,256

Sources: Bexar Appraisal District, 2011, State of Texas Office of the Comptroller, 2011.

Based on this analysis, the Expressway Alternative would have the largest potential loss in property tax revenues at an estimated $534,152 per year, while the Elevated Expressway Alternative could result in a $347,256 loss in property tax revenue. Of the taxing jurisdictions that could be impacted, Comal ISD stands to lose the most annual tax revenue of the two Proposed Build Alternatives.

Conclusion and Proposed Mitigation Measures

The US 281 Corridor Project would have both short and long term economic effects. In the short term, the proposed project would generate engineering and construction jobs, as well as jobs created to meet the demand for goods and services by those employed to construct the proposed project. Long term economic effects include the permanent removal of taxable property in Bexar County from the tax rolls of the County, the City of San Antonio, North East ISD, and Comal ISD where additional ROW would be required; however, this long term effect is not anticipated to be substantial when the total potential property tax revenue is compared to the net property tax revenues for each major taxing jurisdiction.

Long-term economic effects under either of the Proposed Build Alternatives would include the permanent removal of taxable property in Bexar County from the tax rolls of Bexar County, the City of San Antonio, North East ISD, and Comal ISD where additional ROW would be required. **Table 3-30** shows the potential annual tax revenue losses by major taxing jurisdictions that could result from the ROW acquired for the Proposed Build Alternatives.

In terms of mitigation measures that may offset any property tax losses, the US 281 Corridor Project is projected to introduce $462,495,361 (*Mobility 2035*) into the local economy which could have a net effect of increasing property values (AZDOT 2001; MNDOT 2009; LECG 2006), and introducing additional local and statewide income and local employment.

3.5 PEDESTRIAN AND BICYCLE FACILITIES

3.5.1 Methodology

Information about the existing and proposed pedestrian and bicycle facilities along the US 281 project corridor was obtained via field reconnaissance and the SA-BC MPO's Pedestrian Chapter and Bicycle Chapter of *Mobility 2035*, which includes current and proposed bicycle corridor maps. The data collected was used to ascertain the environmental consequences to pedestrian and bicycle facilities as a result of the Proposed Build Alternatives.

3.5.2 Affected Environment

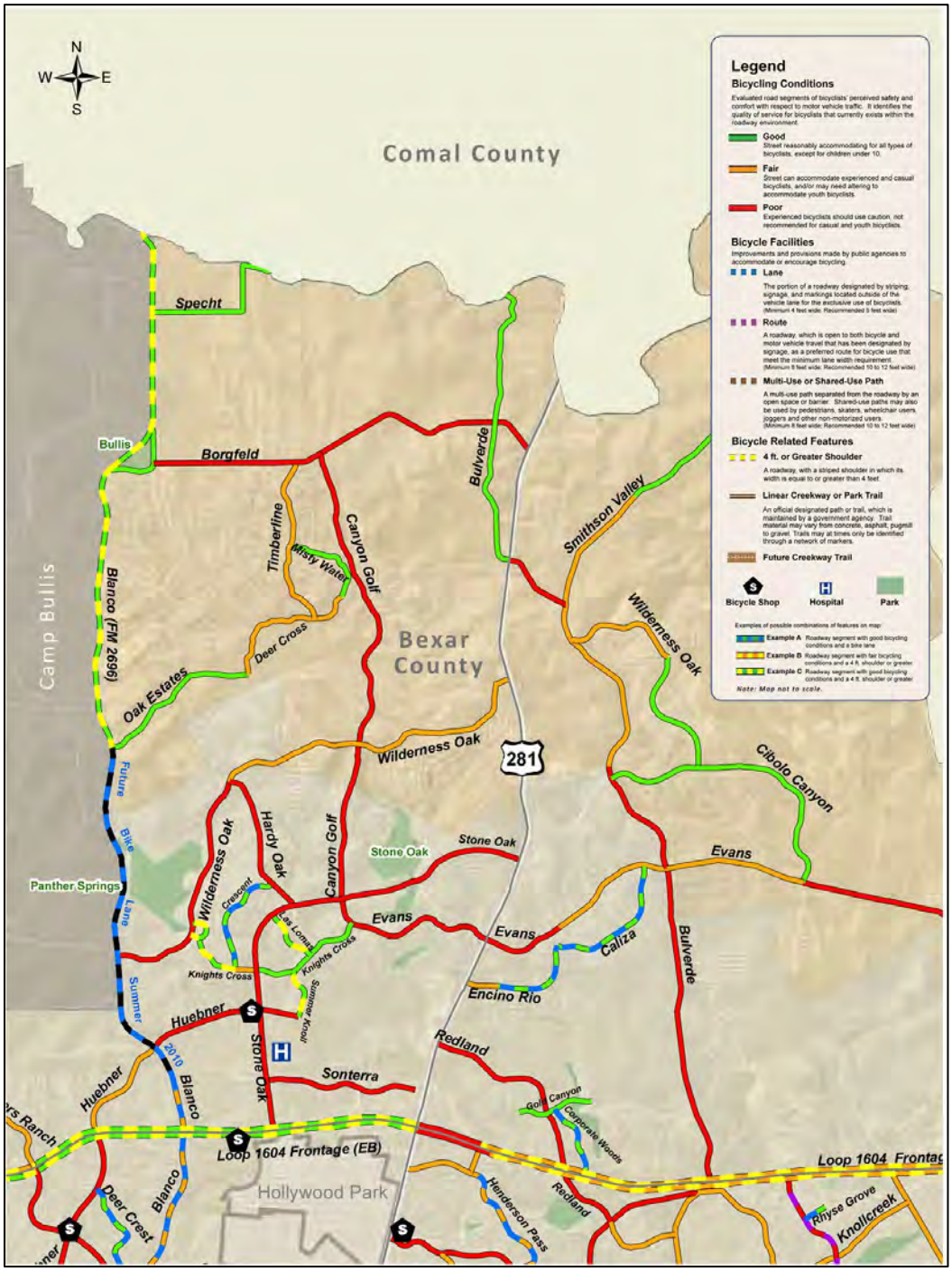
Currently, there are limited pedestrian facilities (i.e. sidewalks) within the US 281 project corridor. Several cross walks have been built in conjunction with the US 281 Super Street. The SA-BC MPO has identified five goals and objectives which would "support comprehensive, coordinated and continuous regional planning for pedestrian facilities". The five goals include:

1) develop a regional pedestrian system
2) provide a safe pedestrian system
3) employ accessible, barrier-free, state-of-the-art design
4) engage the public in the transportation planning process
5) identify and efficiently use available funding

The SA-BC MPO's Pedestrian Mobility Advisory Committee (PMAC) supports several unfunded sidewalk projects, with one project located at Evans Road and Bulverde Road, approximately 1.5 miles east of US 281. As of December 2009, there are no other planned sidewalk projects located in the US 281 project corridor.

There is one bike facility with a dedicated bike lane in the corridor, which is located at US 281 and Encino Rio, east of US 281. The SA-BC MPO defines a bike lane as "the portion of a roadway designated by striping, signage, and markings located outside of the vehicle lane for the exclusive use of bicycles" (SA-BC MPO 2009b). The SA-BC MPO's *Regional Bicycle Master Plan* has been adopted and has conducted three data collection efforts in 2001, 2006 and 2009, resulting in a series of *Bicycle Route Sustainability Maps*. As of 2009, there are approximately 136 miles of on-road bicycle facilities in San Antonio; an increase of approximately 70 miles from 2004. The *2009 Bicycle Conditions Map* shows road segments that have been evaluated based on bicyclists' perceived safety and comfort with respect to motor vehicle traffic. It identifies the quality of service that currently exists within the roadway environment for bicyclists. The map shows "poor" bicycling conditions at all intersections within the US 281 project corridor, north of Loop 1604, except for at Encino Rio. **Figure 3-12** shows the proposed bicycle facilities for the US 281 project corridor. Bicycle facilities have been planned at most cross streets on US 281, but not on the US 281 project corridor itself, as approved by the San Antonio City Council and Bexar County in 2005.

Figure 3-12: Recommended bicycle corridor map



Source: SA-BC MPO, 2009d.

3.5.3 Environmental Consequences

No-Build Alternative

Under the No-Build Alternative any additional pedestrian or bicycle facilities beyond the existing condition would be developed by other proposed projects or entities. Moreover, safety for pedestrians and bicyclists could decrease due to an increase in congestion from traffic on the US 281 project corridor and existing cross streets.

Proposed Build Alternatives

Both Proposed Build Alternatives include a provision for bicycle and pedestrian facilities within the US 281 project corridor ROW. These facilities could take the form of bikeable shoulders or wide curb lanes on the frontage roads, multi-use paths, sidewalks, audible signals and crosswalks. The preliminary designs of the Proposed Build Alternatives contemplate a 10-foot wide paved multi-use path that could be accommodated on either side of the roadway (see **Appendix K1** or **Chapter 2 - Alternatives Considered, Figure 2-11** and **Figure 2-13** for more details). The configuration of the pedestrian and bicycle amenities are preliminary and are subject to change; for example mitigation measures such as the placement of sound walls could affect the design and/or location of the multi-use path. More detailed design of bicycle and pedestrian facilities will be included in the Final EIS as part of the Preferred Alternative.

Funding Options

As described in **Chapter 2 - Alternatives Considered,** both the Expressway Alternative and the Elevated Expressway Alternative are being considered for toll and managed lane funding options. All Proposed Build Alternatives are being analyzed and considered for inclusion of pedestrian and bicycle facilities along the length of US 281, from Loop 1604 to Borgfeld Drive, therefore the impacts to pedestrian and bicycle facilities would not change based on funding options.

3.5.4 Conclusion

Construction of proposed pedestrian and bicycle facilities would increase the safety of the existing conditions and would help fulfill the "Complete Streets" resolution adopted by the Transportation Policy Board (TPB) and supports the goals of the SA-BC MPO's adopted *Regional Bicycle Master Plan*. "Complete Streets" are defined as roadways that enable safe and convenient access to all users, including pedestrians, bicyclists, transit riders and drivers and are conducive to efficient movement of people.

3.6 TRANSPORTATION FACILITIES

This section analyzes each Proposed Build Alternative, and the No-Build Alternative, for their effects on 2035 traffic conditions. Three measures of effectiveness (MOEs) were used to establish a benchmark of existing traffic conditions and to measure and compare 2035 traffic conditions on US 281 for each alternative as well as on two parallel corridors to the US 281 project corridor, Blanco Road and Bulverde Road. These MOEs are Average Peak Period Speed, Average Daily Traffic (ADT), and Peak Period LOS—

widely accepted quantitative measures that help gauge the operational abilities of a transportation system in addressing existing and future travel demands.

3.6.1 Methodology

The SA-BC MPO's travel demand model, as updated in June 2010, was used to benchmark existing traffic conditions and to forecast the 2035 traffic conditions for each of the alternatives being analyzed in this Draft EIS. This model uses validated traffic data from 2008 as its base year which was used to describe the existing traffic conditions on the US 281 project corridor. For the purposes of this study, the existing conditions on the US 281 project corridor were calculated assuming that the US 281 project corridor is as currently configured with the completion of the US 281 Super Street.

The traffic forecasts are based on the 2035 planning horizon used in the SA-BC MPO's most recent update to *Mobility 2035.* As part of this plan, a future land use scenario was adopted which calls for a combination of transit-oriented development and development which emphasizes infill within the core of the metropolitan area. The travel demand model includes the adopted land use scenario, and corresponding distribution of population and employment, to forecast 2035 traffic conditions for the region. A technical memo in **Appendix D** discusses how the travel demand model was used to analyze traffic conditions on the US 281 project corridor and the parallel corridors and provides detailed results of the traffic analysis.

3.6.2 Affected Environment

The existing traffic conditions on the US 281 project corridor and the parallel corridors are used to establish a baseline for comparison with the Proposed Build Alternatives and the No-Build Alternative. The existing traffic conditions are modeled using the existing traffic network provided by the SA-BC MPO and the current demographic information. The model attempts to reproduce the actual traffic conditions as much as possible; however, there do remain some variations in the model volumes as compared to the actual counts. In general, the model is more conservative in the traffic volumes on the US 281 project corridor, and tends to underestimate the peak period congestion. The forecasted MOEs can only be obtained using the travel demand model, and in order to compare the forecast conditions with similar existing conditions, the model outputs are used to reflect existing conditions.

Existing Average Peak Period Speed on US 281

Average peak period speed measures the average miles per hour a vehicle can travel on the US 281 project corridor during morning rush hour, between 7:00 a.m. and 9:00 a.m., and evening rush hour, 4:00 p.m. to 6:00 p.m. Under existing conditions, traffic moves during the peak period at approximately 15 miles per hour (mph) on the southern segment of the US 281 project corridor, between Sonterra Boulevard to Marshall Road, and approximately 22 mph on the northern segment of the US 281 project corridor, between Marshall Road and Borgfeld Drive.

Existing ADT on US 281 and the Parallel Corridors

ADT is an estimate of the number of vehicles on the roadway each day. Two locations within the US 281 project corridor were used to compare ADT information and to

represent traffic conditions in the northern and southern portion of the corridor. A point near the intersection of US 281 and Bulverde Road represents conditions along the northern segment of the corridor while a point near the intersection of US 281 and Sonterra Boulevard represents conditions in the southern segment. Under existing conditions, approximately 40,000 vehicles use the northern segment of the US 281 project corridor each day and 80,000 vehicles use the southern segment. In addition, approximately 15,000 vehicles use a parallel corridor, Blanco Road or Bulverde Road, in the north and approximately 55,000 vehicles use a Blanco Road or Bulverde Road corridor in the south.

Existing LOS during Peak Period on US 281 and the Parallel Corridors

LOS is a measure of traffic flow and a driver's perception of how easy it is to change lanes. It is graded on a scale of A to F, A representing the best conditions and F the worst. Different segments of a roadway could potentially have different LOS, for example, in an area where a stop light exists, LOS may be reduced as traffic flow is stopped when the light is red. As such, LOS was measured for this analysis as the percentage of total roadway miles operating at each LOS scale (A through F). Under existing conditions, 25 percent of the miles of the US 281 project corridor operate at LOS D or better during the peak period and 75 percent of the roadway operates at LOS E or F. Blanco Road and Bulverde Road currently have better LOS than the US 281 project corridor with 75 percent of the miles along these parallel corridors operating at LOS D or better during the peak period and 25 percent at LOS E or F.

3.6.3 Environmental Consequences

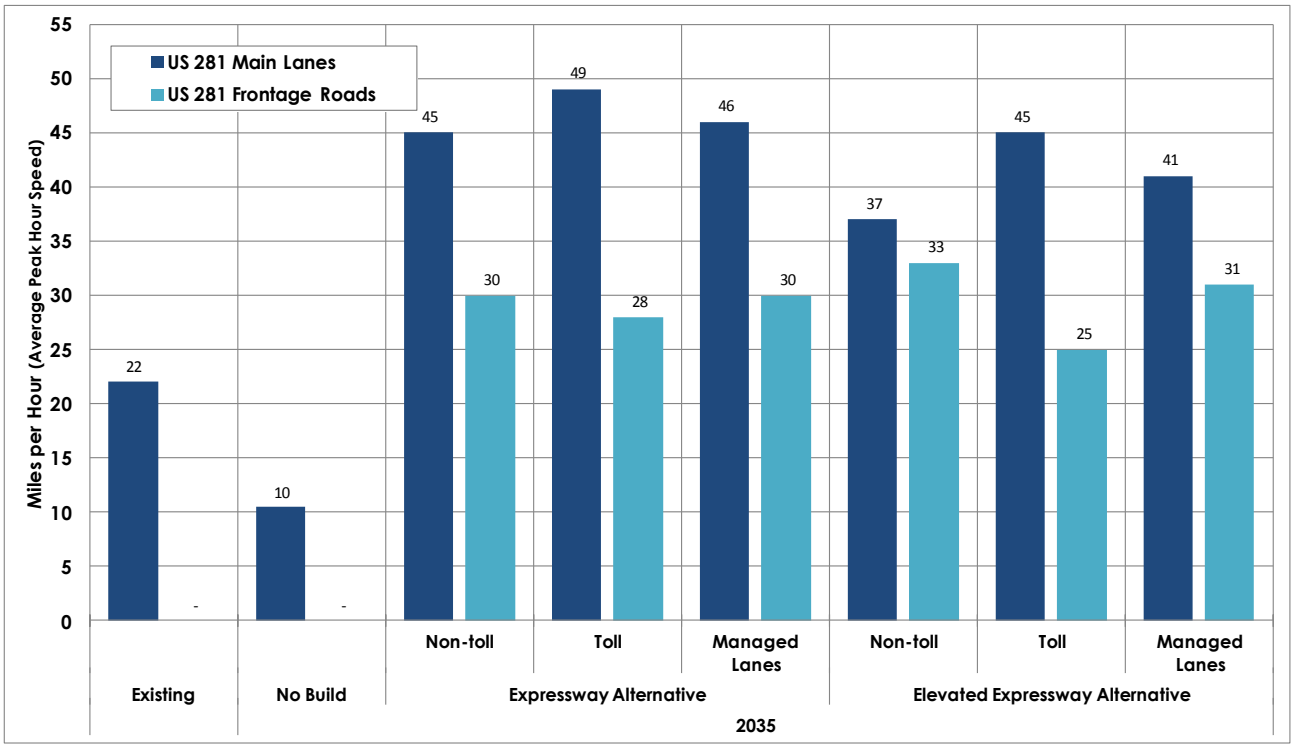
No-Build Alternative Compared to the Proposed Build Alternatives

The same three MOEs used to establish the existing traffic conditions were used to forecast the likely 2035 traffic conditions for each alternative being analyzed in this Draft EIS, including the No-Build Alternative.

2035 Average Peak Period Speed on US 281

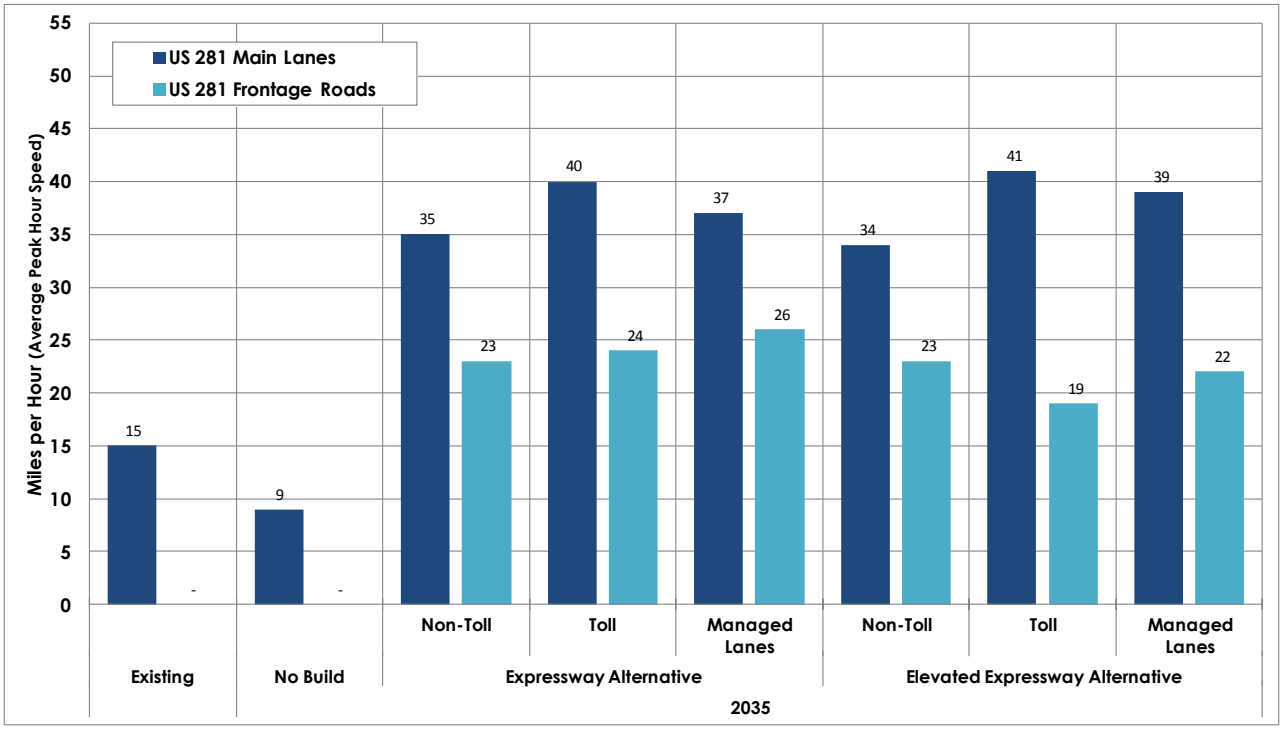
Figure 3-13 and **Figure 3-14** highlight the forecasted 2035 average peak period speeds along the US 281 project corridor and compare it with the 2008 existing conditions. **Figure 3-13** focuses on the northern segment of the US 281 project corridor, between Marshall Road and Borgfeld Drive, and **Figure 3-14** focuses on the southern segment of the US 281 Project Corridor, between Sonterra Boulevard and Marshall Road. As shown, both Proposed Build Alternatives have the potential to improve average peak period speed on the US 281 main lanes over the existing conditions. If no improvements are made, it is likely that the average peak period speed would be reduced on the US 281 project corridor and along the parallel corridors by 2035.

Figure 3-13: 2035 average peak period speed – northern segment (between Marshall Road and Borgfeld Drive)



Source: SA-BC MPO Travel Demand Model, 2010, US 281 EIS Team, 2010-2011.

Figure 3-14: 2035 average peak period speed –southern segment (between Sonterra Boulevard and Marshall Road)

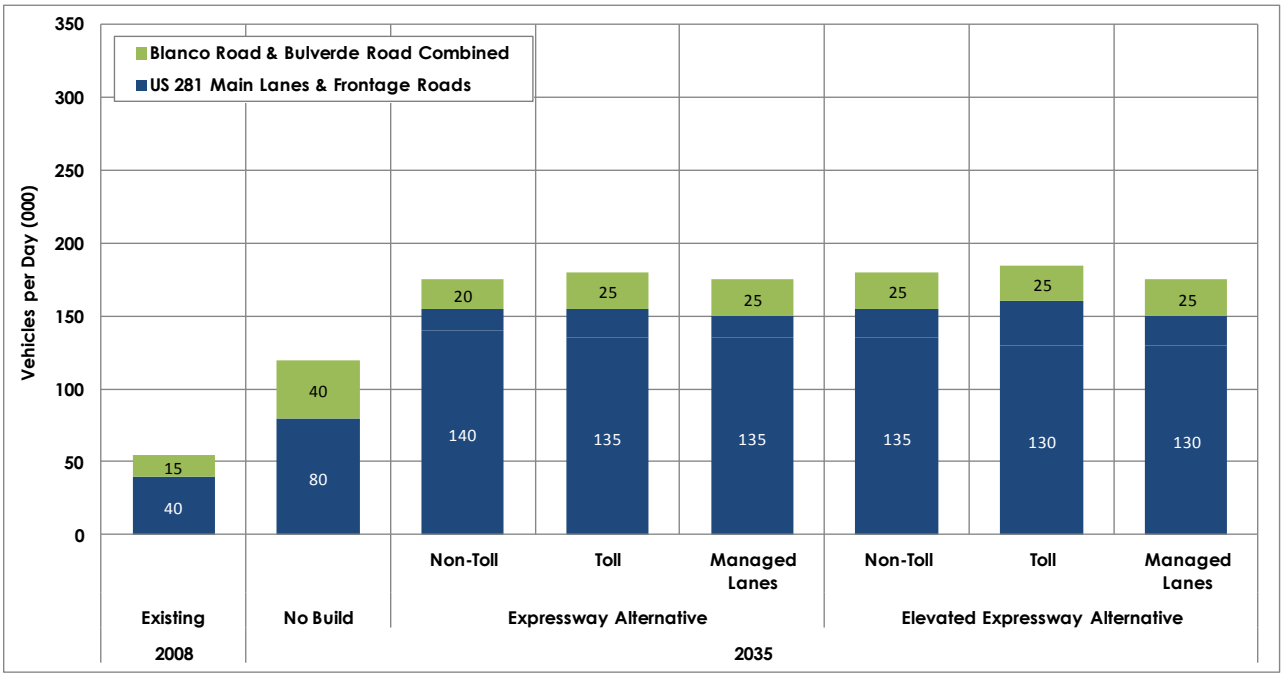


Source: SA-BC MPO Travel Demand Model, 2010, US 281 EIS Team, 2010-2011.

2035 ADT on US 281 and the Parallel Corridors

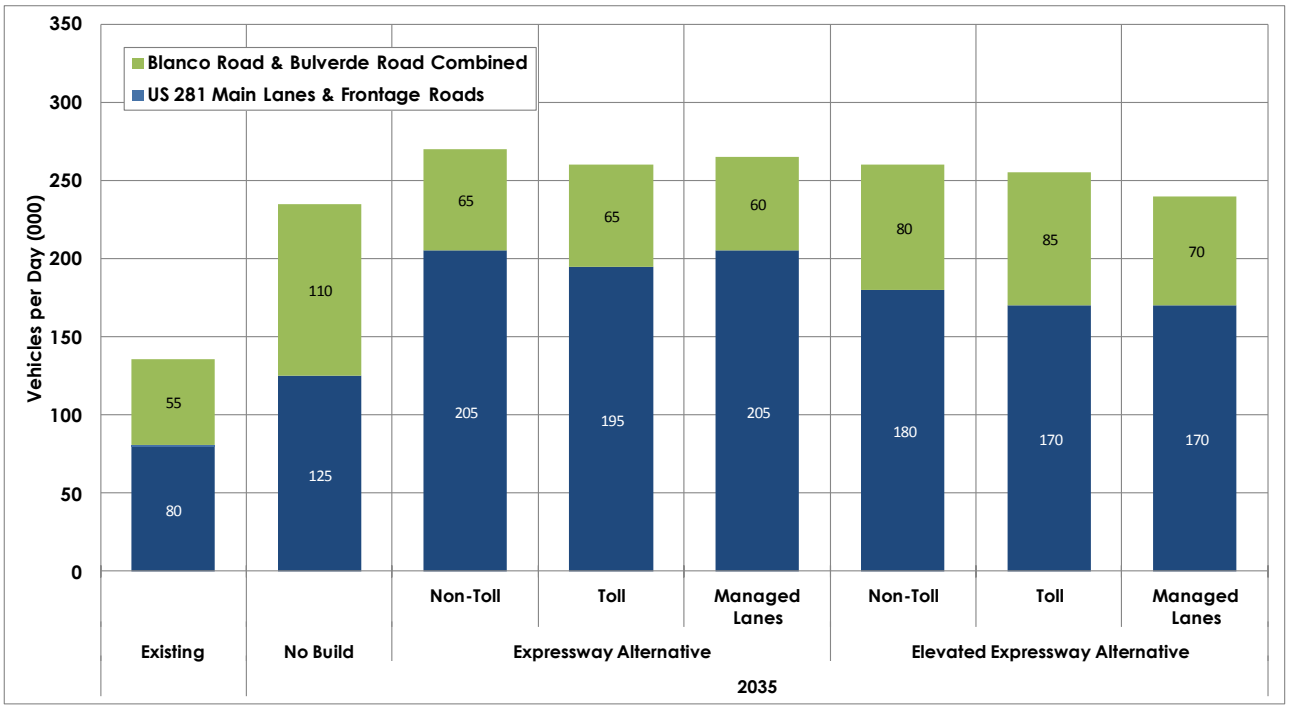
By 2035, the average number of vehicles traveling on the US 281 project corridor and along the parallel corridors is anticipated to grow. Using ADT as the metric, an alternative is considered effective if the majority of the daily traffic can be accommodated on the main lanes of the facility and thereby reduce the amount of traffic using the parallel corridors for through movement. If no improvements are made to the US 281 project corridor, the parallel corridors are likely to carry a larger portion of the 2035 daily traffic volume in comparison to the Proposed Build Alternatives. Under the No-Build Alternative, the northern segment could see 40,000 vehicles per day (vpd) on the parallel corridors and 80,000 vpd on the main lanes of the US 281 project corridor and along the southern segment, 110,000 vpd and 125,000 vpd respectively in 2035. **Figure 3-15** and **Figure 3-16** compare the 2035 ADT for each Proposed Build Alternative and the No-Build with each other and the existing conditions. **Figure 3-15** highlights the northern segment of the corridor while **Figure 3-16** highlights the southern segment.

Figure 3-15: 2035 average daily traffic – northern segment (near the intersection of US 281 and Bulverde Road)



Source: SA-BC MPO Travel Demand Model, 2010, US 281 EIS Team, 2010-2011.

Figure 3-16: 2035 average daily traffic – southern segment (near the intersection of US 281 and Sonterra Boulevard)

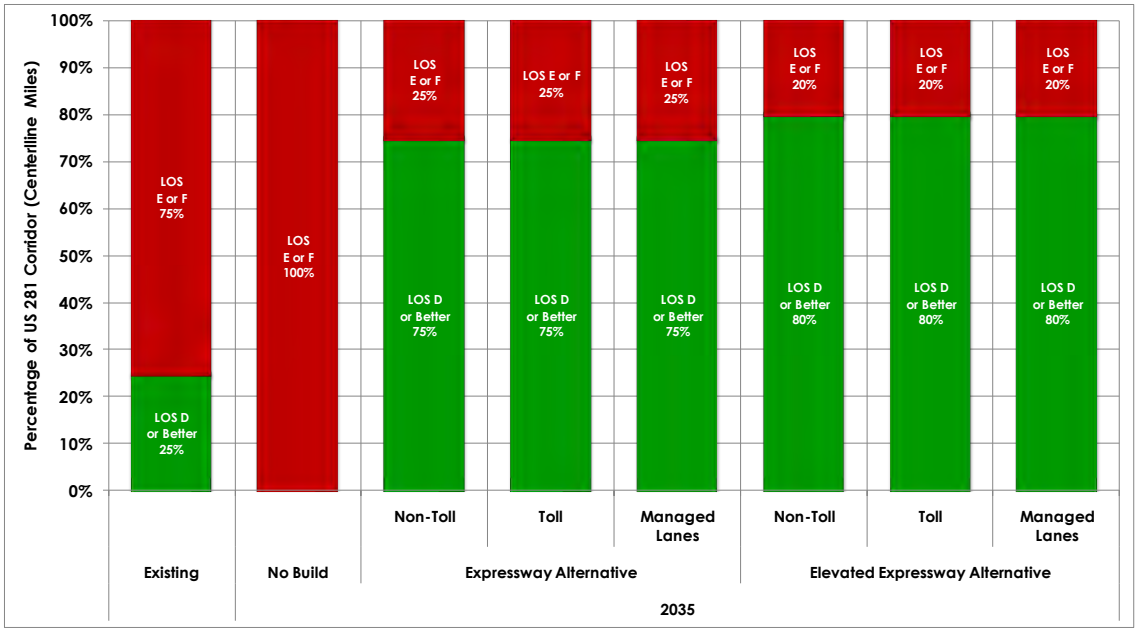


Source: SA-BC MPO Travel Demand Model, 2010, US 281 EIS Team, 2010-2011.

2035 Peak Period LOS on US 281 and the Parallel Corridors

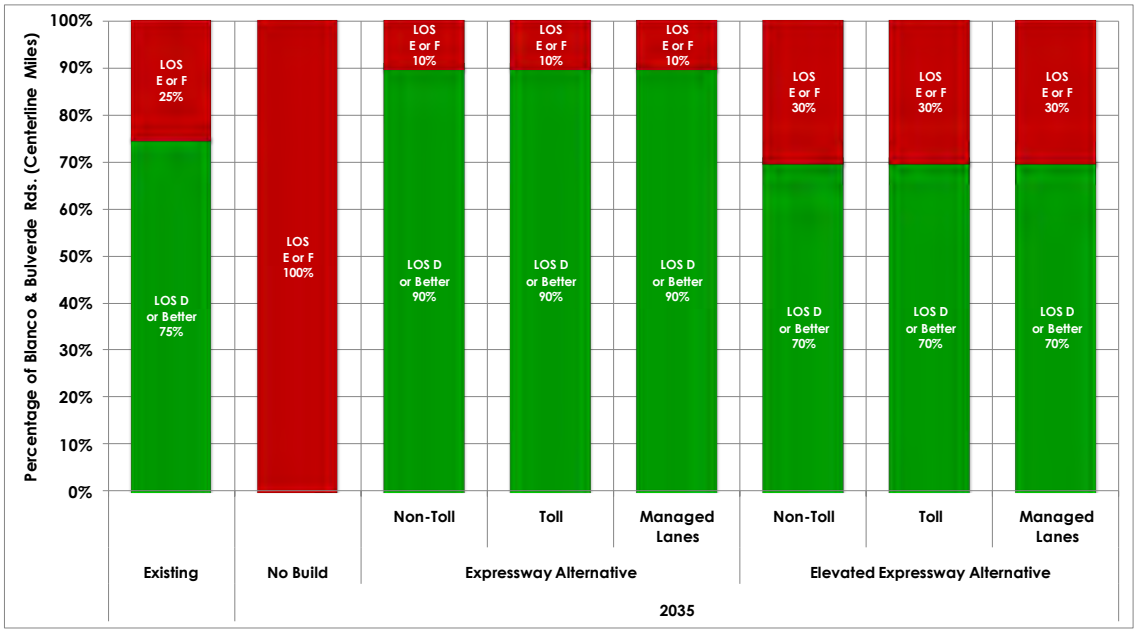
Figure 3-17 compares the peak period LOS that each alternative is likely to offer the driving public along the main lanes of the US 281 project corridor in 2035 and **Figure 3-18** compares the 2035 peak period LOS likely to be experienced on the parallel corridors. As shown, the No-Build Alternative would likely result in 100 percent of the miles along the main lanes of the US 281 project corridor and the parallel corridors to be operating at LOS E or F during the peak period by 2035. Both of the Proposed Build Alternatives stand to improve the peak period LOS on the US 281 main lanes compared to existing conditions as well as the No-Build Alternative.

Figure 3-17: Peak period LOS – US 281 main lanes



Source: SA-BC MPO Travel Demand Model, 2010, US 281 EIS Team, 2010-2011.

Figure 3-18: Peak period LOS– parallel corridors combined – Blanco Road & Bulverde Road



Source: SA-BC MPO Travel Demand Model, 2010, US 281 EIS Team, 2010-2011.

3.6.4 Conclusion

Compared to the Proposed Build Alternatives, the No-Build Alternative is the least effective at improving traffic speeds and traffic flow during peak period travel times on the US 281 project corridor. A summary of the three MOEs follows:

Average Peak Period Speeds: The two toll alternatives, Expressway Alternative (Toll) and Elevated Expressway Alternative (Toll), have the potential to provide the fastest speeds on the main lanes of the US 281 project corridor while Expressway Alternative

(Managed Lanes) and Elevated Expressway Alternative (Non-toll) have the potential to provide the fastest speeds on the frontage road lanes. The speeds will vary from segment to segment but will generally correspond to the overall facility type (non-toll, toll or managed lanes). In other words, the use of the frontage roads will vary between the facility types.

ADT: If no improvements are made, it is possible that traffic could divert from the US 281 project corridor to the parallel corridors and other regional roadways by 2035. Expressway Alternative (Non-toll) is likely to carry the highest ADT on the main lanes and frontage roads throughout the US 281 project corridor. Along the northern segment, Expressway Alternative (Non-toll) is likely to carry the lowest ADT on the parallel corridors and Expressway Alternative (Managed Lanes) is likely to carry the lowest ADT on the parallel corridors along the southern segment.

LOS: The Elevated Expressway Alternative has the potential to provide better LOS on the main lanes throughout the US 281 project corridor. The Expressway Alternative has the potential to provide better LOS on the parallel corridors.

The above analysis offers an overview of the likely 2035 traffic conditions on US 281 project corridor and along the parallel corridors for comparison purposes. The traffic forecasts used for analysis of the Preferred Alternative in the Final EIS will be developed in coordination with, and approved by the TxDOT Transportation Planning and Programming Division (TPP).

3.7 AIR QUALITY

Air pollution may contribute to adverse human health effects and ecosystem degradation. Motor vehicles, industries, construction equipment and some commercial operations are among the sources of air pollution in the San Antonio area. The main air pollutants emitted from motor vehicles are volatile organic compounds (VOC), nitrogen oxides (NOx), carbon monoxide (CO), carbon dioxide (CO_2), particulate matter (PM) and a class of compounds called mobile source air toxics (MSATs). VOC and nitrogen oxides can react in the air in sunlight to form ground-level ozone (O_3). Because the reactions take place over several hours, maximum concentrations of ozone are often far downwind of the precursor sources. Thus, ozone is a regional problem and not a local condition.

3.7.1 Methodology

This analysis was accomplished in accordance with *TxDOT's Air Quality Guidelines 2006, Amended 2011 (*TxDOT 2006, 2011*)*. In the Draft EIS, an air quality impact CO level was calculated for each of the alternatives to determine the potential for impacts along the US 281 project corridor. A MSAT analysis will be completed for the Preferred Alternative and documented in the Final EIS.

Regional Compliance

The NEPA of 1969 and the Clean Air Act of 1970 (CAA), as amended, resulted in federal requirements for USDOT to consider the impact proposed highways, such as the US 281 Corridor Project, may have on the local air quality. Under the CAA, the US EPA sets national ambient air quality standards (NAAQS) for seven air pollutants to protect

public health and the environment, with an adequate margin of safety. NAAQS exist for seven pollutants: CO, O_3, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), PM for both 10 and 2.5 microns and less (PM_{10} and $PM_{2.5}$), and lead (Pb). The CAA amendment of 1990 establishes specific milestones toward attaining the NAAQS, depending on the severity of the air pollution problem in the region. EPA classifies the status of a county's ambient air with respect to conformity to the NAAQS. The designations are as follows:

Table 3-31: NAAQS Attainment Designations

Designation	Definition
Nonattainment	Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.
Attainment	Any area (other than an area identified as Nonattainment) that meets the national primary or secondary ambient air quality standard for the pollutant.
Unclassifiable	Any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.

Source: EPA 2011.

3.7.2 National Ambient Air Quality Standards

The NAAQS for the seven pollutants are listed in **Table 3-32**. EPA delegated authority for monitoring and enforcing air quality regulations in Texas to the Texas Commission on Environmental Quality (TCEQ) Office of Air Quality Planning and Standards (OAQPS). The TCEQ may adopt other, more stringent, air quality standards than those of the EPA. However, the TCEQ observes the same air quality standards as the EPA.

Motor vehicles are the primary source of air pollution emissions associated with the proposed US 281 Corridor Project. In addition to CO, motor vehicles also produce VOC and NOx, which can react under certain conditions to form O_3. Determining the cause of O_3 through modeling requires long-term meteorological data and detailed area-wide emission rates for all potential sources (industry, business, and transportation).

Particulate matter consists of tiny particles that are emitted by vehicle engines (especially the diesel engines of trucks), brake pads, tires, and other moving parts of motor vehicles. These particles contribute to smog and haze, and are dangerous to human health, especially to people with respiratory conditions. The EPA provides health criteria for particles smaller than 10 microns (about 1/7 the width of a human hair) and for particles smaller than 2.5 microns.

CO is a very reactive gas that can cause asphyxiation. Because of its high reactivity, it does not persist in the air long after it is emitted, and therefore CO is a local problem where it occurs.

Table 3-32: National Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month	0.15 µg/m3 (1)	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.75 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate Matter [71 FR 61144, Oct 17, 2006]	$PM_{2.5}$	primary and secondary	Annual	15 µg/m³	Annual mean, averaged over 3 years
			24-hour	35 µg/m³	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 µg/m³	Not to be exceeded more than once per year on average over 3 years
Sulphur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: EPA as of October 2011 (http://www.epa.gov/air/criteria.html)
(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
(2) The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
(3) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.
(4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

Regional Air Quality History

In December 2002, 33 states, including Texas, submitted compact agreements pledging to meet the 1997 eight-hour ozone standard earlier than required. The states had to meet a number of criteria, and had to agree to meet certain milestones. The most significant milestone was that the Early Action Compact (EAC) areas had to be in attainment by December 31, 2007, based on air quality data from 2005, 2006, and 2007.

The San Antonio EAC area (includes Bexar, Comal, Guadalupe, Wilson counties) was one of the first to sign an EAC agreement. On March 31, 2004, a final San Antonio EAC plan was submitted to the TCEQ for incorporation into the *State Implementation Plan* (SIP). On November 17, 2004, the TCEQ adopted revisions to the SIP for the Austin, San Antonio and Northeast Texas Early EAC areas. The revisions required the San Antonio EAC area to demonstrate attainment of the eight-hour ozone goal targeted in their plan which was submitted to TCEQ in March 2004. This revision to the plan contains results of photochemical modeling and technical documentation in support of the attainment

demonstration. As a result of these analyses, and at the request of the San Antonio local governments, the revision includes changes to the VOC rules for degreasing and Stage I vapor recovery in all four counties.

On April 2, 2008, the EPA issued final action to designate 13 EAC areas (including San Antonio) as in attainment for the eight-hour ozone standard, as they had met all milestones of the EAC program and demonstrated attainment of the eight-hour ozone standard prior to December 31, 2007. The effective date of this final action was April 15, 2008. Designating the San Antonio area as in attainment for the eight-hour ozone means that there are no further SIP requirements for the existing standard, as long as the area continues to monitor attainment of this standard (TCEQ 2010b).

As of December 2011, San Antonio and Bexar County is in attainment for all of the NAAQS pollutants. However, in 2008, the EPA lowered the eight-hour ozone standard to 0.075 parts per million (ppm). The following year, the EPA, announced it would reconsider the 2008 Ozone standard and in January 2010, proposed to lower the primary ozone standard to a range of 0.060–0.070 ppm. In evaluating the proposed new standard, the EPA extended the implementation of the 2008 eight-hour ozone standard. On July 29, 2011, the EPA postponed the final revisions of the standard for ground-level ozone pollution. Announcement of a revision standard was originally expected by August 31, 2010. However, the date has been delayed multiple times to allow the federal agency a greater opportunity to review scientific studies that will guide their decision on pollution limits necessary to protect human health and the environment. The EPA on September 22, 2011, issued a memo on the Implementation of the Ozone NAAQS. The memo stated that the EPA is implementing the 2008 standard for ozone (0.075 ppm). In a separate attachment to the memo, the EPA listed 52 areas that are expected to exceed the ozone standard, of which the AACOG region is not on the list. Ozone measures are regional in nature and not project specific; therefore, conformity is based on the regional transportation network. The US 281 Corridor Project would reduce congestion, and although traffic is expected to increase in the future, potential impacts to air quality would be partly offset by reductions in average vehicle emissions, as younger vehicles with more effective pollution controls replace older vehicles on the highway. The AACOG region will continue to monitor the ozone level in the area as the San Antonio region is relatively close to being at or exceeding the newly implemented 2008 ozone standard.

The US 281 project corridor is located in Bexar County, as described above, is in attainment or unclassifiable for all NAAQS; therefore, the transportation conformity rules do not apply. The US 281 Corridor Project is included the SA-BC MPO financially constrained *Mobility 2035*, as revised and 2011-2014 Transportation Improvement Program (TIP), as revised and the subsequent 2013-2016 TIP, adopted by SA-BC MPO Transportation Policy Board on May 17, 2010 and April 23, 2012, respectfully. However the US 281 Corridor Project may not be consistent with the current *Mobility 2035* or TIP, depending upon identification of the Preferred Alternative. TxDOT will not take final action on this environmental document until the US 281 Corridor Project is consistent with *Mobility 2035*, 2011-2014 TIP, and 2013-2016 TIP.

3.7.3 Traffic Air Quality Assessment (TAQA)

Since the project would add capacity and the design year traffic is above the 140,000 vehicles per day (vpd) threshold, a traffic air quality analysis was required for CO. CO

is an odorless and toxic gas. CO results from the incomplete oxidation of carbon in the combustion of organic fuels.

Methodology

Of the criteria pollutants, CO is readily modeled for highway projects and is required by FHWA Technical Advisory T6640.8A (1987). A Traffic Air Quality Analysis (TAQA) for CO was prepared in accordance with *TxDOTs 2006 Air Quality Guidelines, Amended 2011*. Carbon monoxide concentrations for the proposed project were modeled at the closest receptors using the worst-case meteorological conditions using the air quality model CAL3QHC, in accordance with TxDOT air quality guidelines. CAL3QHC is a line source dispersion model specifically designed for the prediction of pollutant concentrations in the vicinity of highways. The estimated traffic volumes in 2015 and in 2035, the planning horizon for the project, are shown in **Table 3-33**. Stone Oak Parkway and Bulverde Road were selected as representative intersections with some of the highest traffic volume for the southern and northern project area, respectfully. The traffic forecasts were originally developed in 2008 by the SA-BC MPO for its regional traffic allocation model. The same traffic forecasts are used for predicting vehicle emissions for regional air quality conformity. The traffic allocation model assigns traffic to non-tolled and tolled scenarios based on a presumed travel costs, including tolls. As costs increase on a roadway within the model, more traffic would be expected to divert from the higher cost roadway to a lower cost road (e.g. traffic from tolled mainlanes shifts to a parallel roadway or the frontage road). Topography and meteorology of the project area do not restrict dispersion of the air pollutants.

Table 3-33: Estimated Daily Traffic Volume on US 281 at Stone Oak Parkway and Bulverde Road

Alternative	Existing (Vehicles per Hour)	2015 (Vehicles per Hour)	2035 (Vehicles per Hour)
Stone Oak Parkway			
No-Build	2,900	3,350	5,900
Expressway	-	4,350	10,550
Elevated Expressway	-	3,600	9,750
Bulverde Road			
No-Build	2,650	3,250	5,600
Expressway	-	4,000	9,850
Elevated Expressway	-	3,850	9,400

Source: SA-BC MPO and US 281 EIS Team, July 2012.

Affected Environment

The San Antonio region is in attainment of the NAAQS for CO. Existing background CO concentrations, attributable to emissions in the general community and to CO transported into that community, for the vicinity of the project area are estimated to be 1.7 and 1.1 ppm for the existing one-hour and the eight-hour concentrations, respectively. These estimated background CO concentrations were obtained from *TxDOT's Air Quality Guidelines 2006, Amended 2011*. TCEQ has several Continuous Air Monitoring Stations (CAMS) located throughout the state that monitor air quality in Texas. These sites measure different parameters such as, but not limited to, CO, NOx, nitrogen dioxide, and O_3. The closest station to the project area that measures CO is CAMS 27 (deactivated October 6, 2010), which is located at 615 E. Houston in San Antonio, Texas (approximately 15 miles from the US 281 project corridor). For the month of September 2010, this station measured an average 0.1 ppm for existing one-hour CO concentrations, which is below the 1.7 ppm for one-hour background concentrations obtained from TxDOT's *2006 Air Quality Guidelines* and well below the one-hour NAAQS of 35 ppm for CO (TCEQ 2010a).

CAMS Station

Environmental Consequences

No-Build Alternative

The No-Build Alternative would not relieve the traffic congestion on US 281. The No-Build Alternative would likely lead to increased congestion and decreased mobility as additional land development occurs along the US 281 project corridor. CO emissions would be sensitive to the projected increased congestion. The No-Build Alternative would result in higher projected CO emissions along US 281.

Proposed Build Alternatives

The projected year (2015) and the design year (2035) concentration for one-hour and eight-hour CO and the percentage of the NAAQS for the Proposed Build Alternative are presented in **Table 3-34**. CO levels are not expected to exceed NAAQS for any of the analysis years.

Table 3-34: CO Emission Concentrations

Year	Alternative	One-Hour CO (ppm) Standard 35ppm	One-Hour % NAAQS	Eight-Hour CO (ppm) Standard 9 ppm	Eight-Hour % NAAQS
Stone Oak Parkway					
2015	No-Build	2.8	8%	1.8	20%
	Expressway	2.8	8%	1.8	20%
	Elevated Expressway	2.2	6%	1.4	16%
2035	No-Build	3.4	10%	2.1	23%
	Expressway	2.8	8%	1.8	20%
	Elevated Expressway	2.3	7%	1.5	17%
Bulverde Road					
2015	No-Build	2.5	7%	1.6	18%
	Expressway	2.0	6%	1.3	14%
	Elevated Expressway	2.2	6%	1.4	16%
2035	No-Build	3.6	10%	2.2	24%
	Expressway	2.5	7%	1.6	18%
	Elevated Expressway	2.8	8%	1.8	20%

Source: US 281 EIS Team, July 2012.
Note: NAAQS for CO is 35 ppm for one-hour and 9 ppm for eight-hours. Analysis includes a one-hour background concentration of 1.7 ppm and an eight-hour background concentration of 1.1 ppm.

3.7.4 Mobile Source Air Toxics

In addition to the seven criteria air pollutants, the EPA also regulates MSATs. Most MSATs originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., bulldozers), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

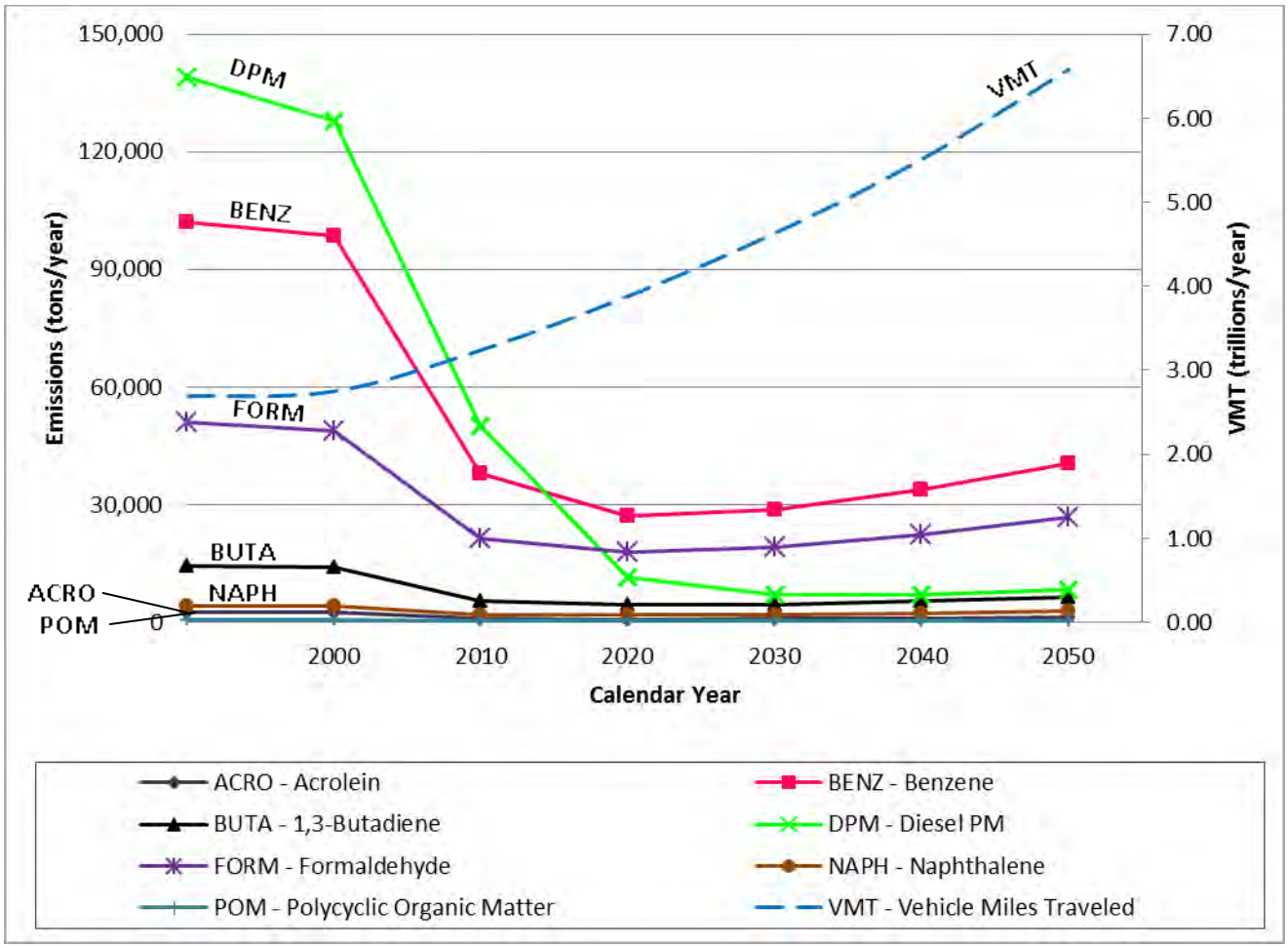
Background

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/ncea/iris/index.html). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA

considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

The 2007 EPA Mobile Source Air Toxics (MSAT) rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (vehicle-miles travelled, VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSAT is projected from 1999 to 2050, as shown in **Figure 3-19** and **Table 3-35**.

Figure 3-19: U.S. VMT vs. MSAT Emissions, 1999-2050



Source : EPA. MOBILE6.2 Model run (August 2009).
Note:(1) Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050.
(2) Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors

Table 3-35: Projected National MSAT Emissions and Percent Reduction for 1999-2050 for Vehicles Operating on Roadways Using EPA's MOBILE6.2 Model

Pollutant/VMT	Pollutant Emissions (tons) and Vehicle-Miles Traveled (VMT) by Calendar Year							Reduction
	1999	2000	2010	2020	2030	2040	2050	1999 to 2050
Acrolein	2,570	2,430	1,000	775	824	970	1,160	-55%
Benzene	102,000	98,400	38,000	27,000	28,700	33,900	40,500	-60%
1,3-Butadiene	14,400	14,100	5,410	4,360	4,630	5,460	6,520	-55%
Diesel PM	139,000	128,000	50,000	11,400	7,080	7,070	8,440	-94%
Formaldehyde	50,900	48,800	21,400	17,800	19,000	22,400	26,800	-47%
Naphthalene	4,150	4,030	1,990	1,780	2,030	2,400	2,870	-31%
Polycyclic Organic Matter	561	541	259	233	265	313	373	-33%
Trillions VMT	2.69	2.75	3.24	3.88	4.63	5.51	6.58	145%

Source: U.S. Environmental Protection Agency. MOBILE6.2 Model run 20 August 2009

Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision-making within the context of the National Environmental Policy Act (NEPA). The FHWA, EPA, the Health Effects Institute, and others have funded and conducted research studies to try to more clearly define potential risks from MSAT emissions associated with highway projects. The FHWA will continue to monitor the developing research in this emerging field.

Project-Specific MSAT Information

A qualitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives, found at:

http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/mobile_source_air_toxics/msatemissions.pdf

For each alternative in this document, the amount of MSAT emitted would be proportional to the vehicle miles traveled (VMT – distance traveled multiplied by the ADT), assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for each of the Build Alternatives is higher than that for the No-Build Alternative, because the additional capacity increases the efficiency of the roadway and attracts rerouted trips from elsewhere in the transportation network (see **Table 3-33**). This increase in VMT would lead to higher MSAT emissions for the preferred action alternative along the highway corridor, along with a corresponding decrease in MSAT emissions along the parallel routes (e.g. Bulverde and Blanco Road). The emissions increase is offset somewhat by lower MSAT emission rates due to

increased speeds; according to EPA's MOBILE6.2 emissions model, emissions of all of the priority MSAT except for diesel particulate matter decrease as speed increases. The extent to which these speed-related emissions decreases would offset VMT-related emissions increases cannot be reliably projected due to the inherent deficiencies of technical models. Also, regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by 72 percent between 1999 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

The additional travel lanes contemplated as part of the Proposed Build Alternatives will have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, under each alternative there may be localized areas where ambient concentrations of MSAT could be higher under certain Proposed Build Alternatives than the No-Build Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the expanded roadway sections that would be built adjacent to existing residential properties, under the Proposed Build Alternatives (See **Figure 3-8**). However, the magnitude and the duration of these potential increases compared to the No-Build alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. In sum, when a highway is widened, the localized level of MSAT emissions for the Build Alternative could be higher relative to the No Build Alternative, but this could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSAT will be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be lower in the future.

Incomplete or Unavailable Information for Project-Specific MSAT Health Impacts Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The U.S. Environmental Protection Agency (EPA) is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, http://www.epa.gov/ncea/iris/index.html). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of

risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's 2009 Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents, which can be found at the following address: (http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/100109guidmem.cfm). This Appendix also discusses a variety of FHWA research initiatives related to air toxics. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306).

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts - each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable. The results produced by the EPA's MOBILE6.2 model, the California EPA's Emfac2007 model, and the EPA's MOVES model in forecasting MSAT emissions are highly inconsistent. Indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates diesel particulate matter (PM) emissions and significantly overestimates benzene emissions.

Regarding air dispersion modeling, an extensive evaluation of EPA's guideline CAL3QHC model was conducted in an NCHRP study (http://www.epa.gov/scram001/dispersion_alt.htm#hyroad), which documents poor model performance at ten sites across the country - three where intensive monitoring was conducted plus an additional seven with less intensive monitoring. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections. Such poor model performance is less difficult to manage for demonstrating compliance with National Ambient Air Quality Standards for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to reliably forecast MSAT exposure near roadways, and to determine the portion of time that people are actually exposed at a specific location.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of

occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://wwwcf.fhwa.dot.gov/exit.cfm?link=http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine a "safe" or "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than safe or acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

3.7.5 Conclusion

Both of the Proposed Build Alternatives are similar in foot-print, locate traffic closer to sensitive receptors, and neither would alter or restrict the dispersion of air pollutants. The Proposed Build Alternatives would reduce CO compared to the No-Build Alternative and modeling indicates that local concentrations of CO are not expected to exceed national standards at any time for the US 281 Corridor Project.

This Draft EIS includes a qualitative MSAT assessment has been provided relative to the various alternatives of MSAT emissions and has acknowledged that the Proposed Build Alternatives of the project may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated. A quantitative MSAT analysis will be completed after the identification of a Preferred Alternative and documented in the Final EIS.

3.7.6 Mitigation

Alamo RMA would require the construction contractor to comply with appropriate federal, state, and local regulations concerning the generation of dust from construction activities. Typically, activities to minimize air quality impacts during construction would include covering or treating disturbed areas with dust suppressors, using tarpaulins on loaded trucks, and sprinkling water on dust generating surfaces such as roads and other areas where construction equipment is in operation. Because emissions of CO from motor vehicles increase as vehicle speed decreases, disruption of traffic during construction (such as the temporary reduction of roadway capacity and the increased queue lengths) could result in short-term elevated concentrations of CO. To minimize the amount of emissions generated, reasonable efforts would be made during the construction phase to limit disruption to traffic, especially during peak travel periods.

3.8 TRAFFIC NOISE

3.8.1 Methodology

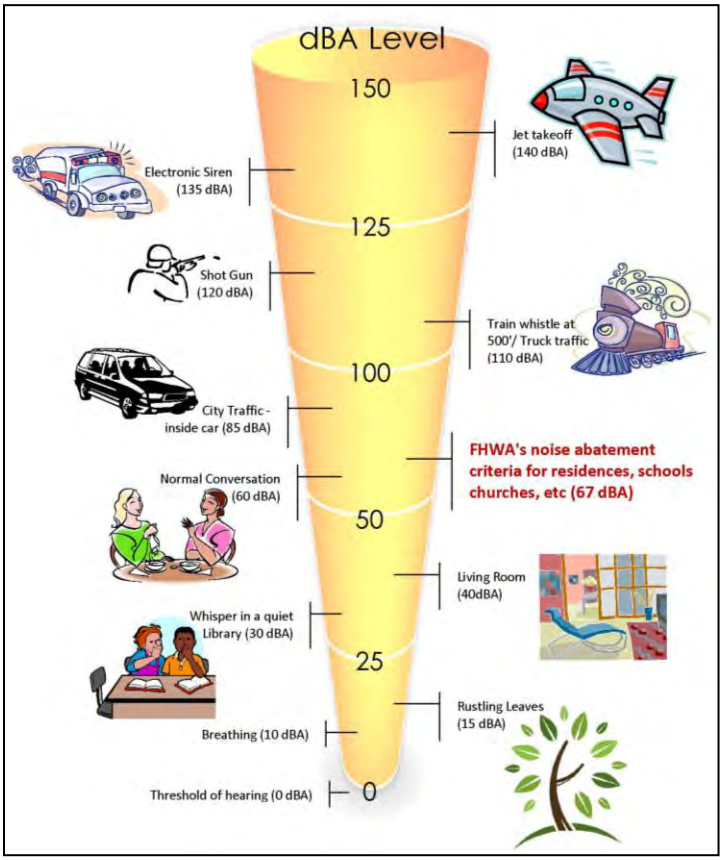
This analysis was completed in accordance with 23 CFR 772 and used FHWA's traffic noise model (TNM 2.5). FHWA has recently published new guidance, *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA 2010), and TxDOT's latest *Guidelines for Analysis and Abatement of Roadway Traffic Noise* (TxDOT 2011b). Traffic volumes were developed by the US 281 EIS Team based on the SA-BC MPO's current travel demand model (2010).

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dBA."

Figure 3-20 illustrates some common sound/noise levels in dBA. Also, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent level and is expressed as "Leq."

Figure 3-20: Common sound/noise levels



Source: US 281 EIS Team, 2010.

The traffic noise analysis typically includes the following elements:

- Identification of land use activity areas that might be impacted by traffic noise.
- Determination of existing noise levels.
- Prediction of future noise levels.
- Identification of possible noise impacts.
- Consideration and evaluation of measures to reduce noise impacts

FHWA has established the Noise Abatement Criteria (NAC) for various land use activity areas that are used as one of two means to determine when a traffic noise impact will occur (see **Table 3-36**).

A noise impact occurs when either the absolute or relative criterion is met:

- Absolute criterion: the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dBA below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dBA or above.
- Relative criterion: the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. "Substantially exceeds" is defined as more than 10 dBA. For example: a noise impact would occur at a Category B residence if the existing level is 54 dBA and the predicted level is 65 dBA (11 dBA increase).

Table 3-36: FHWA Noise Abatement Criteria

Activity Category	FHWA dBA (Leq)	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential
C	67 (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools , television studios, trails, and trail crossings
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F
F	--	Agricultural, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted

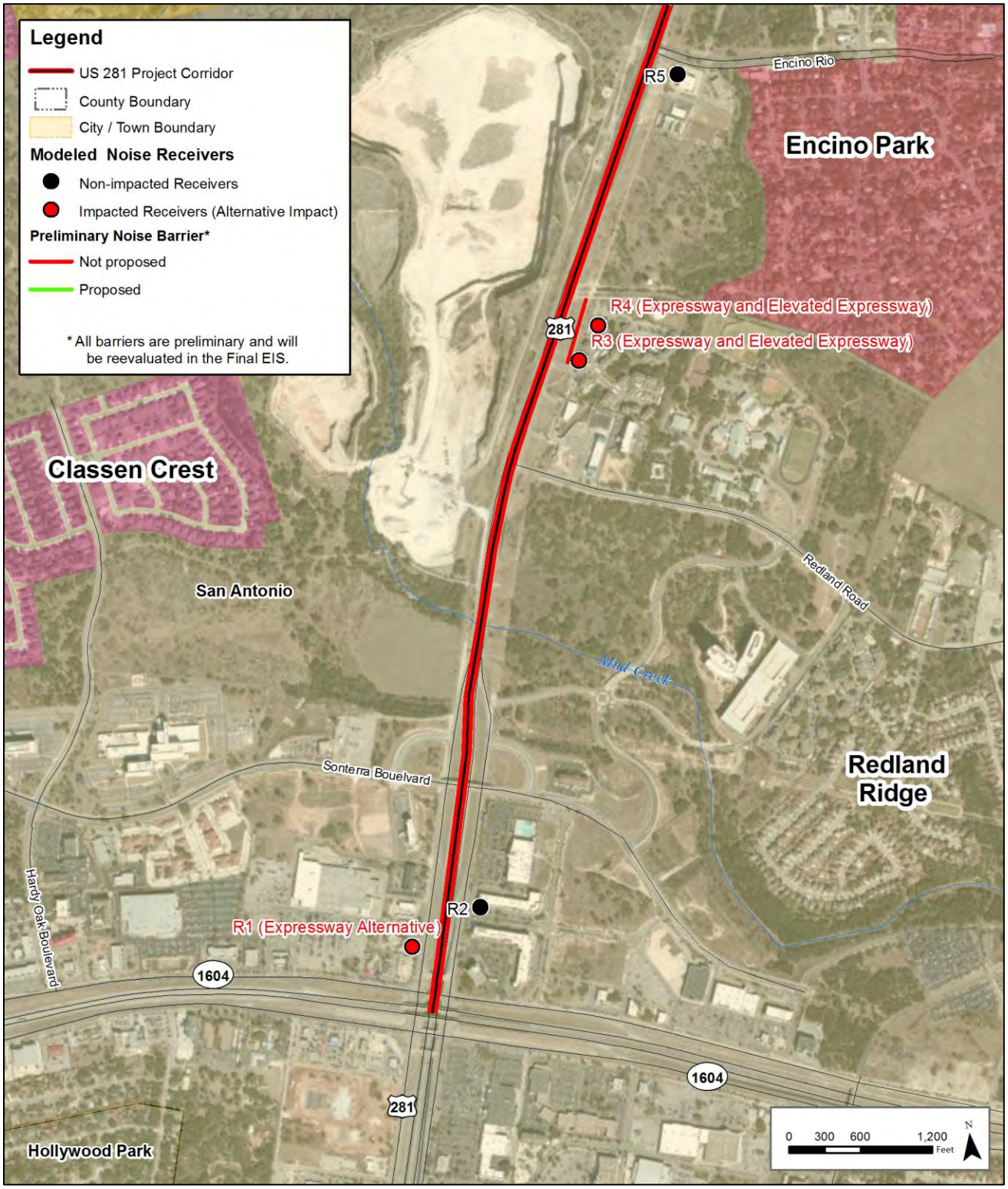
Note: Commercial/retail s structures are classified as Category F, which has no established noise abatement criteria. Primary consideration is given to exterior areas (Category A, B C, or E) where frequent human activity occurs. However, interior areas (Category D) are used if exterior areas are physically shielded from the roadway, or if there is little or no human activity in exterior areas adjacent to the roadway. Source: TxDOT, 2011b .

When a traffic noise impact occurs, noise abatement measures must be considered. A noise abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

3.8.2 Affected Environment and Environmental Consequences

A preliminary noise analysis was performed to determine the anticipated (model predicted) impacts from future traffic generated noise levels at representative receiver locations (**Figure 3-21a** through **Figure 3-21e**) along both of the Proposed Build Alternatives. The analysis was accomplished using FHWA's latest traffic noise modeling software TNM2.5. The model primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise. For the Draft EIS, terrain was not applied to the models thus allowing a conservative estimate of noise levels associated with the US 281 Corridor Project.

1 **Figure 3-21a: US 281 noise receiver locations**



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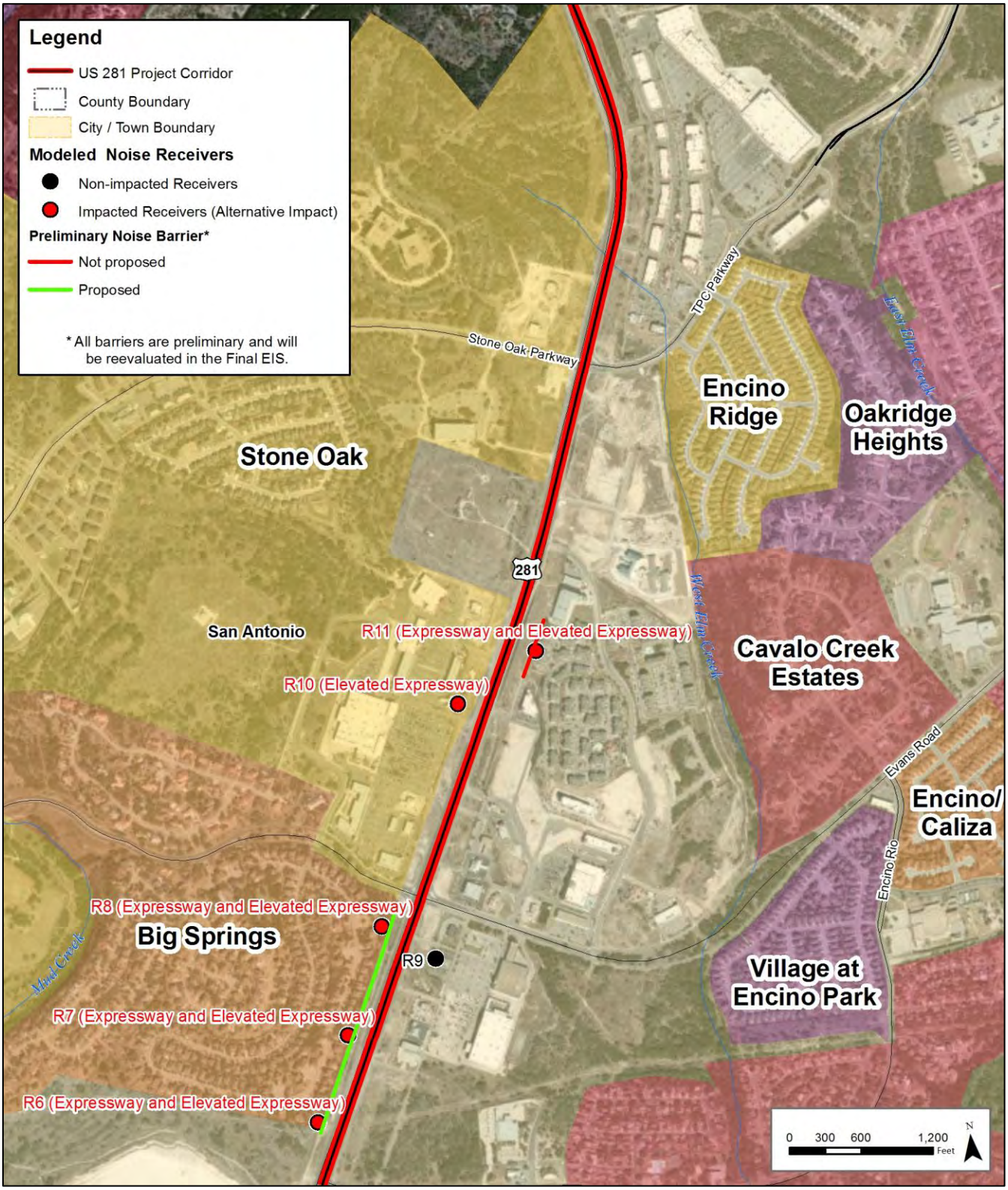
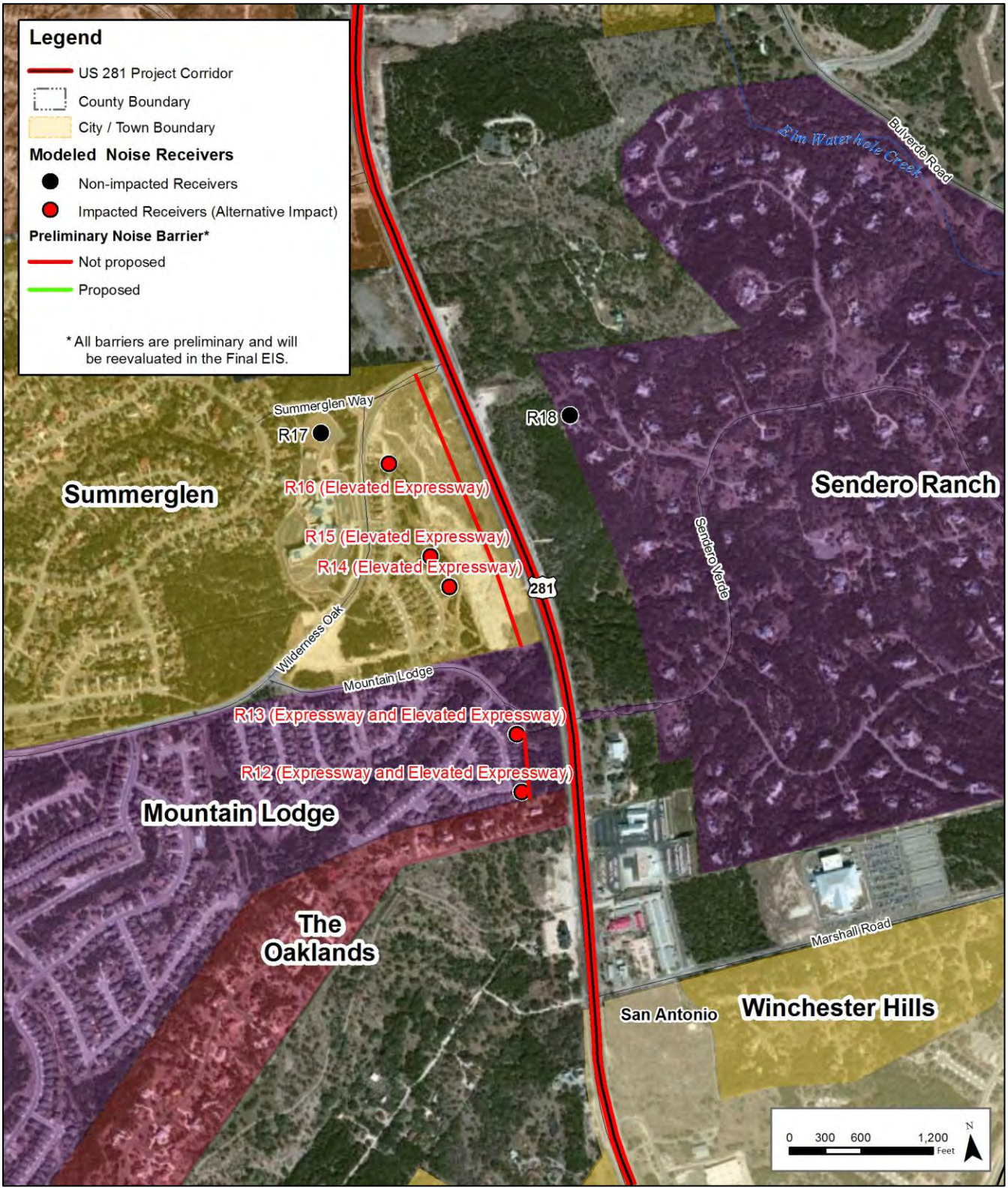
3 Source: US 281 EIS Team, 2011.

Figure 3-21b: US 281 noise receiver locations



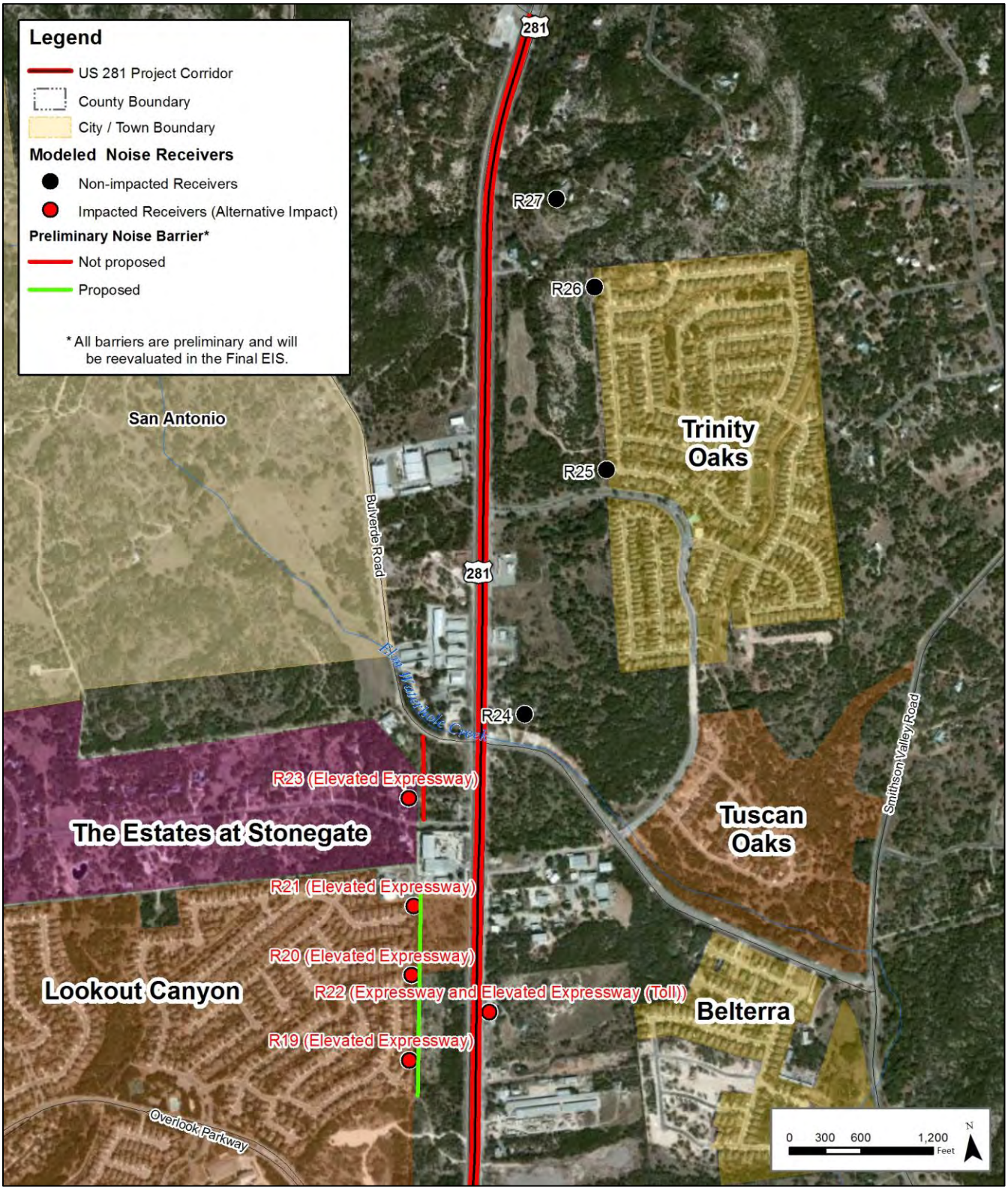
Source: US 281 EIS Team, 2011.

Figure 3-21c: US 281 noise receiver locations



Source: US 281 EIS Team, 2011.

Figure 3-21d: US 281 noise receiver locations



Source: US 281 EIS Team, 2011.

Figure 3-21e: US 281 noise receiver locations

Source: US 281 EIS Team, 2011.

The ambient sound levels characterize the existing sound environment within the US 281 project corridor at each representative receiver and are shown in **Table 3-37**.

Table 3-37: Ambient Noise Conditions within the US 281 Project Corridor

Representative Receiver	Description	NAC Category
R1	Restaurants -Various	E
R2	Restaurants -Various	E
R3	Multi-Family Residential - Ravinia Apartments	B
R4	Multi-Family Residential - Ravinia Apartments	B
R5	Nonprofit - Goodwill	D
R6	Single-family Residential - Big Spring	B
R7	Single-family Residential - Big Spring	B
R8	Single-family Residential - Big Spring	B
R9	Restaurants - Various	E
R10	Office - Frost Bank	E
R11	Multi-Family Residential - View At Encino Commons	B
R12	Single-family Residential - Mountain Lodge	B
R13	Single-family Residential - Mountain Lodge	B
R14	Single-family Residential - Summerglen	B
R15	Single-family Residential - Summerglen	B
R16	Single-family Residential - Summerglen	B
R17	School - Tuscany Heights Elementary	C
R18	Single-family Residential - Sendero Ranch	B
R19	Single-family Residential - Lookout Canyon	B
R20	Single-family Residential - Lookout Canyon	B
R21	Single-family Residential - Lookout Canyon	B
R22	Restaurant (closed)	E
R23	Single-family Residential - The Estates at Stonegate	B
R24	Single-family Residential - 26480 Bulverde Road	B
R25	Single-family Residential - Trinity Oaks	B
R26	Single-family Residential - Trinity Oaks	B
R27	Single-family Residential - 27320 North US 281	B
R28	School - Kiddie Koop Day Care Center	C
R29	Place of Worship - Bulverde United Methodist Church	C

Source: US 281 EIS Team, 2010.

Future predicted traffic noise levels were modeled at receiver locations (**Table 3-38**) that represent the land use activity areas adjacent to the US 281 Corridor Project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement. **Table 3-38** summarizes the potential noise impacts by NAC category within the US 281 Project Corridor.

Table 3-38: Preliminary Noise Impacts for the US 281 Project Corridor by Alternative

Alternative	Representative Receiver	Description	NAC Category	FHWA NAC (dBA)	Existing (dBA)	Predicted 2035 (dBA)	Change (+/- dBA)	Noise Impact	Potential Receivers (#)
No-Build	R1	Restaurants	E	72	66	68	+2	No	2
	R2	Restaurants	E	72	64	66	+2	No	2
	R3	Residential	B	67	63	68	+5	Yes	24
	R4	Residential	B	67	63	65	+2	No	
	R5	Non-profit	D	52	39	41	+2	No	1*
	R6	Residential	B	67	68	70	+2	Yes	24
	R7	Residential	B	67	69	71	+2	Yes	
	R8	Residential	B	67	67	69	+2	Yes	
	R9	Restaurants	E	72	61	63	+2	No	4
	R10	Office	E	72	64	66	+2	No	1
	R11	Residential	B	67	62	65	+3	No	8
	R12	Residential	B	67	54	58	+4	No	9
	R13	Residential	B	67	55	58	+3	No	
	R14	Residential	B	67	51	55	+4	No	17
	R15	Residential	B	67	51	54	+3	No	
	R16	Residential	B	67	51	54	+3	No	
	R17	School	C	67	47	50	+3	No	10*
	R18	Residential	B	67	51	54	+3	No	4
	R19	Residential	B	67	53	56	+3	No	20
	R20	Residential	B	67	53	57	+4	No	
	R21	Residential	B	67	53	57	+4	No	
	R22	Restaurants	E	72	70	73	+3	Yes	1
	R23	Residential	B	67	53	56	+3	No	1
	R24	Residential	B	67	56	59	+3	No	1
	R25	Residential	B	67	47	50	+3	No	24
	R26	Residential	B	67	49	51	+2	No	
	R27	Residential	B	67	53	57	+4	No	1
	R28	School	C	67	58	61	+3	No	1*
	R29	Place of Worship	C	67	69	72	+3	Yes	3*

Table 3-38: Preliminary Noise Impacts for the US 281 Project Corridor by Alternative

Alternative	Representative Receiver	Description	NAC Category	FHWA NAC (dBA)	Existing (dBA)	Predicted 2035 (dBA)	Change (+/- dBA)	Noise Impact	Potential Receivers (#)
Expressway (Non-Toll)	R1	Restaurants	E	72	66	71	+5	Yes	2
	R2	Restaurants	E	72	64	69	+5	No	2
	R3	Residential	B	67	63	71	+8	Yes	24
	R4	Residential	B	67	63	66	+3	Yes	
	R5	Non-profit	D	52	39	46	+7	No	1*
	R6	Residential	B	67	68	72	+4	Yes	24
	R7	Residential	B	67	69	72	+3	Yes	
	R8	Residential	B	67	67	70	+3	Yes	
	R9	Restaurants	E	72	61	68	+7	No	4
	R10	Office	E	72	64	70	+6	No	1
	R11	Residential	B	67	62	73	+11	Yes	8
	R12	Residential	B	67	54	66	+12	Yes	9
	R13	Residential	B	67	55	66	+11	Yes	
	R14	Residential	B	67	51	60	+9	No	17
	R15	Residential	B	67	51	59	+8	No	
	R16	Residential	B	67	51	58	+7	No	
	R17	School	C	67	47	54	+7	No	10*
	R18	Residential	B	67	51	56	+5	No	4
	R19	Residential	B	67	53	62	+9	No	20
	R20	Residential	B	67	53	62	+9	No	
	R21	Residential	B	67	53	62	+9	No	
	R22	Restaurants	E	72	70	72	+2	Yes	1
	R23	Residential	B	67	53	61	+8	No	1
	R24	Residential	B	67	56	62	+6	No	1
	R25	Residential	B	67	47	55	+8	No	24
	R26	Residential	B	67	49	56	+7	No	
	R27	Residential	B	67	53	60	+7	No	1
	R28	School	C	67	58	63	+5	No	1*
	R29	Place of Worship	C	67	69	73	+4	Yes	3*

Table 3-38: Preliminary Noise Impacts for the US 281 Project Corridor by Alternative

Alternative	Representative Receiver	Description	NAC Category	FHWA NAC (dBA)	Existing (dBA)	Predicted 2035 (dBA)	Change (+/- dBA)	Noise Impact	Potential Receivers (#)
Expressway (Toll)	R1	Restaurants	E	72	66	71	+5	Yes	2
	R2	Restaurants	E	72	64	69	+5	No	2
	R3	Residential	B	67	63	71	+8	Yes	24
	R4	Residential	B	67	63	70	+7	Yes	
	R5	Non-profit	D	52	39	46	+7	No	1*
	R6	Residential	B	67	68	72	+4	Yes	24
	R7	Residential	B	67	69	72	+3	Yes	
	R8	Residential	B	67	67	70	+3	Yes	
	R9	Restaurants	E	72	61	68	+7	No	4
	R10	Office	E	72	64	69	+5	No	1
	R11	Residential	B	67	62	72	+10	Yes	8
	R12	Residential	B	67	54	65	+11	Yes	9
	R13	Residential	B	67	55	66	+11	Yes	
	R14	Residential	B	67	51	60	+9	No	17
	R15	Residential	B	67	51	59	+8	No	
	R16	Residential	B	67	51	58	+7	No	
	R17	School	C	67	47	54	+7	No	10*
	R18	Residential	B	67	51	56	+5	No	4
	R19	Residential	B	67	53	62	+9	No	20
	R20	Residential	B	67	53	62	+9	No	
	R21	Residential	B	67	53	62	+9	No	
	R22	Restaurants	E	72	70	71	+1	Yes	1
	R23	Residential	B	67	53	61	+8	No	1
	R24	Residential	B	67	56	61	+5	No	1
	R25	Residential	B	67	47	54	+7	No	24
	R26	Residential	B	67	49	56	+7	No	
	R27	Residential	B	67	53	59	+6	No	1
	R28	School	C	67	58	62	+4	No	1*
	R29	Place of Worship	C	67	69	73	+4	Yes	3*

Table 3-38: Preliminary Noise Impacts for the US 281 Project Corridor by Alternative

Alternative	Representative Receiver	Description	NAC Category	FHWA NAC (dBA)	Existing (dBA)	Predicted 2035 (dBA)	Change (+/- dBA)	Noise Impact	Potential Receivers (#)
Expressway (Managed)	R1	Restaurants	E	72	66	71	+5	Yes	2
	R2	Restaurants	E	72	64	69	+5	No	2
	R3	Residential	B	67	63	71	+8	Yes	24
	R4	Residential	B	67	63	70	+7	Yes	
	R5	Non-profit	D	52	39	46	+7	No	1*
	R6	Residential	B	67	68	72	+4	Yes	24
	R7	Residential	B	67	69	72	+3	Yes	24 (cont.)
	R8	Residential	B	67	67	70	+3	Yes	
	R9	Restaurants	E	72	61	68	+7	No	4
	R10	Office	E	72	64	69	+5	No	1
	R11	Residential	B	67	62	73	+11	Yes	8
	R12	Residential	B	67	54	65	+11	Yes	9
	R13	Residential	B	67	55	66	+11	Yes	
	R14	Residential	B	67	51	60	+9	No	17
	R15	Residential	B	67	51	59	+8	No	
	R16	Residential	B	67	51	58	+7	No	
	R17	School	C	67	47	54	+7	No	10*
	R18	Residential	B	67	51	56	+5	No	4
	R19	Residential	B	67	53	62	+9	No	20
	R20	Residential	B	67	53	63	+10	No	
	R21	Residential	B	67	53	62	+9	No	
	R22	Restaurants	E	72	70	72	+2	Yes	1
	R23	Residential	B	67	53	61	+8	No	1
	R24	Residential	B	67	56	61	+5	No	1
	R25	Residential	B	67	47	54	+7	No	24
	R26	Residential	B	67	49	56	+7	No	
	R27	Residential	B	67	53	60	+7	No	1
	R28	School	C	67	58	63	+5	No	1*
	R29	Place of Worship	C	67	69	73	+4	Yes	3*

Table 3-38: Preliminary Noise Impacts for the US 281 Project Corridor by Alternative

Alternative	Representative Receiver	Description	NAC Category	FHWA NAC (dBA)	Existing (dBA)	Predicted 2035 (dBA)	Change (+/- dBA)	Noise Impact	Potential Receivers (#)
Elevated Expressway (Non-Toll)	R1	Restaurants	E	72	66	69	+3	No	2
	R2	Restaurants	E	72	64	67	+3	No	2
	R3	Residential	B	67	63	68	+5	Yes	24
	R4	Residential	B	67	63	68	+5	Yes	
	R5	Non-profit	D	52	39	45	+6	No	1*
	R6	Residential	B	67	68	75	+7	Yes	24
	R7	Residential	B	67	69	75	+6	Yes	
	R8	Residential	B	67	67	73	+6	Yes	
	R9	Restaurants	E	72	61	69	+8	No	4
	R10	Office	E	72	64	73	+9	Yes	1
	R11	Residential	B	67	62	71	+9	Yes	8
	R12	Residential	B	67	54	70	+16	Yes	9
	R13	Residential	B	67	55	70	+15	Yes	
	R14	Residential	B	67	51	64	+13	Yes	17
	R15	Residential	B	67	51	63	+12	Yes	
	R16	Residential	B	67	51	63	+12	Yes	
	R17	School	C	67	47	56	+9	No	10*
	R18	Residential	B	67	51	59	+8	No	4
	R19	Residential	B	67	53	68	+15	Yes	20
	R20	Residential	B	67	53	67	+14	Yes	
	R21	Residential	B	67	53	68	+15	Yes	
	R22	Restaurants	E	72	70	70	+0	No	1
	R23	Residential	B	67	53	67	+14	Yes	1
	R24	Residential	B	67	56	64	+8	No	1
	R25	Residential	B	67	47	55	+8	No	24
	R26	Residential	B	67	49	56	+7	No	
	R27	Residential	B	67	53	61	+8	No	1
	R28	School	C	67	58	63	+5	No	1*
	R29	Place of Worship	C	67	69	72	+3	Yes	3*

Table 3-38: Preliminary Noise Impacts for the US 281 Project Corridor by Alternative

Alternative	Representative Receiver	Description	NAC Category	FHWA NAC (dBA)	Existing (dBA)	Predicted 2035 (dBA)	Change (+/- dBA)	Noise Impact	Potential Receivers (#)
Elevated Expressway (Toll)	R1	Restaurants	E	72	66	69	+3	No	2
	R2	Restaurants	E	72	64	66	+2	No	2
	R3	Residential	B	67	63	68	+5	Yes	24
	R4	Residential	B	67	63	69	+6	Yes	
	R5	Non-profit	D	52	39	45	+6	No	1*
	R6	Residential	B	67	68	74	+6	Yes	24
	R7	Residential	B	67	69	74	+5	Yes	
	R8	Residential	B	67	67	73	+6	Yes	
	R9	Restaurants	E	72	61	69	+8	No	4
	R10	Office	E	72	64	72	+8	Yes	1
	R11	Residential	B	67	62	70	+8	Yes	8
	R12	Residential	B	67	54	69	+15	Yes	9
	R13	Residential	B	67	55	69	+14	Yes	9 (cont.)
	R14	Residential	B	67	51	64	+13	Yes	17
	R15	Residential	B	67	51	63	+12	Yes	
	R16	Residential	B	67	51	62	+11	Yes	
	R17	School	C	67	47	56	+9	No	10*
	R18	Residential	B	67	51	59	+8	No	4
	R19	Residential	B	67	53	67	+14	Yes	20
	R20	Residential	B	67	53	67	+14	Yes	
	R21	Residential	B	67	53	67	+14	Yes	
	R22	Restaurants	E	72	70	71	+1	Yes	1
	R23	Residential	B	67	53	66	+13	Yes	1
	R24	Residential	B	67	56	64	+8	No	1
	R25	Residential	B	67	47	54	+7	No	24
	R26	Residential	B	67	49	56	+7	No	
	R27	Residential	B	67	53	60	+7	No	1
	R28	School	C	67	58	63	+5	No	1*
	R29	Place of Worship	C	67	69	71	+2	Yes	3*

Table 3-38: Preliminary Noise Impacts for the US 281 Project Corridor by Alternative

Alternative	Representative Receiver	Description	NAC Category	FHWA NAC (dBA)	Existing (dBA)	Predicted 2035 (dBA)	Change (+/- dBA)	Noise Impact	Potential Receivers (#)
Elevated Expressway (Managed)	R1	Restaurants	E	72	66	69	+3	No	2
	R2	Restaurants	E	72	64	67	+3	No	2
	R3	Residential	B	67	63	68	+5	Yes	24
	R4	Residential	B	67	63	69	+6	Yes	
	R5	Non-profit	D	52	39	45	+6	No	1*
	R6	Residential	B	67	68	74	+6	Yes	24
	R7	Residential	B	67	69	74	+5	Yes	
	R8	Residential	B	67	67	73	+6	Yes	
	R9	Restaurants	E	72	61	69	+8	No	4
	R10	Office	E	72	64	73	+9	Yes	1
	R11	Residential	B	67	62	71	+9	Yes	8
	R12	Residential	B	67	54	69	+15	Yes	9
	R13	Residential	B	67	55	70	+15	Yes	
	R14	Residential	B	67	51	64	+13	Yes	17
	R15	Residential	B	67	51	63	+12	Yes	
	R16	Residential	B	67	51	63	+12	Yes	17 (cont.)
	R17	School	C	67	47	56	+9	No	10*
	R18	Residential	B	67	51	59	+8	No	4
	R19	Residential	B	67	53	67	+14	Yes	20
	R20	Residential	B	67	53	67	+14	Yes	
	R21	Residential	B	67	53	68	+15	Yes	
	R22	Restaurants	E	72	70	70	+0	No	1
	R23	Residential	B	67	53	67	+14	Yes	1
	R24	Residential	B	67	56	64	+8	No	1
	R25	Residential	B	67	47	55	+8	No	24
	R26	Residential	B	67	49	56	+7	No	
	R27	Residential	B	67	53	61	+8	No	1
	R28	School	C	67	58	63	+5	No	1*
	R29	Place of Worship	C	67	69	71	+2	Yes	3*

Source: US 281 EIS Team, 2012
* The land area of the Category C or D land use facility shall be divided by the representative receptor single-family residential lot size development within the study area to determine the equivalent number of residences.

Table 3-39: Summary of the Total Preliminary Noise Impacts for the US 281 Corridor Project

Alternative	NAC Category					Residential Communities Affected
	B	C	D	E	Total	
No-Build	24	3	0	0	27	Big Spring
Expressway (Non-toll)	65	3	0	3	71	Ravinia Apartments, Big Spring, View At Encino Commons, Mountain Lodge
Expressway (Toll)	65	3	0	3	71	
Expressway (Managed Lanes)	65	3	0	3	71	
Elevated Expressway (Non-toll)	103	3	0	1	107	Ravinia Apartments, Big Spring, View At Encino Commons, Mountain Lodge, Summerglen, Lookout Canyon, The Estate at Stonegate
Elevated Expressway (Toll)	103	3	0	2	108	
Elevated Expressway (Managed Lanes)	103	3	0	1	107	

Source: US 281 EIS Team, 2012.

Table 3-39 indicates the number of residences (NAC Category B) that could potentially be impacted by traffic noise for each alternative, including the No-Build Alternative. For example, the traffic noise level along the US 281 project corridor at 24 residences would be equal to or greater than 66 dBA in 2035 and 65 residences in 2035 under the Expressway Alternative. The number of homes potentially impacted by Elevated Expressway Alternative is greater than number that would be potentially impacted by Expressway Alternative. This is due to the elevated mainlanes location on the outside of the existing lanes south of Stone Oak Parkway along US 281 in Elevated Expressway Alternative. The existing US 281 lanes would function as frontage roads for local traffic (vehicles traveling at lower speeds) to access residential areas and businesses along US 281 and the elevated mainlanes would provide access for through traffic (vehicles traveling at higher speeds). The elevated mainlanes would have higher traffic volumes than the frontage roads. This is important because, as traffic volumes and speeds increase, traffic noise levels also increase (TxDOT 2011b).

Traffic Noise Abatement Measures

As indicated in **Table 3-39**, the Proposed Build Alternatives would result in a traffic noise impact and the following noise abatement measures were considered for inclusion in design of the Proposed Build Alternative: traffic management, alteration of horizontal and/or vertical alignments, acquisition of undeveloped property to act as a buffer zone, and the construction of sound walls.

- Traffic management: altering the flow of traffic for the purpose of lowering noise levels would degrade the designed effectiveness/functionality of the proposed project. Substantial speed reductions would be required to lower noise levels by a readily perceptible amount and would be detrimental to the efficient movement of traffic.
- Alteration of horizontal and/or vertical alignments: a major realignment (more than double the existing distance from roadway to receiver) would be required to achieve the minimum required reduction in noise and, therefore, would not

be feasible when considering the stated need and purpose for the proposed project as well as the other associated environmental issues.

- Buffer zone: the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than to abate traffic noise impacts and, therefore, is not feasible.
- Noise barriers: this is the most commonly used noise abatement measure.

Before a noise abatement measure can be proposed for incorporation into the project, it must be both feasible and reasonable. In order to be feasible, it must be able to reduce the predicted noise level at an impacted receiver by at least seven dBA for at least one receiver; and to be reasonable, it must not exceed the cost-effectiveness criterion of $25,000 for each receiver that would benefit by a reduction of at least five dBA in the predicted noise level. A construction cost of $18 per square foot is used as per TxDOT guidelines.

The following noise barriers (**Figure 3-21a** through **Figure 3-21e)** would not be feasible and reasonable for the following impacted receivers and, therefore, are not proposed for incorporation into the US 281 Corridor Project. However, the status of impacted receivers and noise abatement may change for the Final EIS when the noise models are refined and rerun with the Preferred Alternative:

- R1, R10, and R22: these receivers represent two restaurants and one office. Noise barriers would have a detrimental effect on these receivers by restricting views and access by potential customers. A continuous noise barrier would restrict access to these businesses. Gaps in a noise barrier would satisfy access requirements but the resulting non-continuous barrier segments would not be sufficient to achieve the minimum, feasible reduction of 7 dBA.
- R3 and R4: these receivers represent a multi-family residence called the Rivinia Apartments. A noise barrier that would achieve the minimum feasible reduction of 7 dBA at this location would exceed the reasonable, cost-effectiveness criterion of $25,000.
- R14, R15, and R16: these receivers represent a total of 17 residences in Summerglen. A preliminary noise barrier that would achieve the minimum feasible reduction of 5 dBA and 7 dBA at this location would exceed the reasonable, cost-effectiveness criterion of $25,000.
- R23: this receiver represents a separate, individual residence in The Estate at Stonegate. Noise barrier that would achieve the minimum feasible reduction of 5 dBA and 7 dBA at this location would exceed the reasonable, cost-effectiveness criterion of $25,000.
- R11: these receivers represent a multi-family residence called View at Encino Commons. A noise barrier that would achieve the minimum feasible reduction of 7 dBA at this location would exceed the reasonable, cost-effectiveness criterion of $25,000.
- R12 and R13: these receivers represent a total of 9 residences in Mountain Lodge. A continuous noise barrier would restrict access to Mountain Lodge Road (the main access point to this subdivision). Gaps in a noise barrier would satisfy access requirements but the resulting non-continuous barrier segments would not be sufficient to achieve the minimum, feasible reduction of 7 dBA.

Noise barriers would be feasible and reasonable for the following impacted receivers and, therefore, are proposed for incorporation into the project. However, the status of

impacted receivers and noise abatement may change for the Final EIS when the noise models are refined and rerun with the Preferred Alternative:

- R6-R8: these receivers represent a total of 24 residences in Big Spring. Based on preliminary calculations, a noise barrier 2,020 feet in length and 12 feet in height would reduce noise levels by 7 to 10 dBA for all benefited receivers at a total cost of $436,320 or $18,180 for each benefited receiver.
- R19-R21: these receivers represent a total of 20 residences in Lookout Canyon. Based on preliminary calculations, a noise barrier 1,700 feet in length and 16 feet in height would reduce noise levels by at least 6 to 10 dBA for 20 benefited receivers at a total cost of $489,600 or $24,480 for each benefited receiver.
- R29: this receiver represents a total of 3 potential receivers for Bulverde United Methodist Church. Based on preliminary calculations, a noise barrier 290 feet in length and 14 feet in height would achieve a noise reduction of 7 dBA for Bulverde United Methodist Church at a total cost of $73,080 or $24,360 for each benefited receiver.

The Final EIS will also include a noise impact corridor analysis for predicted (2035) for undeveloped land, Category G. This is to avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, no new activities are planned or constructed along or within the noise impact corridor.

This preliminary noise analysis results are most likely an overestimation of potential impacts and are based on a worst case scenario because roadway design, including horizontal alignments, have been developed to a conceptual level only, and vertical profiles have not been fully developed at this stage of the planning and environmental process.

A comprehensive traffic noise analysis will be performed for the Preferred Alternative and documented in the Final EIS. On the date of approval of the Final EIS/ROD (Date of Public Knowledge), FHWA, TxDOT and Alamo RMA are no longer responsible for providing traffic noise abatement for new development adjacent to the project.

Highway Construction Noise

Noise associated with the construction of the project is difficult to predict. Heavy machinery (a major source of noise in construction) is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are more tolerable. None of the receivers are expected to be exposed to construction noise for a longer duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

Noise Contours

Traffic noise impact contours are used for projects that have some amount of undeveloped land (Category G) adjacent to the highway. Some of the land use activity areas along the Proposed Build Alternatives are currently Category F, undeveloped land. There is no NAC for undeveloped land; however, to avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs should ensure, to the maximum extent possible, that no

new activities are planned or constructed along or within the following predicted noise contours (**Table 3-40**).

Table 3-40: Noise Impact Contours by Build Alternatives

Alternative	66 dBA Impact Contour Approximate Distance from Roadway (ft)	
	Westside	Eastside
Expressway (Non-toll)	175	145
Expressway (Toll)	175	150
Expressway (Managed Lanes)	175	145
Elevated Expressway (Non-toll)	235	170
Elevated Expressway (Toll)	230	165
Elevated Expressway (Managed Lanes)	230	165

Source: US 281 EIS Team, 2012.

3.8.3 Conclusion and Proposed Mitigation Measures

A preliminary noise analysis was performed to determine worst-case predicted impacts from future traffic-generated noise levels at sites affected by each of the alternatives. Impacts are predicted to occur along all alternatives at several receiver locations, both individual and in groups. Expressway Alternative (non-toll, tolled, and managed) is predicted to potentially impact 71 receivers; Elevated Expressway Alternative is predicted to potentially impact between 107 to 108 receivers.

Under the No-Build Alternative, increases in population and employment growth are projected throughout the study area. It is expected that ambient noise levels would increase within areas of concentrated development associated with this projected growth. The preliminary noise analysis indicates a potential for four areas that will be meet or exceed the NAC noise level by 2035. These areas are would not be analyzed or mitigated for under the No-Build Alternative.

Based on the preliminary noise analysis, abatement measures were analyzed for potentially impacted receiver locations within the project area. In determining and providing abatement measures for traffic noise impacts, primary consideration is given to exterior areas where frequent human use occurs and lower noise levels would be of benefit.

This preliminary noise analysis showed a potential of seven areas for the Expressway Alternative and nine areas for the Elevated Expressway Alternative within the US 281 project corridor that may meet the feasible and reasonableness criteria for a noise barrier. This preliminary noise analysis, proposed three areas, receptors 6-8, 19-21, and 29 for noise abatement. Once the Preferred Alternative is identified and a more detailed traffic and engineering design are available, then a detailed noise abatement analysis will be

performed for the Final EIS and all impacted receptors and noise abatement will be reevaluated for feasibility and reasonability for incorporation into the project's Preferred Alternative.

A copy of the traffic noise analysis completed in the Final EIS will be made available to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that would avoid traffic noise impacts. On the date of approval of the Final EIS (Date of Public Knowledge), FHWA, TxDOT, and Alamo RMA are no longer responsible for providing noise abatement for new development adjacent to the US 281 Corridor Project.

3.9 WATER QUALITY

3.9.1 Surface Water

The TCEQ *Permanent Rules Chapter 307, Texas Surface Water Quality Standards (TSWQS) Subsections 307.2 – 307.10*, effective August 17, 2000, presents surface water quality standards that apply to all surface waters in the State. These standards are designed to establish goals for water quality throughout the State and provide a basis from which TCEQ regulatory programs can establish reasonable methods to implement and attain these goals. In compliance with Section 303(d) of the federal Clean Water Act (CWA), the TCEQ identifies water bodies in the State that do not meet the TSWQS. The compilation of these water bodies is called the 303(d) List. The major surface waters of the State are classified in the TSWQS as "segments" for the purposes of water quality management and designation of site-specific standards.

Methodology

In the Draft EIS, baseline and potential impacts to surface water quality include an inventory of surface waters in the US 281 project corridor, as well as listing 303(d) stream segments per TCEQ's TSWQS, which complies with Section 303(d) of the CWA.

In the Final EIS, the same method will be used to analyze surface water quality impacts for the Preferred Alternative; however, in compliance with the Edwards Aquifer Rules, coordination with TCEQ would be initiated for Phase I storm water permits, which include a Texas Pollutant Discharge Elimination System (TPDES) permit and a Notice of Intent (NOI) General Permit. In addition, and in accordance with TCEQ policies, a Storm Water Management Guidelines for Construction Activities would provide guidance for temporary erosion control measures during construction. Best management practices (BMP) would be identified to avoid/minimize impacts to water quality. Low Impact Development (LID) will also be considered for the Preferred Alternative following RG-348, *Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices.* According to this guidance, the LID techniques currently approved by TCEQ are bioretention, permeable friction course, biological media filter vault, storm water filter cartridge, and hydrodynamic storm separator wet vault.

Affected Environment

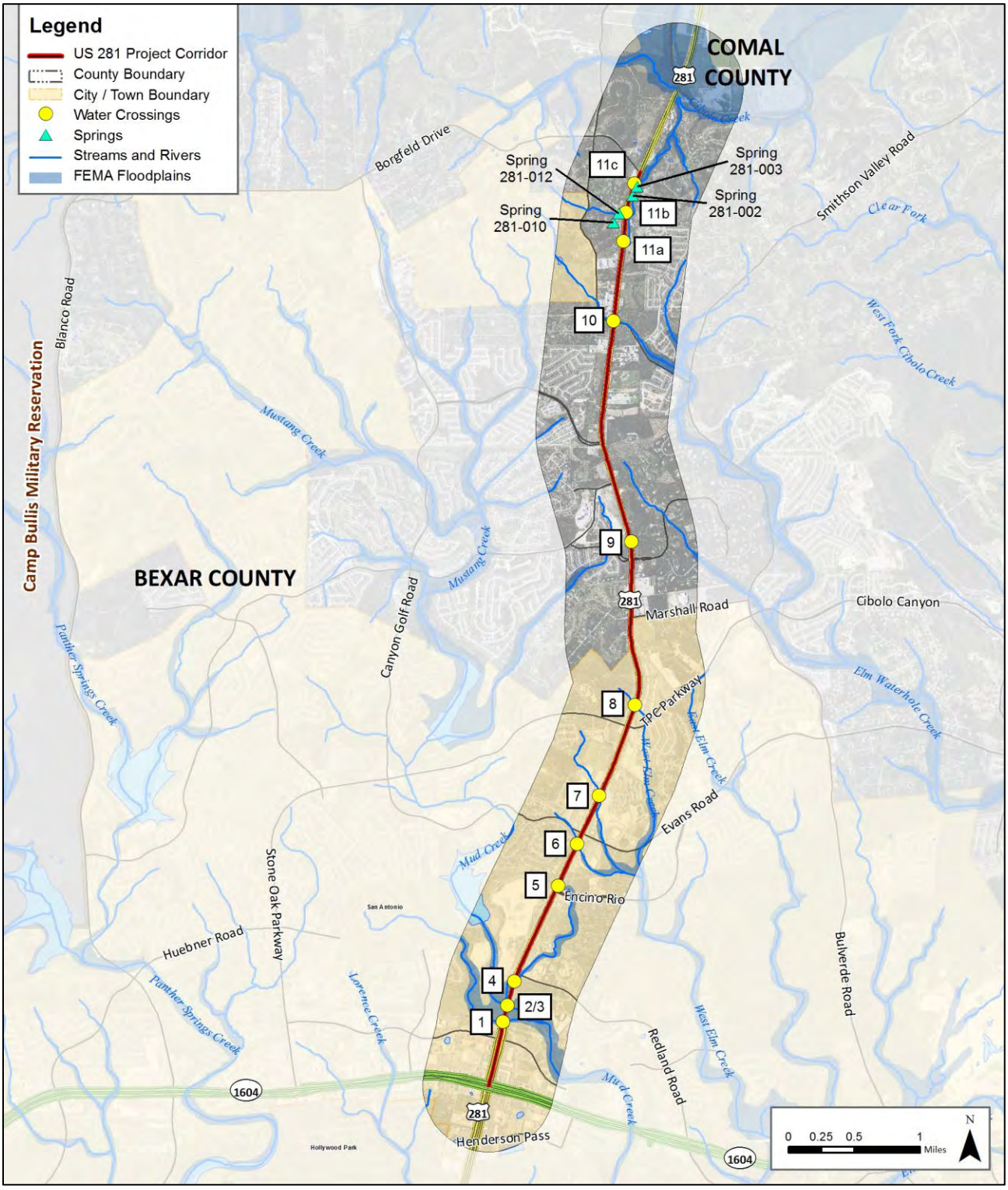
According to Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) panel numbers 48029C0277 E, 48029C0140 E and 48029C0130 E, the US

Geological Survey (USGS) 7.5 Minute Topographic Map Quadrangles (Bulverde, Camp Bullis, Castle Hills and Longhorn, TX quads), and field reconnaissance, the US 281 project corridor crosses three streams and eight tributaries for a total of eleven water crossings. The three streams are (1) Mud Creek, (2) West Elm Creek, and (3) Elm Waterhole Creek. Mud Creek has four tributaries that cross the US 281 project corridor, West Elm Creek has two, Elm Waterhole Creek has one, and one tributary to Cibolo Creek. Four ephemeral springs were identified during field work. Three of the springs surface waters that cross the US 281 project corridor are shown in **Figure 3-22**.

Classified water bodies are defined by TCEQ as those listed and described in Appendix A (Site-Specific Uses and Criteria for Classified Segments) or Appendix C (Segment Descriptions) of the TSWQS. Water bodies in the State are grouped into 25 basins with each basin assigned a number. The US 281 project corridor is located in Basin 19, the San Antonio River Basin. A portion of the surface waters within the project corridor drain into Segment 1908, Upper Cibolo Creek, which is located within five (5) miles upstream of the project corridor. The length of Segment 1908 extends from the Missouri-Pacific Railroad Bridge west of Bracken Drive in Comal County to a point 1.5 kilometer (0.9-mile) upstream of the confluence of Champee Springs in Kendall County.

Segment 1908, Assessment Unit 108_02 is listed on the 2010 Texas Water Quality Inventory and 303(d) List and classified as a freshwater stream, which is designated for aquatic life use, fish consumption use, general use and public water supply use. This segment is affected by urban and rural storm water runoff. The TCEQ is required, under Section 303(d) of the CWA, to identify water bodies that do not meet, or are not expected to meet, applicable water quality standards for their designated uses. These water bodies are then placed on the previously mentioned 303(d) List. Segment 1908 is listed on the 2010 Texas Water Quality Inventory and 303(d) List due to bacteria contamination upstream of Boerne. The sources of contamination are indicated by the TCEQ to be unknown point and nonpoint sources. The US 281 project corridor is located approximately 0.70-mile downstream of Segment 1908, Upper Cibolo Creek, but the portion of the creek that is impaired is located upstream approximately 19 miles from US 281. Since the project corridor is within five (5) miles upstream of Segment 1908, a 303(d) listed water; coordination with the TCEQ would be required prior to any construction activities in association with the review of the storm water pollution and prevention plan.

Figure 3-22: Surface waters that cross the US 281 project corridor



Source: FEMA, 2010, USGS, 2010, US 281 EIS Team, July 2011.

Environmental Consequences

No-Build Alternative

The No-Build Alternative would have no impacts to existing surface water quality conditions and would provide no additional improvements, BMPs, or protection measures to reduce existing direct or indirect surface water quality impacts. Only a small portion of the existing corridor meets TCEQ Edwards Aquifer Rules with vegetative filter strips that were installed with the US 281 Super Street project.

Proposed Build Alternatives

Both of the Proposed Build Alternatives would result in both short-term, construction-related water quality impacts and long-term water quality impacts. An increase in impermeable surface resulting from the additional pavement would result in direct water quality impacts by way of the resultant increased storm water runoff. Surface water runoff from roadways frequently contains automobile pollutants such as oil, grease, antifreeze, particles from brake linings and tires, and municipal trash and debris.

In addition to the increase in impermeable surface area, both of the Proposed Build Alternatives have the potential to impact surface water quality in other ways. The construction of either of the Proposed Build Alternatives would result in soil disturbances during construction, resulting in temporary water quality impacts by temporarily increasing the level of suspended particles in storm water runoff. Both of the Proposed Build Alternatives have the potential to impact surface water quality at stream crossings. **Table 3-41** summarizes the potential impacts to the eleven surface water crossings within the US 281 project corridor. All of the water crossings are ephemeral streams that only flow for short durations after rain events and runoff from rainfall is the primary source of flow. Aquatic life is typically absent or extremely scarce. As shown, it is anticipated that the greatest potential total impact to surface waters would occur with the Expressway Alternative.

Field reconnaissance verified the presence of an observable ordinary high water mark (OHWM) for each of the surface water crossings listed in **Table 3-41.** The Expressway Alternative has the potential to permanently impact nine water crossings and two springs with the greatest impacts occurring at crossings 6, 7, and 8. Whereas, the Elevated Expressway Alternative has the potential to permanently impact a total of six water crossings and two springs with the greatest impacts occurring at crossings 5, 7, and 8. Any of these potential waters of the US that are determined by the USACE to be jurisdictional waters of the US would be subject to permitting requirements under Section 404 of the CWA.

In regards to increased impermeable surfaces and as displayed in **Table 3-42**, the Expressway Alternative consists of the largest amount of increased impermeable surface area compared to the Elevated Expressway Alternative. Thus, the Elevated Expressway Alternative would be expected to result in fewer impacts to water quality.

Table 3-41: Direct Impacts to Jurisdictional Surface Waters

Crossing	Impact Type	Short-term Construction and Permanent Impacts (acres)		Stream Class	Stream Name
		Expressway Alternative	Elevated Expressway Alternative		
1	Culvert	0.00	0.00	Ephemeral	Tributary to Mud Creek
2	Bridge	0.00	0.00	Ephemeral	Mud Creek
3	Culvert	0.04	0.00	Ephemeral	Tributary to Mud Creek
4	Culvert	0.03	0.02	Ephemeral	Tributary to Mud Creek
5	Culvert	0.07	0.08	Ephemeral	Tributary to Mud Creek
6	Culvert	0.10	0.06	Ephemeral	Tributary to West Elm Creek
7	Culvert	0.16	0.26	Ephemeral	Tributary to West Elm Creek
8	Culvert	0.08	0.07	Ephemeral	West Elm Creek
9	Culvert	<0.01	0.00	Ephemeral	Tributary to Elm Waterhole Creek
10	Culvert	< 0.01	0.00	Ephemeral	Elm Waterhole Creek
11a	Culvert	0.02	0.00	Ephemeral	Tributary to Cibolo Creek
11b	Culvert	0.03	0.05	Ephemeral	Tributary to Cibolo Creek
11c	Culvert	0.03	0.02	Ephemeral	Tributary to Cibolo Creek

Source: US 281 EIS Team, July 2011.

Table 3-42: Impacts to Surface Water Quality per Proposed Build Alternative

Surface Water Quality Impacts	Expressway Alternative	Elevated Expressway Alternative
Increased Impermeable Surface Area (acres)	86	83
Number of Stream Crossings	12	12
Permanent Impacts to Stream Crossings	9	6

Source: US 281 EIS Team, July 2011.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, both the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same and stormwater management improvements are proposed for all lane options; therefore the impacts to surface water quality would not change based on funding options.

Conclusion and Proposed Mitigation Measures

Based on the additional fill within water crossings and additional acreage of impermeable surface area, the Expressway Alternative would have the greatest potential to impact jurisdictional waters and surface water quality in the project corridor. The increase in impermeable surfaces could lead to non-point source pollution (i.e., vehicle residues) due to runoff during rain events and flooding as a result of either of the

Proposed Build Alternatives. Roadway runoff can have potentially substantial impacts to the water quality of streams as well as water quality downstream. Numerous constituents may be found in roadway runoff from multiple sources. These constituents can include: particulates, nitrogen, phosphorous, metals, salts, petroleum, pesticides, polychlorinated biphenyls (PCBs) and rubber. Any storm water runoff would either be allowed to run off the roadway, or it would be collected by retention/detention areas and redirected by drainage ways or culverts. Localized runoff contributed by the Proposed Build Alternatives would represent an increase over existing conditions.

Under the authority of the EPA, the State of Texas has authority to implement the Federal National Pollutant Discharge Elimination System (NPDES) program, which is the TPDES. The TCEQ administers Phase I storm water permits for construction projects disturbing five acres or more within the State of Texas. Since this project would include five or more acres of earth disturbance, the Alamo RMA would comply with the TCEQ TPDES Construction General Permit (CGP).

To address water quality issues during construction, a Storm Water Pollution Prevention Plan (SW3P) would be prepared prior to construction. The SW3P would be followed throughout construction phases to minimize sediment-laden storm water discharge to project corridor streams. The SW3P would be prepared pursuant to the TxDOT manual, *Storm Water Management and Guidelines for Construction Activities*. The SW3P may include, but is not limited to, silt fences, inlet protection barriers, hay bales, and seeding or sodding of excavated soils. Exposure of the soil surface would be minimized during all clearing activities in order to maintain soil integrity. All temporary erosion control measures would be implemented prior to the start of construction and maintained throughout the phases of construction. At the completion of construction, the TxDOT specifications, *Seeding for Erosion Control*, would be followed to restore and reseed all areas disturbed.

For post-construction controls, a combination of vegetative filter strips and retention would be utilized to control total suspended solids. Other areas of the ROW would be planted with native species of grasses, shrubs, or trees. An analysis of the size and location of retention ponds are illustrated in **Appendix K1** and the calculations are presented in **Appendix K3**.

Activities involving the discharge of dredged or fill material below the plane of ordinary high water of waters of the United States, including wetlands, is subject to Section 404 of the CWA and Section 401 water quality certification. The occurrence of stream crossings and other waters of the US associated with the Proposed Build Alternatives would be analyzed relative to limitations of applicable permits within the USACE's Nationwide Permit (NWP) program. Following the identification of a Preferred Alternative for the US 281 Corridor Project, coordination with the USACE will occur to verify the determinations. Verifications are typically valid for five years.

3.9.2 Groundwater

This section outlines the affected environment and groundwater resources associated with the surface and sub-surface geology within and surrounding the US 281 project corridor in northern Bexar County. The US 281 project corridor crosses the Edwards and Trinity Aquifers (**Figure 3-23**) which supply water to millions of people in Central Texas.

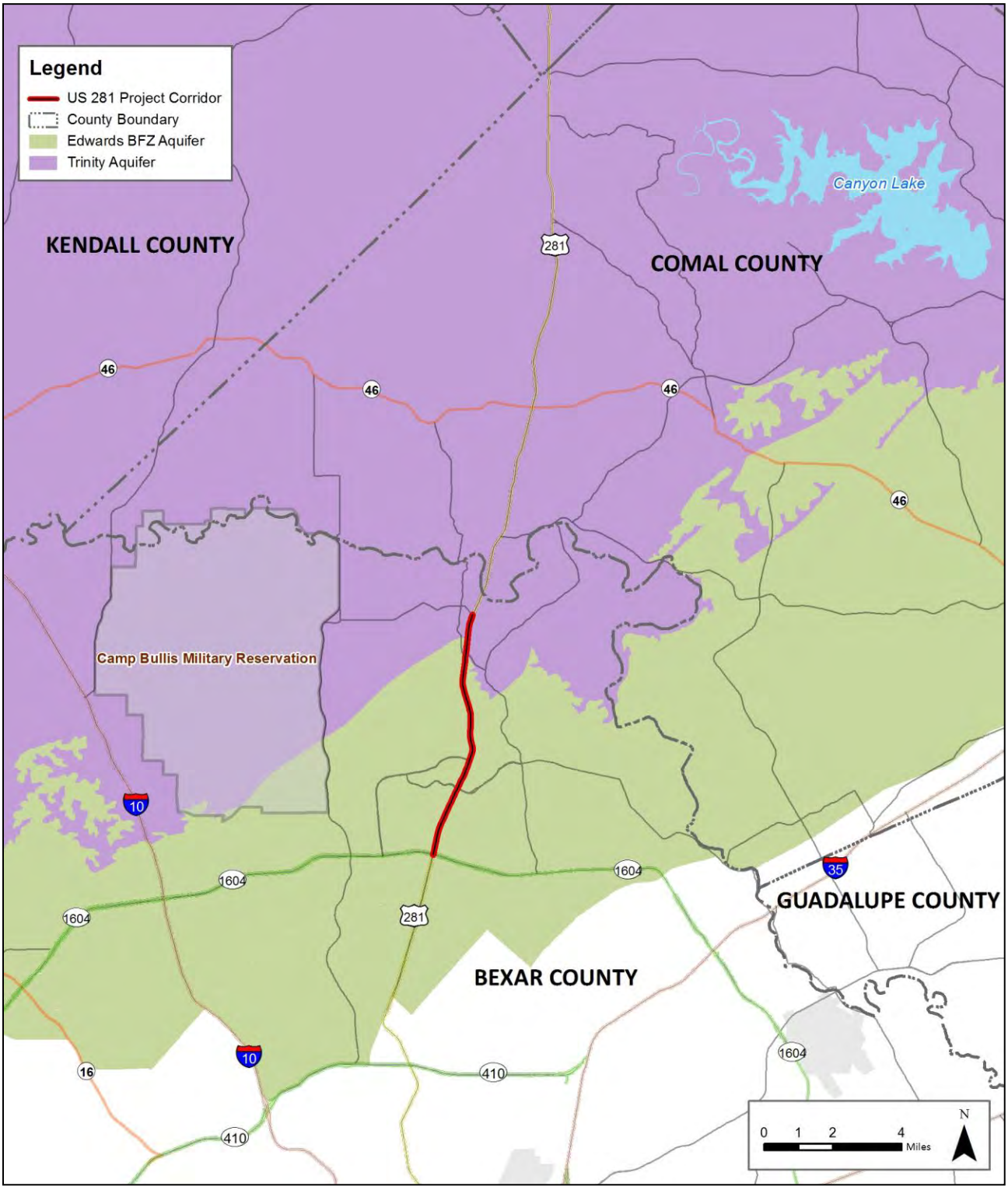
The US 281 project corridor is located in the southeastern portion of the Edwards Plateau Physiographic Province of Central Texas, along the Balcones Fault Zone (BFZ) and within the Hill Country. The BFZ also forms the Balcones Escarpment, which is a highly eroded region bordering the Edwards Plateau on its southern and western boundaries. The project corridor is typified by higher elevations to the north and west, generally sloping in a southeastern direction. Canyons and drainage basins were formed by surface flow of the San Antonio River Basin.

Methodology

This section provides a groundwater quality inventory and assessment including analysis of geology and karst recharge features, sources of contamination, aquifer flow paths and discharge. In addition, a survey of public drinking water systems was completed including a review of water supply wells in the US 281 project corridor and previously published groundwater reports that have been conducted in the area.

In the Final EIS, the same method will be used to analyze groundwater quality impacts for the Preferred Alternative; however, in compliance with the Edwards Aquifer Rules, coordination with TCEQ would be initiated for Phase I storm water permits, which includes a TPDES permit and a NOI General Permit. In addition, and in accordance with TCEQ policies, *Storm Water Management Guidelines for Construction Activities* would provide guidance for temporary erosion control measures during construction. Best management practices would be identified to avoid/minimize impacts to water quality. LID will also be considered for the Preferred Alternative following RG-348, *Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices* (See **Appendix K-3**). According to this guidance, the LID techniques currently approved by TCEQ are bioretention, permeable friction course, biological media filter, storm water filter cartridge, and hydrodynamic storm water separator wet vault.

Figure 3-23: Location of the project area in relation to local aquifers



Source: TWDB, Aquifer database, July 2011.

Affected Environment

Groundwater Geology

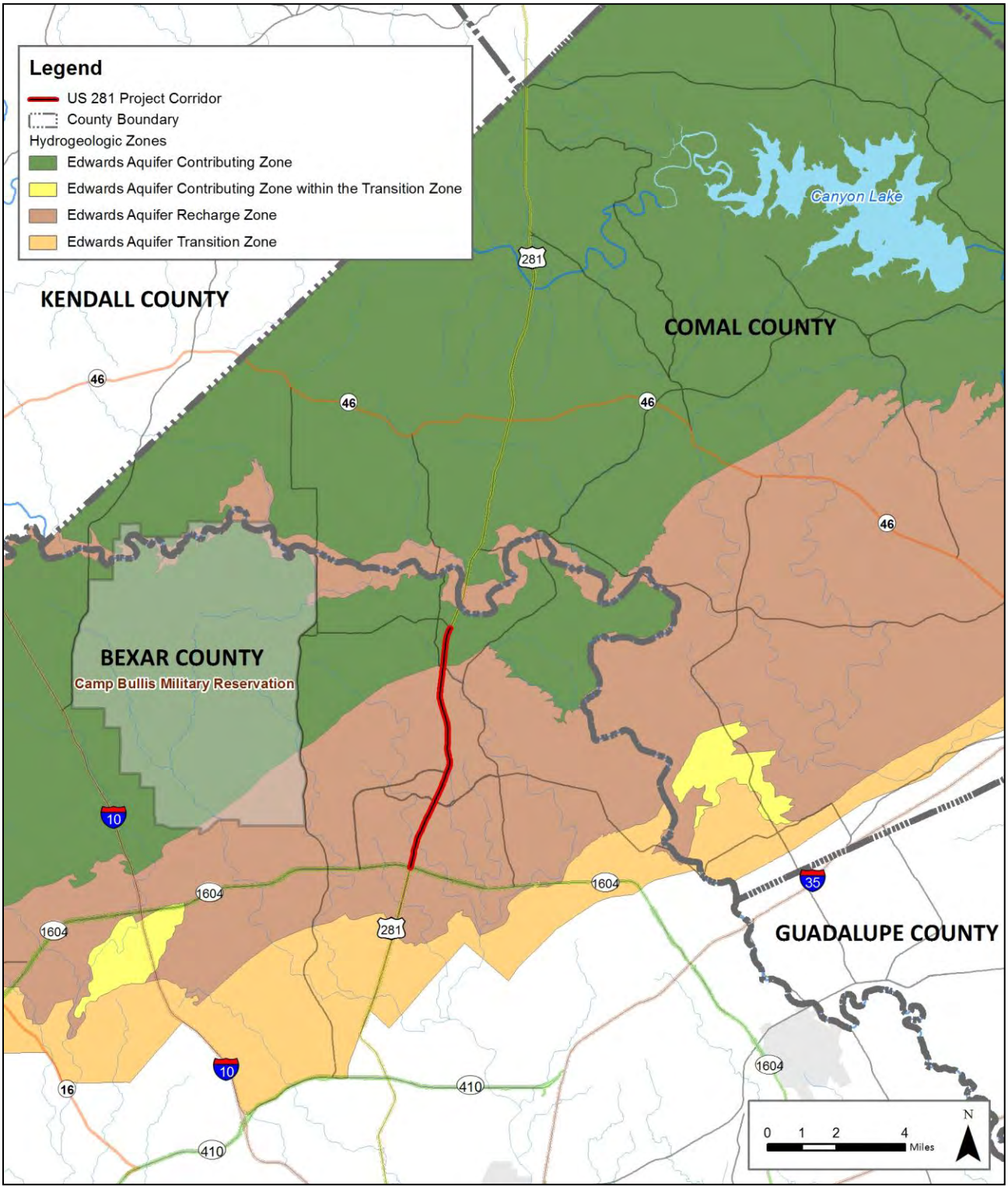
The actual area of consideration for groundwater quality expands beyond the required ROW for both of the Proposed Build Alternatives because of the nature and extent of these aquifers. The sensitive Edwards Aquifer Recharge Zone (EARZ) is found at the surface through much of this area (**Figure 3-24**). Much of the recharge to this aquifer is focused and channeled through several creeks that cross the outcrop areas. The remaining surface water flow eventually drains into the San Antonio River within Bexar County. Both the Edwards and Trinity Aquifers are karstic in nature and can quickly transmit potential contaminants long distances with little to no natural filtration.

The analysis of the affected groundwater environment includes a large area because the aquifers themselves are laterally extensive. Any water wells or other hydrologic features that sustain habitat for troglobitic species near the project corridor may experience rapid and concentrated impacts to any contamination issues. The regional area may also be impacted, possibly more diluted in concentration, and over an extended time scale. The regional area may experience water quality degradation that is then transmitted more diluted through flow paths towards the major spring discharge points of Comal and San Marcos Springs (Otero 2007).

The geologic formations occurring within and surrounding the project corridor are comprised mostly of Cretaceous age rocks with some overlaying Quaternary alluvium along surface drainages (**Figure 3-25**). The soils that have formed on top of these limestones are relatively thin and offer very minimal filtering capability. The limestone bedrock developed from the accumulation of thick sequences of marine sediments deposited in a lagoon environment on the San Marcos Platform protected by a barrier reef during the Cretaceous age about 100 million years ago. In Central Texas, the Cretaceous strata slightly dip to the southeast at about 10 to 15 feet-per-mile toward the Gulf of Mexico.

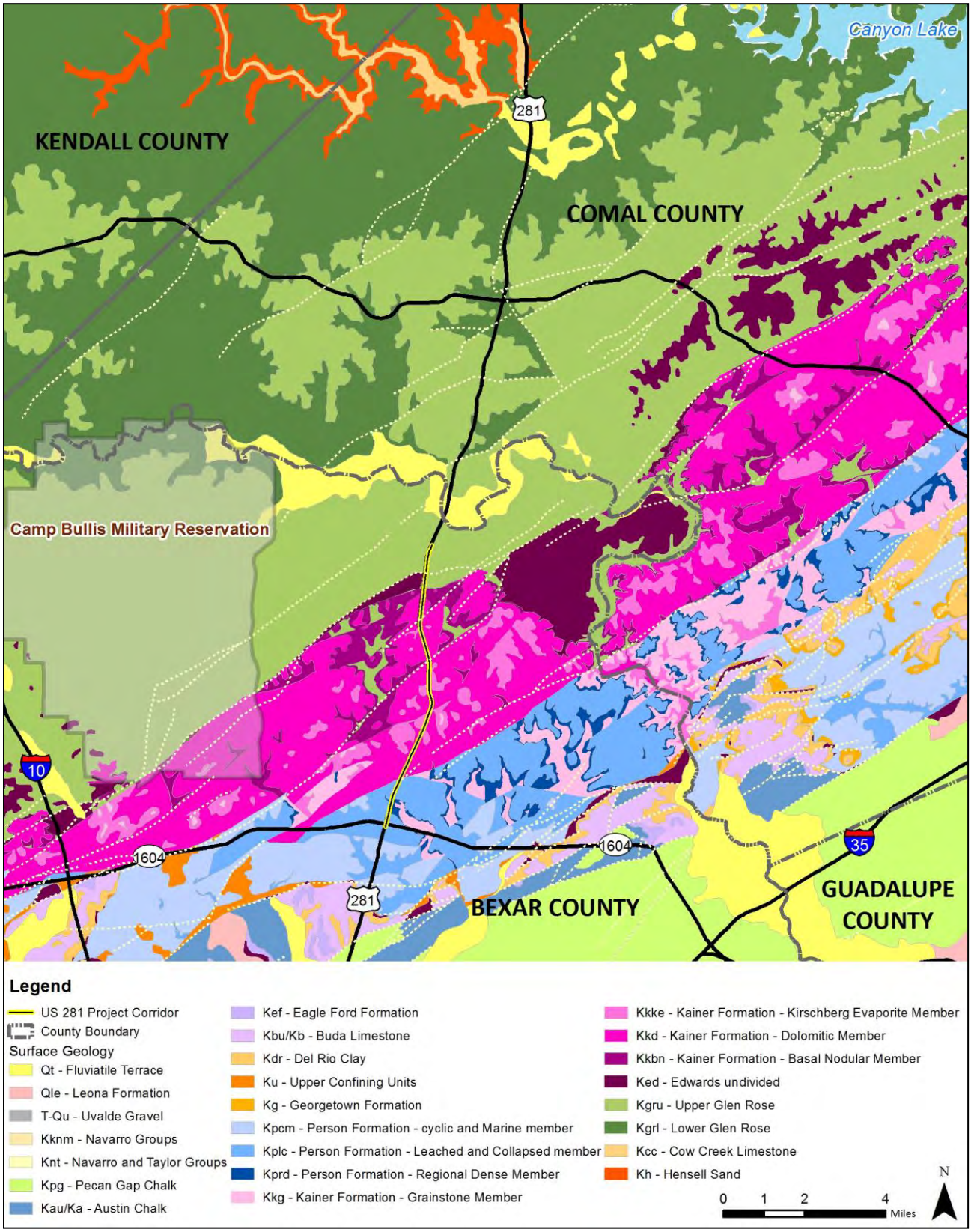
Major tectonic uplifting of the Edwards Plateau occurred along the BFZ during Miocene times about 15 million years ago, which resulted in the accelerated erosion of the Hill Country topography seen today. The boundary between the Edwards Plateau and Gulf Coastal Plain occurs along the trace of the BFZ. The BFZ is comprised mostly of northeast-southwest normal faults with displacement toward the southeast. The accumulative displacements for some of these fault sets can be greater than 1,000 feet. The Miocene faulting permitted meteoric water to percolate into the limestone allowing for extensive karstic diagenesis that resulted in interconnected, sometimes cavernous porosity of the prolific Edwards Aquifer. See **Appendix J2** for detail on the Hydrostratigraphy of the Edwards and Trinity Aquifers

Figure 3-24: Map of the four Edwards Aquifer Zones in the region surrounding the project area



Source: TCEQ Edwards Aquifer Hydrographic Zone dataset, July 2011.

Figure 3-25: Geologic map of region surrounding the US 281 project



Source: USGS Geologic Map of the Edwards Aquifer Recharge Zone (Blome et al., 2005); TNRIS 1:250,000 Geologic Atlas of Texas; USGS 1:24,000 National Hydrography dataset; July 2011.

Groundwater Quality

This area is in a semi-arid environment with average annual rainfall of about 30 to 35 inches per year. Evaporation of 75 to 90 inches per year removes much of this water prior to recharging the aquifers. Many of the rainfall events occur as thermal convection thunderstorms that can produce excessive amounts of precipitation in short periods of time. Some of this water makes its way into the aquifers usually through concentrated areas along creeks and rivers in outcrop areas of the recharge zone.

The Edwards Aquifer is one of the most permeable and productive limestone aquifers in the United States. In the San Antonio region, the aquifer supplies drinking water to more than 1.7 million people and provides habitat for several endangered aquatic species. The Trinity Aquifer plays a lesser role in this region but is none the less designated as a major aquifer of Texas and regionally spans most of Central Texas. The stratigraphic, lithologic, and hydrologic characteristics of the rocks in Bexar County are summarized in **Figure 3-25**.

Both the Edwards and Trinity Aquifers in this area have karst characteristics with heterogeneous flow, storage and transport of the groundwater via underground conduit systems. Flow in karst aquifers occurs over a wide range of permeability, from flow through the rock matrix (least permeable), flow in planar fractures and bedding planes to turbulent flow through integrated conduit systems (most permeable). Surface landforms commonly seen in this terrain are (1) recharge features such as solution widened fractures, sinkholes and losing streambed sections, (2) transmission features such as active and relict caves, and (3) discharge features such as permanent and ephemeral springs. In general, most storage occurs in the matrix, while most flow occurs in the conduits. Matrix and conduit components may or may not mix effectively. Thus, some components of the aquifer may have very long residence times and be relatively resistant to surface contamination, while other components of the aquifer may have extremely rapid travel times and be very vulnerable to contamination. The vulnerable portions of the aquifer are also the most productive and the ones that eventually feed the major springs and wells.

In addition to the variability of flow velocities, flow directions are also variable. Flow directions are influenced by hydraulic gradients both regional and local, but are also controlled by the location of conduit systems, which are often influenced by older development that occurred in previous flow regimes. Thus, flow paths may not follow local topography or surface watersheds. It is common for flow in karst aquifers to cross between watershed boundaries. The pattern and direction of flow in karst is often stage dependent, as high water levels can utilize different flow paths and travel in unpredictable directions.

Karst aquifers are, by their nature, extremely vulnerable to contamination. Soils in karst areas tend to be thin and patchy. When eroded by damaging practices, they are slow to be replaced. Thus, the filtration of diffuse recharge afforded by soils is at best low, and is only decreased by human activity. Recharge in karst systems commonly occurs as point recharge into specific karst features, bypassing what little filtration a limited soil zone might afford. Furthermore, a karst flow system is formed by convergent flowpaths that combine to form efficient flow networks. Rapid transportation through integrated flow networks leads to lower residence times, minimizing the opportunity for the die-off of pathogens or the degradation of hazardous chemicals. These efficient flow networks can cover large areas, allowing contaminants to travel long distances very quickly,

endangering distant water supplies before problems are identified (Ford and Williams, 2007). Finally, monitoring of contaminant plumes is very difficult due to the anisotropic nature of karst flow systems, where traditional placement of up and down gradient monitoring wells are likely to miss the conduits through which the contaminants are flowing.

Edwards Aquifer

The length of the Edwards Aquifer in the San Antonio region extends approximately 180 miles from the groundwater divide near Brackettville in the west to the groundwater divide north of Kyle in the northeast (**Figure 3-23**). The Edwards Aquifer varies in width from five (5) to 40 miles from the northern limit of the recharge zone to the southern limit of fresh water. The southern boundary of the aquifer is a gradational zone of increasing salinity from 350 ppm to over 300,000 ppm total dissolved solids (TDS).

Two distinctive zones, fresh and saline, can be found in the Edwards Aquifer with a transition area between them. Locally, the point at which TDS reaches 1,000 ppm is referred to as the "bad-water line" and is the approximate southern extent of potable water. The freshwater zone has gone through extensive changes since deposition, whereas the saline zone has retained more of its original depositional lithology. The high productivity of the Edwards Aquifer freshwater zone is a result of dissolution along fractures associated with Balcones faulting. The voids created by the dissolved rock made pathways for the water to move through the limestone. Effective porosity within the freshwater Edwards Aquifer is primarily the result of dissolution of the original rock matrix along bedding planes, joints, and fractures after deposition.

The Edwards Aquifer, as regulated by the TCEQ and has four zones: (1) the Contributing Zone, (2) the Recharge Zone, (3) the Transition Zone and (4) the Confined Zone (**Figure 3-24**). The four zones are described below.

1. *The Contributing Zone*. Water flows over less permeable bedrock and is routed onto the Recharge Zone. The Contributing Zone is composed of drainage areas and catchments of surface streams that flow over the Recharge Zone. Much of the Contributing Zone lies over the older Glen Rose Limestone Formation.
2. *The Recharge Zone*. This is a relatively narrow band of outcrops of heavily faulted and karstified Edwards limestone. In the Recharge Zone, surface water flows underground to contribute to the Edwards Aquifer. Water stored in the Recharge Zone as part of the Edwards Aquifer is unconfined. The flow of water is driven by gravity to discharge at water-table springs, to enter deeper flow systems and discharge at artesian springs, or to contribute to the Confined Zone of the Aquifer.
3. *The Transition Zone*. This consists primarily of younger bedrock overlying the Confined Zone. These younger and generally less permeable rocks of the Transition Zone overlie and form the upper confining cap to the Artesian Zone of the Edwards Aquifer. While the surface bedrock in the Transition Zone is generally less permeable and karstified than the rocks of the Edwards Group, it is also extensively fractured and faulted by the BFZ, and hosts some high-permeability pathways into the Artesian Zone.
4. *The Confined Zone*. Also, termed the Artesian Zone, this consists of layers of impermeable rock overlying the Edwards limestone which traps water inside.

Water levels of the Edwards Aquifer and associated flows of Comal Springs, San Marcos Springs, and other major and minor natural discharge points, are affected by the rate of water entering the aquifer (recharge) and the rate of water exiting the aquifer (discharge). Decreased spring discharge and/or degradation of water quality, including anthropogenic contamination, can adversely affect the health of eight (8) federally listed endangered or threatened species (See **Section 3.16**) that depend on adequate minimum flows at the Comal and San Marcos Springs for survival.

Recharge occurs from water entering the recharge zone from streams, natural catchments, recharge structures, localized runoff, upland recharge from precipitation events, and potential cross-formational flow from the Trinity Aquifer. Seasonal rainfall over the region ultimately controls the rate of recharge. Discharge occurs from withdrawal of water from wells and from natural springs and seeps. An unknown smaller quantity is discharged to the saline water zone (Maclay 1995). Discharge is greatly affected by water demand and rate of pumping. If recharge is high, the aquifer can sustain higher levels of pumping, while maintaining higher levels of springflows. However, if there is low seasonal recharge followed by reduced rainfall and by high rates of pumping, then aquifer levels will decline with resulting decreased spring discharge.

Estimates of the average annual recharge of the Edwards Aquifer vary according to changes in weather cycles and resulting precipitation over the recharge zone. Maclay (1995) cites an average annual recharge of 635,000 acre-feet. However, Klemt et al. (1979) indicate an average annual recharge of approximately 651,000 acre-feet. Data from the Edwards Aquifer Authority's (EAA) 2008 Hydrogeologic Data Report (2009) indicate an average annual recharge of 724,300 acre-feet for the period of record 1934-2008, and an even higher annual average of 991,700 acre-feet during the last ten (10) year period 1999-2008. Lowest annual recharge (44,000 acre-feet) occurred during 1956 at the peak of the drought of record. Highest recharge (2,486,000 acre-feet) occurred in 1992. Streams losing flow as they cross the Edwards outcrop account for a majority of the recharge to the aquifer (85 percent). A much smaller portion is contributed by direct precipitation and localized runoff within the recharge zone (15 percent). Rates of infiltration of water carried by the streams across the recharge zone have been estimated by the US Army Corps of Engineers (USACE) in 1965 to range from 500 to greater than 1,000 cubic feet per second (cfs).

Water discharges the Edwards Aquifer from wells and from natural springs and seeps occurring near geological faults along the Edwards Limestone and Balcones Escarpment. Wells are the principal source of water for agricultural, municipal, and industrial uses in the region. Average annual discharge from wells over the period of record 1934-2008 was 310,300 acre-feet (44.6 percent), in comparison to 385,000 acre-feet (55.4 percent) from springflow. During droughts, the proportion of well discharge to spring discharge changes considerably. During 1956 at the height of the drought of record, wells contributed 82 percent of the discharge in comparison to 18 percent for springs. During the drought of 2008, wells contributed 51 percent of the total discharge, while spring discharge comprised 49 percent.

Well discharge has generally increased over the period of record to a point beginning in 1968 and running through 1989 where annual discharge consistently exceeded the average annual recharge (Maclay 1995). Pumping peaked in 1989 at an estimated level of 542,000 acre-feet. Since 1980, as a result of increased pumping, there has been greater

fluctuation of springflow with increased time required for recovery, even during a period that recorded the two highest levels of aquifer recharge (1992 and 1987).

In 1993, the Texas Legislature created the EAA by passage of the EAA Act to "manage, conserve, preserve, and protect the southern segment of the aquifer and to increase the recharge of, and prevent pollution of water in, the aquifer." Although the legislation was passed in 1993, litigation delayed agency start up by three years, until 1996. In 2007, the Texas Legislature mandated the EAA to allow regular permitted withdrawals from the southern segment of the Edwards Aquifer of up to 572,000 acre-feet per year subject to mandated reductions in pumping of up to 40 percent during critical drought periods. These mandates may be further modified by aquifer management strategies currently being developed as part of a Habitat Conservation Plan also mandated in 2007 by the Texas Legislature, as part of the Edwards Aquifer Recovery Implementation Program.

The groundwater of the Edwards Aquifer is generally known to be of high quality, typically fresh, but hard with an average dissolved solid concentration of less than 500 mg/l (TWC 1992). However, increased human development throughout the region has created a higher level of pollutants and greater potential for adversely affecting both surface water and groundwater quality. Cooperative efforts between the EAA, USGS, and TWDB have resulted in a systematic program of water quality monitoring. Each year the EAA measures the quality of water in the aquifer by sampling approximately 80 wells, eight (8) surface water sites, and major spring groups across the region. Sample collection sites are typically selected to provide representative samples of the recharge zone, shallow and deep artesian zone, springs, and surface streams that flow across the recharge zone as well as areas with historical detection of anthropogenic compounds. In 2008, well sampling did not indicate widespread contamination in the aquifer (Johnson et al, 2009). However, elevated nitrate detections (>2 milligrams per liter [mg/L]) were present in 20 of the 81 wells sampled. Metals were detected above a regulatory limit in eight (8) of the 81 wells sampled. Detections of the metals strontium and iron are likely due to naturally occurring sources of these two metals. Strontium detections are typically highest in and close to the saline water part of the aquifer. Iron detections are occasionally high in some parts of the aquifer system. Manganese was unusually high in one well and is scheduled for future monitoring.

Public Water Drinking Systems

Well records and published ground water reports of the TWDB were reviewed to provide information on water-supply wells within a one-mile radius of the project study area. The well records were obtained from the TWDB Ground Water Database (GWDB), which is the most comprehensive and accurate listing of water wells available. However, the database only includes wells, which have been reported to the TCEQ and the TWDB and does not include all water-supply wells in the State of Texas.

The results of the water-supply well review identify a total of 38 water-supply wells that lie within a one-mile radius of the US 281 project corridor (**Figure 3-26**). Twenty-nine of the water-supply wells are public. The total depths range from 260 to 960 feet below ground surface. Seven of the water-supply wells are private. The total depths range from 350 to 580 feet below ground surface.

Private water-supply wells are utilized for domestic livestock and industrial or irrigation purposes. One (1) water-supply well's use is listed as unknown with a depth

of 316 feet below ground surface and one (1) water-supply well's use is listed as commercial with a depth of 600 feet below ground surface.

Environmental Consequences

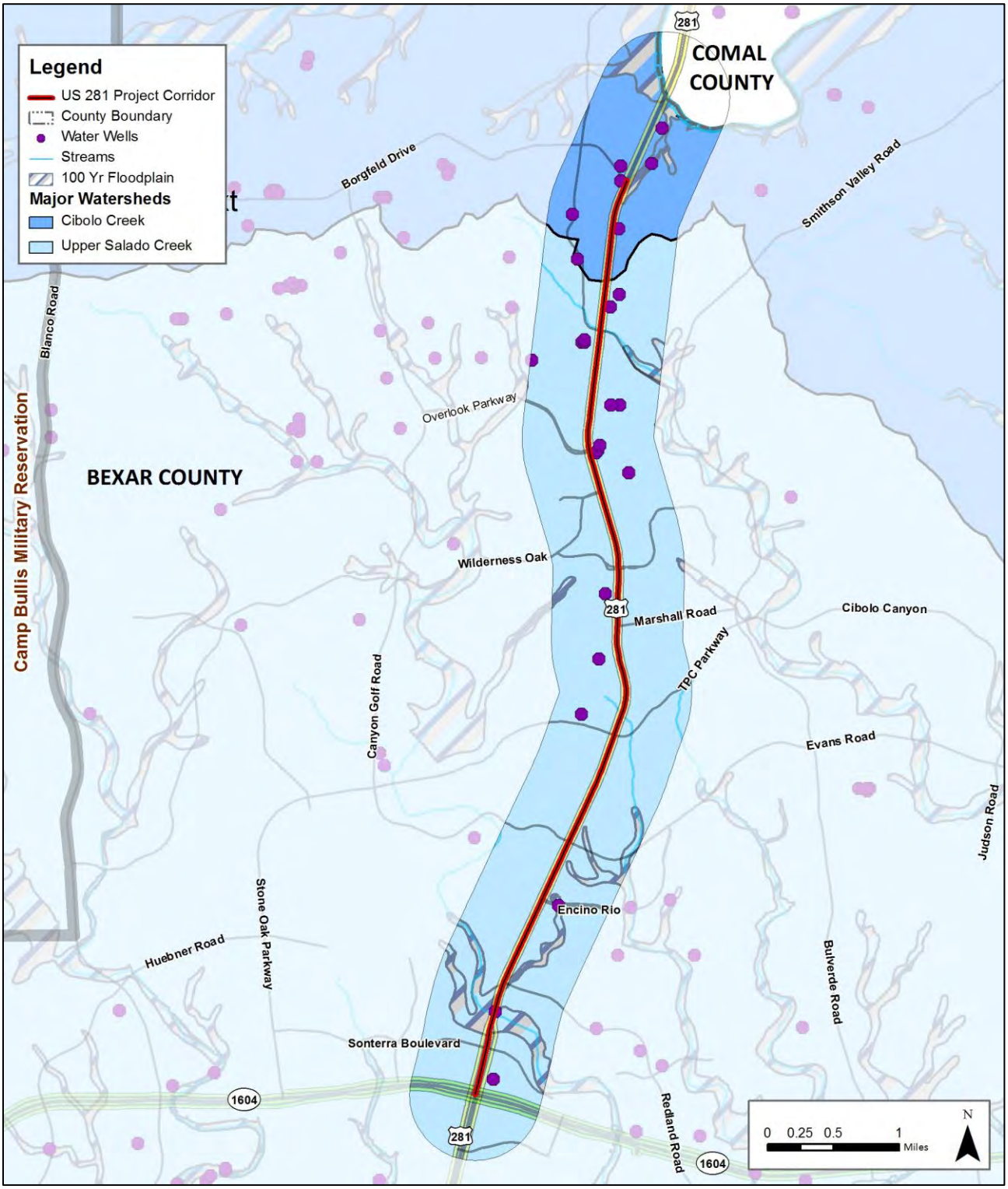
No-Build Alternative

The US 281 project corridor has unpaved and informal shoulders along the entire corridor from Loop 1604 to Borgfeld Drive and does not have a storm water drainage system that meets current TCEQ *Water Pollution Abatement Plan* (WPAP) standards. As such, the US 281 project corridor would remain susceptible to contaminants, such as metals and organic compounds, entering recharge features with the No-Build Alternative.

Proposed Build Alternatives

Construction and operation of either of the Proposed Build Alternatives has a number of potential environmental impacts related to groundwater quality in the local area and within the region. These possible impacts include water supply contamination associated with increased levels of suspended sediment, dissolved metals, VOCs, polycyclic aromatic hydrocarbons (PAH), and other toxic materials resulting from increased anthropogenic disturbance and activity (Barrett et al., 1995). Infiltration of any of these contaminants into the groundwater system is enhanced in the particular hydrogeologic setting of northern Bexar County, which is karstic in nature. Karst aquifers are well documented to rapidly transmit surface water into the subsurface through systems of enhanced permeability channels that include solution-enlarged fractures or joints, faults, solution cavities, solution sinkholes, collapse sinkholes, caves, or combinations of these features. Special consideration is required to protect the karst groundwater resources from urban development, including that related to the proposed US 281 Corridor Project. The entire corridor from Loop 1604 to Borgfeld Drive and will have a storm water drainage system that meets current TCEQ *Water Pollution Abatement Plan* (WPAP) standards (see **Appendix K3**).

Figure 3-26: Water supply wells



Source: TWDB, TNRIS, US 281 EIS Team, July 2011.

Edwards and Trinity Aquifers

Both the Edwards and Trinity Aquifers are utilized in the project corridor and are carbonate aquifers particularly susceptible to contamination due to the nature of rapidly recharging water. The area directly impacted by the proposed highway expansion project includes a zone localized within a 1-mile buffer of the project corridor, but extended regional groundwater impacts are possible throughout both aquifers down gradient of the project corridor. The regional area is based on the portion of the aquifer that might be impacted from direct and indirect degradation of groundwater quality from the construction and operation of the proposed corridor project. The terminal location for flow in the Edwards Aquifer in the vicinity of the US 281 Corridor Project is Comal Springs in Comal County, and possibly San Marcos Springs in Hays County.

Any water wells or hydrologic features in the local one-mile area may experience a more rapid and more intense response to any contamination issues along the highway corridor, but any well or spring downstream of groundwater flow routes from the project corridor can receive pollutants from the highway. The regional area may experience water quality degradation that is then transmitted in a more dilute manner through the flow paths in the Edwards Aquifer towards the major spring discharge points.

The EARZ is located along about an 8-mile length of US 281. Activities along this area could impact or potentially degrade the Edwards Aquifer, which is the primary water source for over 1.7 million people in Central Texas and is also the water source for San Antonio Springs, San Pedro Springs, Hueco Springs, Comal Springs and San Marcos Springs among other sites. Several of these springs are the sole habitat for several federally listed endangered species, thus require protection mandated by federal law.

The middle unit of the Trinity Aquifer is the most utilized portion of this groundwater resource in the project area, and is found about 500 to 1,000 feet below the Edwards limestone. The primary recharge for the middle Trinity Aquifer in Bexar County is Cibolo Creek, found at the northern extent of the US 281 Corridor Project. This section of the project area near Cibolo Creek should be considered particularly sensitive as interconnection between the Trinity and Edwards Aquifers occurs here, and although it is not a direct outcrop of Edwards limestone, the portion of Glen Rose limestone in Cibolo Creek is considered within the EARZ (**Figure 3-25)**. It is also possible for groundwater recharge to the Trinity Aquifer to occur in karst features located in portions of the Kainer Formation where the thickness of the Edwards limestone is relatively thin. Numerous caves exist in northern Bexar County that extend from the Edwards into the Glen Rose limestone, and can serve as rapid recharge conduits for water, including contaminants that may be associated with surface water.

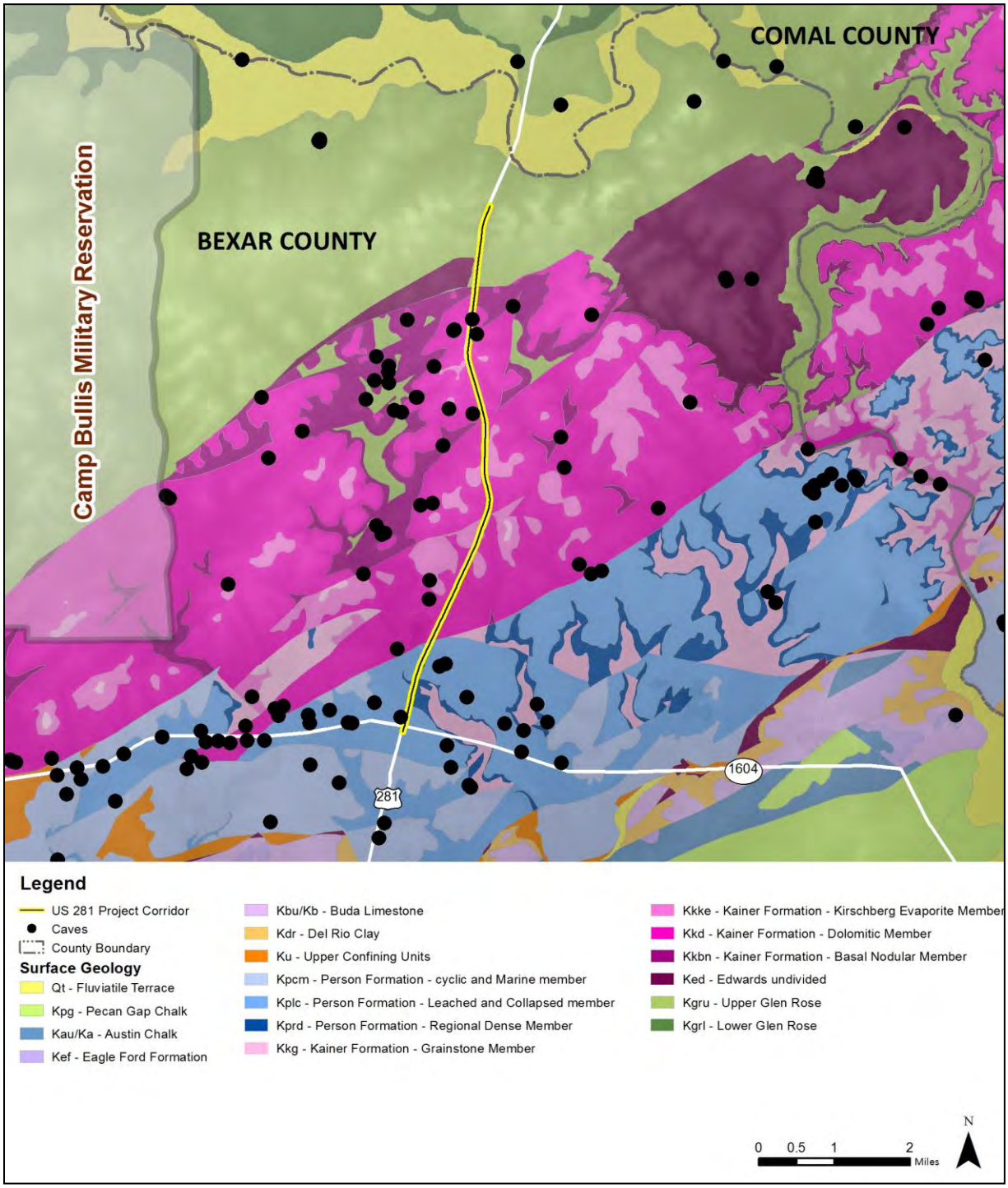
Karst Recharge Features

Both the Edwards and Trinity Aquifers have secondary developed porosity that allows water to enter and travel through the limestone matrix. This porosity can be structurally controlled with features such as fractures and faults or stratigraphically controlled by the originally deposited layers in the limestone. The openings in the rock might be karst related features such as caves, sinkholes, or other dissolution formed voids that have enhanced both structural and stratigraphical related porosity and permeability of the aquifer.

Areas with extensive secondary porosity are believed to be most sensitive to recharge and potential contamination that can ultimately impact the quality of groundwater in the aquifer. However, water can enter the aquifer almost anywhere along the limestone outcrop where there are no apparent conduits to the subsurface even if the area has not been previously mapped with karst or other hydrologically sensitive features. Notable recharge features in the Edwards Aquifer include: recharge along streambeds (Cibolo Creek and Helotes Creek in Bexar Co.), recharge in surface water impoundments that create high hydraulic gradients (Medina Lake in Medina Co.), discrete recharge through a network of caves, solution cavities, and sinkholes, and diffuse upland recharge through areas.

Karst features are highly susceptible to rapid point contamination and fast travel times. There are thousands to tens of thousands of recharge features into the Edwards and Trinity Aquifers. Within northern Bexar County, there have been more than 1,400 karst features identified, and many near highway US 281 (**Figure 3-27**). Information regarding significant recharge features of the Edwards and Trinity Aquifer are gathered from TCEQ geologic assessment records, published papers, database of the Texas Speleological Survey, common knowledge, and professional experience.

Figure 3-27: Karst features in the area surrounding the US 281 project corridor



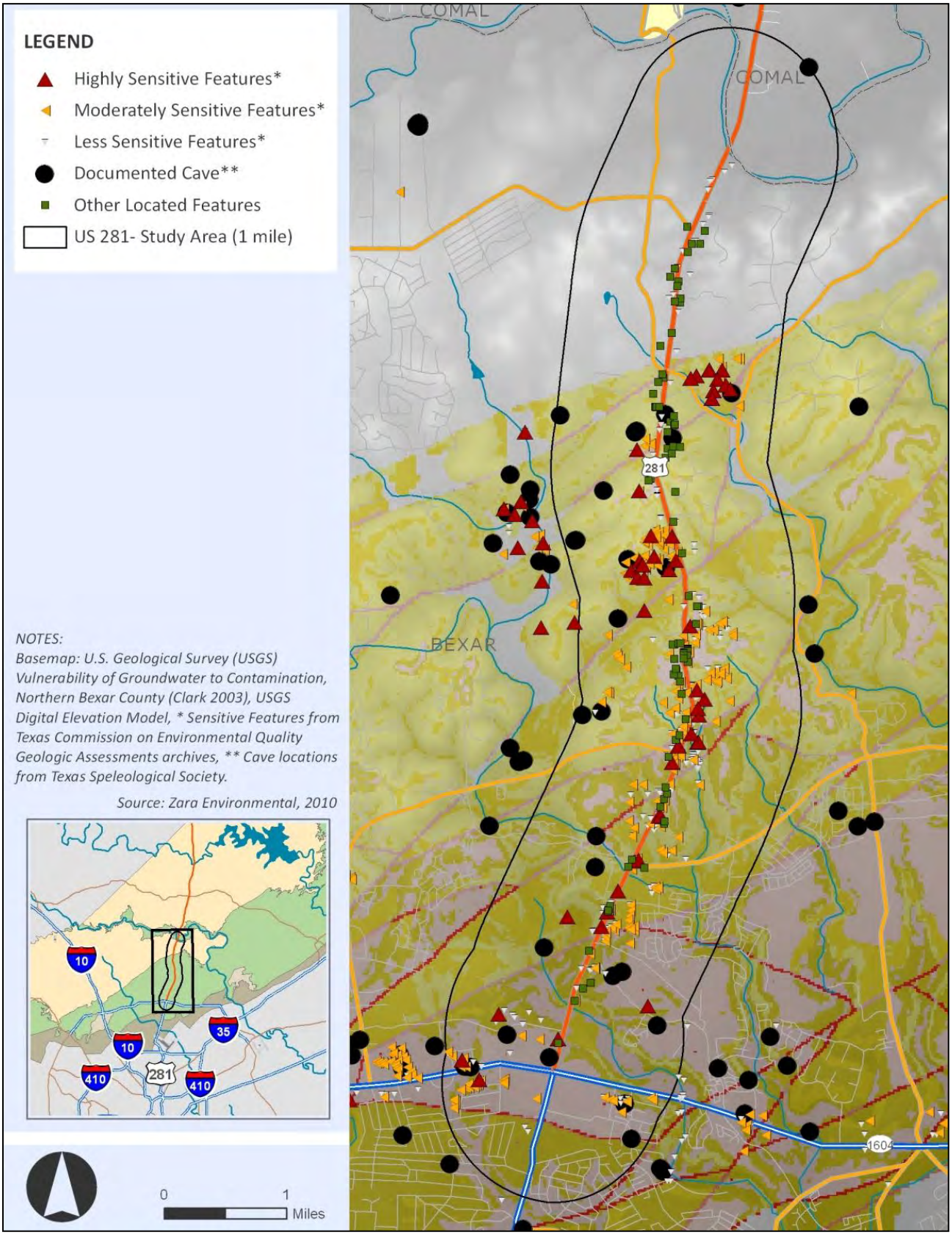
Source: USGA Geologic Map of the Edwards Aquifer Recharge Zone (Blome et al., 2005), TNRIS 1:250, 000 Geolofic Atlas of Texas, USGS 1:24,000 National Hydrography dataset; July 2011.

In Bexar County, significant caves include: Backhole, Banzai Mud Dauber Cave, Bet-Ya-Can't-Find-It Cave, Bear Cave, Blanco Road Cave, Boneyard Pit, Bullis Hole, Camp Bullis Bad Air Cave, Camp Bullis Bat Cave, Camp Bullis Cave No. 1, Camp Bullis Cave No. 3, Cave of the Creek, Cave of the Woods, Cibohole, Corkscrew Cave, Dead Deer Cave, Eagles Nest Cave, Elm Springs Cave, Elm Water Hole Cave, 50 Bucket Cave, Fair Hole (Bexar, Comal and Kendall Counties), Genesis Cave, George's Hole, Grosser's Sink, Hill's and Dale's Pit, Hold Me Back Cave, Hornet's Last Laugh Cave, Hunting Headquarters Cave, Jabba's Giant Sink, MARS Shaft, MARS Pit, Poison Ivy Pit, 17' Pit, Poor Boy Baculum Cave, Root Canal Cave, SARA Site 4 Cave, Shavano Park Cave, Stealth Cave, Summerglen Cave, Twin Sinks Cave, and Wedge Cave. Numerous caves and karst features are found within one mile of the proposed project area and several within the direct impact area.

The portions of the outcrop area that exhibit more porosity and permeability are inherently more vulnerable to receiving contamination. However, all voids that can receive potential recharge into the ground are not always observable and at a mapable scale. The outcrop of the Edwards Aquifer and the nearby upgradient Contributing Zone can be susceptible and vulnerable to potential contamination. As previously described, the Edwards Aquifer has been divided into aquifer subdivisions with differing lithologic characteristics. The two units with the most inherent porosity and permeability are the collapsed and leached members in the Person Formation and the Kirschberg evaporite member of the Kainer Formation. In addition to the stratigraphic units, areas that have been faulted and broken structurally have additional fractures that have greatly added to the porosity and permeability of the limestone. Karst features that result in caves, sinkholes and collapsed features also add greatly to the sensitivity to recharge elements.

Vulnerability modeling of groundwater contamination in the Edwards Aquifer in northern Bexar County was performed by Clark (2000), in which a numerical weighting system was applied to rate several factors that represented the potential for contamination by recharging water. This model predicts the susceptibility of groundwater to contamination depending on the location and compound effects numerous all hydrologic factors that impact the hydrogeology, including (1) Edwards Aquifer hydrostratigraphic subdivisions, (2) locations of faults, (3) locations of some caves and sinkholes, (4) topographic slope, and (5) soils. Caves, faults, fractures and other karst features act to provide direct passageways for water to enter the aquifer. The lack of soils and topography can also reduce the potential for filtration prior to entering the aquifer. The results of this are presented in **Figure 3-28**.

Figure 3-28: The U S 281 study area with locations of known caves and karst features overlain on groundwater vulnerability map from Clark (2000).



Sources of Contamination

Several mechanisms are possible for introducing contaminants into the groundwater system in urbanized areas. Cumulative buildup of metals and organic compounds along heavily used highways is the most persistent source of pollutants (Van Metre et al. 2000). Large spills from storage tanks on vehicles could possibly occur during accidents, and is listed as a direct threat to water quality in the Edwards Aquifer (Johnson et al. 2009). Gasoline and diesel fuels are the most common hazardous materials carried along the project corridor. An accidental release of a large quantity of hazardous material to a sensitive recharge feature is a low-probability event; however it has the potential to adversely impact the major regional groundwater source. PAH compounds and heavy metal elements are harmful hydrophobic contaminants shown to accumulate with vehicle traffic on highways, and become associated with sediment particles. Storm events wash the contaminated particles into surface streams (Van Metre et al. 2003; Mahler et al. 2006), and in the specific setting of the Edwards Aquifer, can be rapidly transmitted directly into the groundwater system. This could allow for a build-up of PAHs in the aquifer that could present long-term adverse effects on drinking water supplies and eventually make it to springs through direct transfer or re-suspension (Massei et al. 2003).

The implementation of some BMPs can have a positive effect to control of contamination to the water system, and it has been shown that without strict adherence of efficient BMPs, highway construction and operation has a large negative impact on water quality, including groundwater in karst zones (Barrett et al. 1995; Donaldson 2004).

These contaminants are normally conveyed by runoff from the roadway primarily during the "first flush", or the first inch of rain. The first flush carries with it concentrations of pollutants that have accumulated during periods of dry weather between storms, and is strongly correlated with percent land use (Van Metre et al. 2003). TCEQ Edwards Rules (Chapter 213) require the construction and maintenance of permanent water quality controls to remove suspended solids from runoff after construction for the life of the roadway. These water quality controls include filter strips, sand filters, and extended detention basins. The implementation of these engineered water-quality control structures, or BMPs are put in place to help offset potential impacts through short-term retention or filtration prior to discharging to streams. By utilizing suitable BMPs for filtering storm water, the potential for groundwater quality degradation may be reduced, but not eliminated. Other water quality mitigation practices include: defining extent of contamination plumes, predicting groundwater flow paths, building and maintaining effective monitoring networks, and treating contaminated water.

Aquifer Flowpaths

Groundwater flow paths in northern Bexar and southern Comal Counties have been modeled using geologic and hydrologic data (Otero 2007), and flow generally from the US 281 project corridor northeasterly to Comal Springs. Multiple flowpaths are identified and some directly cross the project area, although one of the modeled paths flows in a southwestern direction before turning 180 degrees to flow northeasternly beneath US 281. Most recharge to the flowpaths is primarily regional, occurring in the EARZ west of the project corridor. The permeable sections of the aquifer in the flow paths to Comal Springs, although faulted, are juxtaposed in a manner that promotes the flow of ground water in the project area from the center of Bexar County through

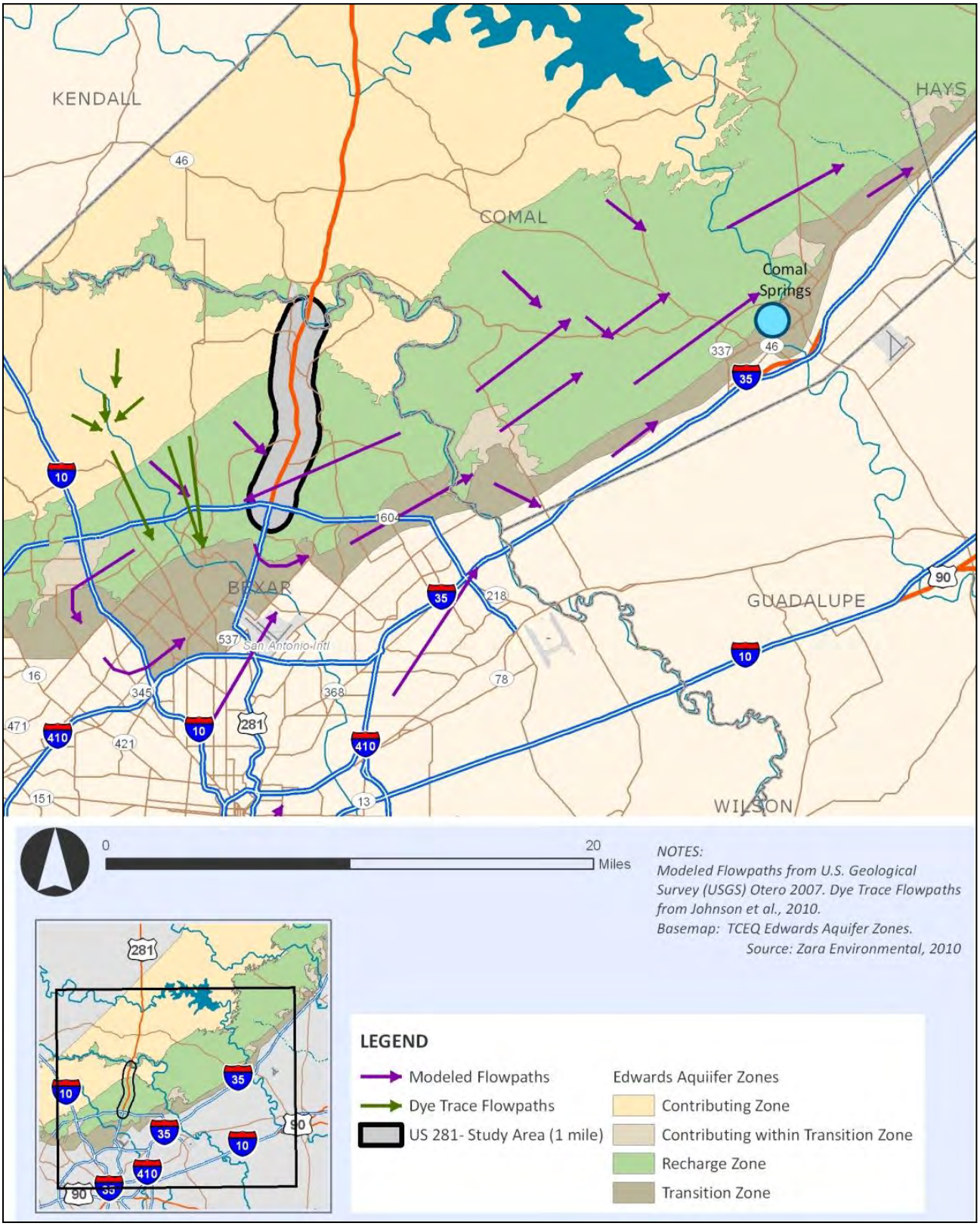
southern Comal County. The ground water then encounters a transverse fault northeast of New Braunfels that forms a barrier to ground-water flow and is forced up along the Comal Springs fault and through the overlying gravels to form a majority of the springs and seeps in the Comal Springs complex. Water-level and spring hydrographs at wells in northern Bexar County, southern Comal County, and Comal Springs provide evidence of patterns indicating a common flow path for ground water flowing past the wells and discharging at Comal Springs (Otero 2007).

Recent dye tracing studies have been conducted under the direction of the EAA (Johnson et al. 2010) and provide good evidence for flowpaths and time of travel in the aquifer. These studies took place near Panther Springs Creek and US 281 (**Figure 3-29**) and are directly applicable to evaluation of sensitivity of the EARZ in the area near the proposed highway project. Four phases of tracing using non-toxic fluorescent dyes were performed through injection sites in six caves and at an additional site that is a soil covered inter-stream location with no visible karst features. Water was sampled for the detection of the dyes in 32 public and private wells located in the general vicinity of Panther Springs Creek near Loop 1604 and US 281.

The path that the dyes took from injection point to receptor crossed under Loop 1604 near Blanco Road, which is approximately 2.5 miles west of US 281. The potential straight-line flow velocities measured from the testing ranged from a low of 43 feet per day to a high of 17,400 feet per day. The large discrepancies in velocities can be attributed to whether a monitored well is located in the vicinity of karst conduit or flow path that might directly channel the dye to a particular location and dye attenuation times in the vadose zone at injection sites. The hydrologic conditions before, during and after dye injections potentially impact both groundwater velocity and direction of groundwater flow. Several mapped faults are located between injection and the monitored receptor wells. The results from the traces indicate that these faults did not interfere or redirect the flow path between receptor and injection locations. The apparent flow direction was perpendicular to the faults and generally parallel to the surface direction along the creek. Additionally, some of the injections were in caves predominantly in the upper Glen Rose and were detected downstream in wells completed into the Edwards Aquifer. The location of one dye injection was in an inter-stream location and was slowly flushed with water over a two-month period in an area with no observable karst features. The dye was detected in two wells, which demonstrated the potential vulnerability of the recharge zone even in areas that are not known to have mapped caves or other karst features.

Both the modeled and traced flowpaths in northern Bexar County have significant implications to construction and operation of the proposed US 281 Corridor Project. The tracer results indicate that contaminants introduced through discrete karst features and even open ground potentially reach water supply wells at extremely rapid rates. Modeled flowpaths show water entering the aquifer in northern Bexar County flows directly to Comal Springs, which provides habitat to endangered species.

Figure 3-29: Modeled and dye traced groundwater flowpaths in the area near US 281 up to Comal Springs



Source: TCEQ Edwards Aquifer Zones, Zara Environmental, 2010.

Aquifer Discharge

Springs are major natural discharge points for aquifers and have been the focal point for establishing cities such as Del Rio, Brackettville, Uvalde, San Antonio, New Braunfels and San Marcos by providing their initial water supply. The areas near many of these springs in Central Texas have been inhabited by man for thousands of years and the springs have been utilized as a water resource. Historically, wells were drilled into the Edwards Aquifer to supplement the water originally available from springs.

Total discharge from springs averages about 385,000 acre-feet/year or 55.4 percent of the total discharge from the Edwards Aquifer (the remaining 45 percent is due to groundwater pumping). The ratio of discharge from wells and springs generally increases during droughts as spring flow rates diminish. In 1956, wells contributed 82 percent of the discharge compared to 18 percent for springs. During the 2008 drought, wells comprised 51 percent and springs 49 percent of the Edwards Aquifer annual discharge. Discharge from springs is relatively higher during years with higher rainfall. For the period of record 1934-2008 for the Edwards Aquifer, withdrawal by wells averaged approximately 310,300 acre-feet/year, which is 44.6 percent of the annual average total discharge from the aquifer.

Major springs in the Trinity Aquifer in the region include Jacob's Well and Dead Man's Hole in Hays County; Spring Creek Cave, Cave Without a Name, and Alzafar Springs in Kendall County; Honey Creek Cave in Comal County; and Cold Springs in Uvalde County.

The Edwards Aquifer is characterized by a number of significant springs. The environment near the springs provides critical habitat for several endangered and threatened species. Additionally, the baseflow from the springs provide a significant portion of the water available to downstream interests along the river basins. Some of the major springs in the Edwards Aquifer from west to east include San Antonio and San Pedro in Bexar County; Comal and Hueco in Comal County; San Marcos in Hays County; and Barton Springs in Travis County. The four springs in closest proximity to the US 281 project corridor are San Antonio, San Pedro, Hueco and Comal.

Because of flow paths and specific recharge areas that feed some springs, long-term impact or contamination from an extremely large spill in the US 281 project corridor could affect water quality at the springs. The springs west of Bexar County will not be impacted because the flowpaths in the Edwards Aquifer generally move eastward. The springs located east of the US 281 project corridor have some potential for degradation if spills or leaks occurred along the highway. San Marcos Springs receives most of its water from an area in western Comal County and into Hays County and would likely be minimally impacted from activities US 281. The remote distance that water would travel in the aquifer from the US 281 project corridor would also limit the impact to San Marcos Springs. Hueco Springs in Comal County recharges from western Comal and northern Bexar Counties, and could be impacted if a major contamination event occurred.

Comal Springs, which is the largest spring in Texas and less than 20 miles from the US 281project corridor, is within in the flowpaths from waters that recharge the Edwards Aquifer near the highway. Contaminants such as PAHs and VOCs have been detected in karst springs of the Edwards Aquifer, originating from either discrete spills or as non-point source contamination due to run-off from urbanized areas. Any level of contaminants from potential spills, construction, or cumulative operation could degrade

the overall quality of the spring water. Of all the springs in the Edwards Aquifer, Comal Springs has the highest potential for impact and water-quality degradation from any activities in northern Bexar County.

Wells are constructed to withdraw water from an aquifer for a variety of uses, such as public supply, agricultural, domestic, stock, industrial or mining. Public supply is the highest use category and is centered on the major metropolitan areas. Irrigation use is second and is predominantly located in western Uvalde and Medina Counties. Wells can also provide artificial pathways to the aquifer for potential contamination from the surface or subsurface especially when the wells are poorly constructed or abandoned. Wells are discharge points for water from the aquifer and can act to bring subsurface contaminants back to the surface where they could come in contact with people or even potentially consumed. Wells located down-gradient of the US 281 project corridor are susceptible to contamination just as springs are, and in many cases could be impacted far more rapidly and with greater concentrations of any pollutant introduced to the aquifer.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, both the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same and stormwater management improvements are proposed for all lane options; therefore the impacts to groundwater would not change based on funding options.

Conclusion and Proposed Mitigation Measures

Both of the Proposed Build Alternatives have the potential to impact groundwater quality via contamination of metals and organic compounds, accidental spills from storage tanks on vehicles, petroleum fuels, and hazardous materials. The potential for groundwater contamination is increased due to the numerous karst features surrounding the project corridor. The karst features can act as a conduit for rapid transmission of contaminants into groundwater. The existing roadway has unpaved and informal shoulders along the entire corridor from Loop 1604 to Borgfeld Drive and does not have a storm water drainage system that meets current TCEQ WPAP standards. Modeled and traced flowpaths of groundwater in northern Bexar County have shown the potential for contaminants to reach water supply wells at rapid rates. These flowpaths have also shown water entering the aquifer in northern Bexar County flows towards Comal Springs, which provides habitat to endangered species.

Under the guidance of the Edwards Aquifer Protection Program, groundwater quality mitigation practices include defining extent of contamination plumes, predicting groundwater flow paths, building and maintaining effective monitoring networks, and treating contaminated water. Treatments may include filter strips, sand filters, and extended detention basins. The implementation of these engineered water-quality control structures, or BMPs are put in place to help offset potential impacts through short-term retention or filtration prior to discharging to streams. The US 281 project corridor has unpaved and informal shoulders along the entire corridor from Loop 1604 to Borgfeld Drive and does not have a storm water drainage system that meets current TCEQ Water Pollution Abatement Plan (WPAP) standards except at the newly constructed US 281 Super Streets project area. As such, the US 281 project corridor

would remain susceptible to contaminants.

The TCEQ rules for development within the Contributing and Recharge Zones of the Edwards Aquifer generally require BMP's that capture and remove of a minimum of 80 percent of the increase in total suspended solids (TSS) generated by new impervious cover (see **Appendix K3**). Generally the most contaminated storm water runoff occurs during the "first flush", the first pulse of runoff generated during a storm event, which mobilizes particles and contaminants that have accumulated on impervious surfaces since the previous rainfall event. The design plans for the preferred alternatives call for the installation of storm water BMP's that will capture and treat the first flush according to TCEQ guidelines. The current highway design does not include any storm water BMP's for treating TSS and other contaminants; therefore, the preferred alternatives would result in an increase in contaminant removal.

So long as the chosen design includes TCEQ approved storm water BMP's, it is likely that runoff water quality will be improved. Improvements in highway runoff water quality could result in improved groundwater quality because highway runoff is not currently treated before entering streams or karst features that may recharge the Edwards Aquifer. The end intended result would be an improvement in the quality of surface water and groundwater associated with the project corridor. If the proposed improvements spur more development along the US 281 corridor, there could be a negative impact on groundwater quality associated with that development, particularly if proper storm water BMP's are not implemented

3.10 FLOODPLAINS

3.10.1 Methodology

The assessment methodology is based on the requirements provided in EO 11988 Floodplain Management, FHPM 6-7-3-2, *Location and Hydraulic Design of Encroachments on Floodplains*, and U.S. Department of Transportation 5650.2 Floodplain Management and Protection. FHPM 6-7-3-2 essentially references 23 CFR § 650 Subpart A, *Location and Hydraulic Design of Encroachments on Floodplains*.

This analysis was completed using the Flood Insurance Rate Maps published by the Federal Emergency Management Agency (FEMA) for Bexar County. The locations of the 100-year floodplain within the area of the Proposed Build Alternatives were determined. Floodplain impacts were assessed by analyzing the amount of additional impermeable surface area and number of linear feet of 100-year floodplain crossings that could result from the Proposed Build Alternatives.

The same method will be utilized in the Final EIS to analyze floodplain impacts for the Preferred Alternative. In addition, a hydraulic study will be conducted to locate and size culverts and bridges at stream crossings and the responses to 23 CFR 650.113 that encroachments on floodplains are the only practicable alternative.

3.10.2 Affected Environment

The US 281 project corridor is located within FEMA Flood Map panel numbers 48029C0130E, 48029C0140E and 48029C0277E and crosses two areas within the 100-year floodplain (Zone A) in the southern and northern extents. The southern extent includes

the floodplain of Mud Creek and the northern extent includes the floodplain of Upper Cibolo Creek, with the majority of floodplain acreage located near the southern extent. The floodplains are shown in **Figure 3-26**.

3.10.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would result in no new encroachment on the 100-year floodplain, and therefore would have no direct or indirect impacts. However, growth in the area would continue, as would potential indirect impacts to the floodplain resulting from that growth and development. Potential floodplain impacts would be regulated by floodplain policy.

Proposed Build Alternatives

Executive Order 11988, *Floodplain Management*, requires that federal agencies avoid activities that directly or indirectly result in the development of a floodplain area. Roadways are impermeable surfaces that deflect, rather than absorb or store water; thus, the presence of floodplains in the vicinity of roadway facilities is an important construction consideration. Building a new roadway, or expanding an existing facility, increases the potential for flooding impacts due to the addition of impermeable surface area. Additionally, roadway construction could alter the extent of the 100-year floodplain by acting as a levee or barrier to the natural ebb and flow of storm waters. The proposed facility would increase runoff rates due to the increase in impervious cover (pavement) surface area. However, the increase would be mitigated for using drainage facilities (such as detention ponds) that would be designed and constructed in compliance with guidelines of the effected cities and flood control districts. Either of the Proposed Build Alternatives would be designed such that potential flooding would be avoided or minimized through mitigation measures (i.e., crossing streams and tributaries at locations that would minimize impacts to floodplains). **Table 3-43** provides estimates of floodplain impacts for the Proposed Build Alternative.

Table 3-43: Impacts to Floodplains by Alternative

Floodplain	No-Build Alternative (acres)	Expressway Alternative (acres)	Elevated Expressway Alternative (acres)
Mud Creek	20.3	28.3	20.8
Unnamed Tributary to West Elm Creek	0.0	0.0	0.3
Unnamed Tributary to Cibolo Creek	3.7	5.2	4.0
Cibolo Creek	3.3	3.3	3.3
Total	27.3	36.8	28.4

Source: FEMA, US 281 EIS Team, July 2011
Note: Acreage and length obtained from data provided in FEMA maps covering study area in Bexar County, TX

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and

managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same; therefore the impacts to floodplains would not change based on funding options.

3.10.4 Conclusion and Proposed Mitigation Measures

Any fill placed into the floodplain would need to be mitigated with floodplain storage adjacent to the roadway (detention facilities). These detention facilities will offset increases in flows as well as add additional floodplain storage to the watershed, which will restore and preserve the natural and beneficial floodplain values.

The design of the Proposed Build Alternatives would not increase the base flood elevation to a level which would violate applicable floodplain regulations and ordinances. The hydraulic design for this project would be in accordance with current TxDOT and FHWA policies and standards. The US 281 Corridor Project would permit the conveyance of the 100 year flood, inundation of the roadway being acceptable, without causing substantial damage to the roadway or other property. Bexar County participates in the National Flood Insurance Program.

During the design phase, potential impacts to floodplains would be identified and drainage structures designed to accommodate anticipated high flows such that upstream and downstream areas are not adversely impacted. The US 281 Corridor Project would be designed in compliance with appropriate local, state, and federal standards to ensure that floodplain encroachment does not increase the risk of flooding to adjacent properties. Adverse impacts would be mitigated through measures such as implementation of BMPs during construction and development of detention facilities to offset anticipated increased flows.

3.11 WILD AND SCENIC RIVERS

The *Wild and Scenic Rivers Act* was enacted into law on October 2, 1968. Section 1(b) of the Act expresses Congressional policy, stating that certain rivers of the Nation that, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values shall be preserved in free-flowing condition, and that their immediate environments shall be protected for the benefit and enjoyment of present and future generations (National Park Service 2003). No river or river segments listed in the Nationwide Rivers Inventory are located within the US 281 project corridor.

3.12 COASTAL ZONE MANAGEMENT AND COASTAL BARRIERS

The *Coastal Zone Management Act* (CZMA) of 1972, as amended in 1996, provides for the preservation, protection, development, and where feasible, restoration and enhancement of the nations coastal zone resources. In Texas, the General Land Office (GLO) is designated as the lead agency that coordinates the development and implementation of the *Texas Coastal Management Plan* (TCMP). The Coastal Coordination Council (CCC) administers the coastal management program and is in charge of adopting uniform goals and policies to guide decision making by all entities regulating or managing

natural resource use within the Texas coastal area.

The boundary of the Texas Coastal Management Zone (CMZ) was delineated in accordance with the requirements of the federal CZMA, federal program development and approval regulations, and the *Texas Coastal Coordination Act*. Requirements dictate that a state's coastal zone boundaries include four elements: inland boundary, seaward boundary, interstate boundaries, and federal land excluded from the boundary. Neither of the Proposed Build Alternatives traverses the Texas CMZ; therefore, no formal coordination with the GLO will be required.

The *Coastal Barrier Resource Act* was passed in 1982 to address potential impacts to coastal barriers caused by development. The US 281 project corridor is not mapped as part of the nation's coastal barrier resources system; therefore, neither of the Proposed Build Alternatives would impact coastal barrier resources.

3.13 WETLANDS AND OTHER WATERS OF THE US

3.13.1 Methodology

A survey was conducted of the general types of wetlands that occur in the US 281 project corridor using published US Fish and Wildlife Service's (USFWS) National Wetland Inventory (NWI) maps, aerial photographs, and US Geological Survey (USGS) topographic maps. Field reconnaissance was conducted to preliminarily verify the presence of wetland areas. The wetlands study area was defined as a quarter mile around the existing US 281 ROW.

In the Final EIS, wetland delineations will be performed within the ROW of the Preferred Alternative and will include a jurisdictional determination and impacts assessment. Final wetland determinations would be decided by the US Army Corps of Engineers (USACE) and other resources agencies during the Section 404 permitting process, if necessary. Permitting and mitigation requirements would be determined as needed.

3.13.2 Affected Environment

Two general types of wetlands occur within the US 281 project area: non-forested and forested, with the majority of the wetlands being forested. According to the NWI maps, four major subclasses of wetlands occur within the areas traversed by the Proposed Build Alternatives: Palustrine Unconsolidated Bottom (PUB), Palustrine Unconsolidated Shore (PUS), Palustrine Scrub-Shrub (PSS), and riverine.

Wetland Types

Palustrine Unconsolidated Bottom (one PUB in the study area - 0.7 acres)
PUB systems are nontidal and less than 6.6 feet in depth, with 25 percent of bottom particles smaller than stones and vegetation cover of less than 30 percent (Cowardin et al. 1979). These areas are most likely natural or man-made ponds. Wetland vegetation occurs in the shallow water areas near the shoreline of these systems; however, little emergent vegetation is generally present. Examples of hydrophytic vegetation types that might occur in PUB systems include sand spikerush (*Eleocharis montevidensis*), floating seedbox (*Ludwigia peploides*), soft rush (*Juncus effusus*), short-bristle beakrush

(Rhynchospora corniculata), and swamp smartweed (Polygonum hydropiperoides).

Palustrine Unconsolidated Shore (eight PUS in the study area - 3.2 acres)
PUS systems are nontidal and less than 6.6 feet in depth, with 75 percent cover of stones, boulders or bedrock and less than 30 percent cover of vegetation. These wetlands are found adjacent to unconsolidated bottoms, are regularly and/or irregularly flooded (Cowardin et al. 1979). These types of wetlands are characterized by erosion and deposition by waves and currents, which produce a number of landforms such as beaches, bars and flats and typically lack vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable.

Palustrine Scrub-Shrub (two PSS in the study area - 6.0 acres)
PSS wetlands are nontidal and less than 6.6 feet in depth. These wetlands area are dominated by woody vegetation less than 20 feet tall. Dominant species include true shrubs, saplings, and stunted trees or shrubs (Cowardin et al. 1979). These wetland systems occur in depressed areas on the landscape, which are hydrologically driven by rainwater or ground water. Shrubs and saplings common to these wetland systems include Drummond's rattlebox (*Sesbania drummondii*), eastern baccharis (*Baccharis halimifolia*), and common buttonbush (*Cephalanthus occidentalis*).

Riverine
A riverine wetland is contained in natural or artificial channels. A low gradient and slow water velocity characterize this riverine wetland with no tidal influence (Cowardin et al. 1979). The substrate consists mainly of mud and sand. Very little vegetation is found within this wetland.

Wetland Functions and Values
Wetland functions and values are included in Sections 401 and 404 of the CWA. Wetland function is a physical or chemical process or activity. A function is related to the wetland's position in the watershed, the overall hydrological cycle, and its ecological integrity. There are 14 functions that are generally recognized: ecological integrity, habitat, environmental education, recreation, food chain support, nutrient cycling, flood control/conveyance, flood flow alteration, ground water recharge, shoreline stabilization and erosion control, quality of life, sediment/toxicant/pathogen retention, nutrient removal/retention/transformation, and historic/archeological significance.

A wetland value is the social benefit that is derived from one or more functions and the physical characteristics associated with a wetland. The value of a particular wetland function, or combination of functions, is based on human judgment of the worth, merit, or importance attributed to those functions. Examples of values are recreation, educational/scientific, uniqueness/heritage, and visual quality/aesthetics. There are 44 recognized methods for measuring functions and values. Upon identification of a Preferred Alternative and wetland delineation, these functions and values of wetlands that may be impacted by the US 281 Corridor Project would be determined jointly with USACE and the resource agencies during the Section 404 permitting process.

3.13.3 Environmental Consequences

No-Build Alternative

With implementation of the No-Build Alternative, there would be no impact to wetlands.

Proposed Build Alternatives

Based on NWI mapping and field reconnaissance, the following discusses the potential impacts to wetlands resulting from the Proposed Build Alternatives. A water/wetland determination/delineation will be performed for the Preferred Alternative for the Final EIS. At that time the USACE will be requested to verify the determinations/delineations. Verifications are typically valid for five years.

Preliminary information based on the NWI maps indicates that there are three small wetlands within the wetlands study area and all the alternatives impact the same acreage as shown in **Table 3-44**. All of these wetlands are palustrine, unconsolidated shore, temporarily/seasonally flooded, diked/impounded. As implied in the NWI naming structure, these wetlands typically serve an agricultural use such as ponds for livestock watering or similar functions. None of the wetland areas serve as an agricultural use and all areas appear degraded. They do, however, appear to be within the 100-year floodplain (i.e. not isolated) and would potentially be subject to USACE jurisdiction.

Executive Order 11990, *Protection of Wetlands,* established a national policy to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Construction activities typically impact wetlands and aquatic systems. The initial clearing of the land during construction activities would remove vegetative cover, which could lead to increased surface runoff and erosion. If this runoff is allowed to flow into streams, it could increase turbidity and sedimentation, or modify water chemistry due to an increase in sediments, nutrients and pollutants while diminishing suitable habitat for aquatic species and plants. Therefore, erosion control measures would be incorporated prior, during, and after construction to minimize impacts from erosion and sedimentation.

Table 3-44: Impacts to NWI Wetlands by Alternative

NWI Wetlands	No-Build Alternative (acres)	Expressway Alternative (acres)	Elevated Expressway Alternative (acres)
PUSAh	0.3	0.3	0.3
PUSAh	0.1	0.1	0.1
PUSCh	0.1	0.1	0.1
Total	0.5	0.5	0.5

Source: NWI, US 281 EIS Team, 2012

NWI maps as well as field investigations were used as part of a preliminary determination to identify any waters of the US, including wetlands within the ROW of the US 281 project corridor. Other information reviewed included aerial infrared photographs Digital Ortho Quarter Quadrangle and USGS topographic survey maps of the project area. The potential for wetland impacts associated with the Proposed Build Alternatives was identified. Once the Preferred Alternative has been identified, a detailed wetland determination/delineation of that alternative will be conducted to identify the jurisdictional waters/wetlands impacts.

Based on limited field surveys of the study area, the greatest potential to encounter wetlands (waters of the US) is adjacent to Cibolo Creek and its tributary. Both of the Proposed Build Alternatives would cross three major streams and eight tributaries located within the wetland study area. The three major streams include: (1) Mud Creek, (2) West Elm Creek, and (3) Elm Waterhole Creek within the project limits. The eight tributaries include: four tributaries of Mud Creek, two tributaries of West Elm Creek, one tributary to Elm Waterhole Creek, and one tributary of Cibolo Creek. Many of these waterways have been channelized and culverted due to surrounding development. More information on these surface water crossings is included in **Section 3.9.1**.

In compliance with the Memorandum of Understanding (MOU) between TxDOT and the GLO, coordination would be conducted regarding roadway crossings over streams, whether they are tidally influenced or not.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, both the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to waters of the US including wetlands would not change based on funding options.

3.13.4 Conclusion and Proposed Mitigation Measures

Activities to minimize the impacts to habitats from highway construction include: minimizing devegetation of the construction area wherever safety allows, decreasing the amount of fill placement, and implementation of BMPs, including an erosion and sedimentation control plan. Specific impact minimization to wetland areas may include; the use of bridge crossings instead of filled embankment; the use of retention basins and revegetated swales to minimize runoff, sedimentation, turbidity, leaching of soil nutrients and chemicals from petroleum products, pavement and waste material; and alleviating flow alterations due to structures which may change established wetland drainage or flooding patterns.

Some degree of impact is often unavoidable, regardless of the care applied during the planning, design and construction of a highway. Therefore, plans for compensatory mitigation may need to be developed to reconstruct the features or habitat that may be impacted, even after practicable minimization has been achieved. Both of the Proposed Build Alternatives would traverse 12 mapped streams and tributaries and impact waters of the US including potential wetlands. It should be noted that alternative evaluations involving avoidance and minimization of wetland impacts where possible have been, and would continue to be, an essential part of the NEPA process and engineering design of the US 281 Corridor Project.

Following the identification of a Preferred Alternative for the US 281 Corridor Project, jurisdictional wetland delineation will be performed and submitted to the USACE for verification. This verified delineation will be used to calculate impacts to waters of the US, including wetlands, associated with the US 281 Corridor Project. Once the extent of impacts has been determined, alternative mitigation scenarios for compensation of these impacts will be identified and evaluated. Mitigation alternatives may include any or all of the following: wetland/habitat restoration, enhancement, creation, and/or preservation. Preference would be given to potential mitigation within the San Antonio

River Basin. Natural resource agencies will be involved in decisions regarding appropriate mitigation ratios, wetland type/function, location and size. A compensatory mitigation plan would be prepared, as necessary, and submitted to the USACE as part of a Section 404 permit application.

3.14 VEGETATION

With the exception of certain vegetation communities that afford habitat for species listed under the Endangered Species Act (ESA), impacts to vegetation communities are generally not regulated under federal or state law. However, there are guidance documents that govern how impacts to vegetation communities are to be documented and mitigated in the interagency agreement between the Texas Parks and Wildlife Department (TPWD) and TxDOT as outlined in the Memorandum of Understanding (MOU) signed in 1998 and the MOA signed in 2001.

The MOU between TxDOT and TPWD specifies the information pertaining to vegetation communities that must be included in environmental documents. The MOU further specifies that TxDOT and TPWD would consult on any non-regulatory mitigation that is deemed appropriate. Any mitigation, regulatory or non-regulatory, would be coordinated with TPWD and the USFWS in accordance with the MOU and other laws. The MOU specifies the habitats that would be given consideration for non-regulatory mitigation.

The 2001 MOA outlines the finalization of the 1998 MOU between TxDOT and TPWD concerning habitat descriptions and mitigation for impacts to habitat. In addition, the MOA defines unusual vegetation and special habitat features and further describes compensatory mitigation in accordance with Provisions (4)(A)(ii) of the MOU.

3.14.1 Methodology

The analysis of the vegetation communities surrounding the US 281 project corridor began through the examination of the following information/data sources:

- aerial images
- USGS topographic maps
- USFWS National Wetland Inventory maps
- USDA soil survey maps
- TPWD Natural Diversity Database

These resources were used to determine the vegetation study area and to create maps to be used for field surveys. The vegetation study area was defined as the existing and proposed ROW for both Proposed Build Alternatives. These maps and field surveys were used to characterize vegetation within the existing ROW and in adjacent areas, when readily visible.

Following the field surveys completed in the Spring of 2010 and the Spring of 2012 the vegetation was described per the TxDOT-TPWD MOA:

- dominant species for each vegetation stratum
- height of trees, if present
- diameter at breast height (dbh) of trees, if present
- acreage of each vegetation community present
- percent canopy cover of trees

Per the TxDOT-TPWD MOU:

Unusual vegetation features may include:

1) unmaintained vegetation
2) trees or shrubs along the fenceline
3) riparian vegetation
4) trees that are usually larger than other trees in the area
5) unusual stands or islands (isolated) of vegetation

Special habitat features, include the following:

1) bottomland hardwoods
2) caves
3) cliffs and bluffs
4) native prairies
5) ponds
6) seeps or springs
7) snags
8) waterbodies and existing bridges with known or easily observed bird or bat colonies

3.14.2 Affected Environment

The US 281 Corridor Project is located in the Edwards Plateau ecological region of Texas. According to the TPWD's *Vegetation Types of Texas* (1984), the corridor is situated within the Live Oak-Ashe Juniper Parks (46 percent), Live Oak-Mesquite-Ashe Juniper Parks (45 percent), and Live Oak-Ashe Juniper Woods (9 percent) regions of Texas. Commonly associated plants of the Live Oak-Ashe Juniper Parks and Live Oak-Mesquite-Ashe Juniper Parks include Texas oak (*Quercus buckleyi*), Ashe juniper (*Juniperus ashei*), cedar elm (*Ulmus crassifolia*), shin oak (*Quercus buckleyi*), netleaf hackberry (*Celtis retculata*), flamleaf sumac (*Rhus lanceolat*a), Texas persimmon (*Diospyros texana*), agarito (*Berberis trifoliata*), Texas pricklypear (*Opuntia lindheimeri*), Texas kidneywood (*Eysenhardtia texana*), greenbriar (*Smilax bona-nox*), Texas wintergrass (*Stipa leucotricha*), little bluestem (*Schizachyrium scoparium*), curly mesquite (*Hilaria belangeri*), Texas grama (*Bouteloua rigidiseta*), Halls panicum (*Panicum hallii*), purple threeawn (*Aristida purpurea*), hairy tridens (*Tridens pilosum*), cedar sedge (*Carex planostachys*), two-leaved senna (*Cassia roemeriana*), mat euporbia (*Euphorbia serpens*), and rabbit tobacco (*Evax prolifera*). Commonly associated plants of Live Oak-Ashe Juniper Woods vegetation type include many of those listed above in addition to escarpment black cherry (*Prunus serotina*), twistleaf yucca (*Yucca rupicola*), and elbow-bush (*Forestier pubescens*).

A field survey of general areas along the US 281 project corridor in 2010 and 2012 indicated an ongoing conversion from native vegetation towards urban/residential development.

Developed Areas (includes maintained vegetation)

Residential/urban vegetation communities within the vegetation study area are primarily rocky with some native vegetation. It is heavily disturbed by residential/urban development. Vegetation within these areas tends to include Roosevelt weed (*Baccharis neglecta*), giant ragweed (*Ambrosia trifida*), annual sunflower

(*Helianthus annuus*), Johnsongrass (*Sorghum halepense*) and ornamental landscaping plants. This component is approximately 80 percent of the vegetation study area.

Live Oak-Ashe Juniper Parks (wooded areas and unmaintained non-wooded)

The majority of the undeveloped or unmaintained portion of the vegetation study area is characterized as Live Oak-Ashe Juniper segmented woodlands. The dominant woody species include plateau live oak (*Quercus fusiformis*) and Ashe juniper (*Juniperus ashei*), with much lesser amounts of Texas oak (*Q. buckleyi*), sugar hackberry (*Celtis laevigata*), Texas ash (*Fraximus texensis*), cedar elm (*Ulmus crassifolia*), escarpment black cherry (*Prunus serotina* var. eximius), and Texas walnut (*Juglans microcarpa* var. *microcarpa*). The understory of these areas are generally well developed with Ashe juniper limbs, vines, various shrubs, including the Texas persimmon (*Diospyros texana*), shunkbush sumac (*Rhus aromatic*), agarito (*Berberis trifoliate*), mountain laurel (*Sophora secundiflora*), prickly pear (*Opuntia* spp.) flameleaf sumac (*Rhus copallium*), elbow bush (*Fortetiera pubescens*), greenbrier (*Smilax bona-nox*), and grape (*Vitis* spp.). The average canopy coverage in these areas range from 50 to 90 percent and the height range was estimated to be 15 to 25 feet. The dbh ranged from 8 to 24 inches and an estimated average dbh of 15 inches. This component is approximately 20 percent of the vegetation study area.

Texas Natural Diversity Database Observations

TPWD's Texas Natural Diversity Database (TxNDD) is a database of observations of rare, threatened and endangered species and communities throughout the state. The TxNDD identified several vegetative species that occur or have historically occurred in Bexar County. The TxNDD was searched July 1, 2011 for Element of Occurrence Records (EORs) to determine if any reports of species have occurred within a 10-mile radius of the US 281 biological study area. The biological study area is defined as 500 feet beyond the proposed ROW for both Proposed Build Alternatives. More information on the results of the TxNDD search can be found in **Section 3.16.2 .**

Several rare vegetative series and plant species have been documented within 10-miles of the US 281 biological study area, but well beyond the US 281 vegetation study area. An occurrence of the plateau live oak/curly mesquite (*Quercus fusiformes/Hilaria belangeri*) series was recorded within the US 281 biological study area in 1992. The bracted twistflower (*Streptanthus bracteatus*) was recorded from two to ten miles west of the US 281 biological study area around Camp Bullis and approximately seven miles west in Eisenhower Park, which is adjacent to an immediately south of Camp Bullis. Additionally, an occurrence of the rare Texas mock-orange (*Philadelphus texensis*) has been recorded as close as seven miles northwest of the US 281 biological study area near the Comal County line. Lastly, the rare bald cypress/sycamore (*Taxodium distichum/Platanus occidentalis*) vegetative series was noted approximately 10 miles northwest in Guadalupe River State Park and the rare plateau live oak/little bluestem (*Quercus fusiformes/Schizachyrium scoparium*) series has been recorded approximately 10 miles in the nearby Honey Creek Wildlife Management Area. None of these species were identified during on-site habitat assessments in 2010 and 2012 of the US 281 biological study area.

TxDOT-TPWD MOU

According to the MOU, there are unusual vegetation and special habitat features within the US 281 project corridor.

Unmaintained vegetation (approximately 118 acres) exists adjacent to the US 281 project corridor and along a utility corridor. This vegetation is the same as other adjacent vegetation within the area and is not considered to be of special importance.

The US 281 project corridor only contains limited fence line vegetation (approximately one acre) with the following dominant species: netleaf hackberry (*Celtis reticulata*), sugarberry (*Celtis laevigata*), live oak (*Quercus virginana*), Ashe juniper (J*uniperus ashei*), cedar elm (*Ulmus crassifolia*), honey mesquite (*Prosopis glandulosa*), baccharis (*Baccharis texana*), and huisache (*Acacia smallii*). These species range from 8 to 24 inches in dbh and an average dbh of 15 inches, and an estimated height range from 10 to 40 feet. Vines located on fence lines were dominated by greenbriar (*Smilax rotundifolia*). Herbarceous vegetation near fence lines was dominated by bluegrass (*Bothriochloa spp.*), broomweed (*Amphiachyris dracunculoides*), little bluestem (*Schizachyrium scoparium*), prickly pear (*Opuntia* spp.), dewberry (*Rubus riograndis*) and maintained turf grasses.

Riparian vegetation (approximately 0.6 acre) can be found near Mud Creek. Dominant tree species include live oak and cedar elm with a dbh range from 8 to 24 inches and an average dbh of 15 inches, and a height range from 18 to 40 feet. Canopy cover is approximately 40 percent.

Trees that are unusually larger than other trees in the area and isolated vegetation were not found during the field surveys.

The vegetation study area is a karst landscape. In this type of terrain, limestone bedrock is dissolved by mildly acidic rain and groundwater to create caves and sinkholes. A number of caves and karst features are known to occur within the US 281 project corridor. The number of features varies within the existing and proposed ROW for either of the Proposed Build Alternatives (see **Section 3.16.3).**

Cut areas are located along the US 281 project corridor in sections that were blasted and excavated to make room for the roadway. These cuts are into limestone and act as shelter and habitat for vegetation and wildlife species.

One rock bottom pond surrounded by emergent grass vegetation was noted on the west side of US 281, approximately 0.2 miles north of Borgfeld Drive. This man-made pond is located above a road cut and is approximately 0.1 acre in size. It is surrounded by Ashe juniper, live oak, Linheimer muhly (*Muhlenbergia lindheimeri*) and white tridens (*Tridens albescens*).

Four springs were identified during karst feature surveys (2010), and one of the springs is located within the existing ROW (#281-002), one is located within the proposed ROW (#281-003) of both Proposed Build Alternatives and the other two springs are located outside of the proposed ROW (#281-010 and #281-012). The two springs located within the vegetation study area are located on the east side of US 281 approximately 0.15 miles south of Borgfeld Drive. The other two springs are located outside the study area and are approximately 300-450 feet west of the existing US 281 ROW and 0.4 miles north of Trinity Park. A field survey was conducted in 2010 at the spring (#281-002) located within the existing US 281 ROW. It appeared to emerge from a mud bank and be highly degraded. ROE was not granted to conduct field surveys at the other three springs. More information about these springs can be found in **Appendix I2** and **Appendix J1**.

Two snags were noted on the east side of US 281 across from Summerglen Way. Both of these were live oak trees.

Twelve drainage crossings were identified within the vegetation study area: including Mud Creek, West Elm Creek, Elm Waterhole Creek, and Cibolo Creek, including four tributaries of Mud Creek, two tributaries of West Elm Creek, one tributary to Elm Waterhole Creek, and one tributary of Cibolo Creek. Most drainage crossings within the US 281 project corridor have been segmented by the development of adjacent commercial and residential properties. Water runoff is carried through a series of concrete box culverts under the developments, across the ROW and then into other concrete box culverts. Only Mud Creek and Cibolo Creek appear to remain relatively undisturbed. More information on these crossings can be found in **Section 3.9.1 .**

Two barn swallow (*Hirundo rustica*) nests were noted under the Sonterra Boulevard overpass.

Bottomland hardwoods, native prairies, and bat colonies under bridges were not found during field surveys in 2010 and 2012.

3.14.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would not involve any impacts to any vegetation types within the vegetation study area, would not involve any impacts requiring compliance with beneficial landscape practices, and would not involve any impacts requiring compliance with EO 13112, regarding invasive species.

Proposed Build Alternatives

The primary impact to vegetation would be removal of existing vegetation due to site preparation and construction of the proposed US 281 Corridor Project. **Table 3-45** contains estimates of the vegetation areas in the existing ROW and proposed ROW.

Table 3-45: Vegetation in Acres per Alternative

Area	Acres within ROW per Alternative		
	No-Build	**Expressway Alternative**	**Elevated Expressway Alternative**
Wooded	35	98	80
Unmaintained (non-wooded)	90	118	111
Developed (including maintained non-wooded vegetation)	145	169	170
Total ROW	378	505	478
Total Vegetation Cover	270	385	361

Source: US 281 EIS Team, Field reconnaissance and GIS analysis, May 2012

Live Oak-Ashe Juniper Park and Live-Oak-Mesquite Ashe-Juniper Park are the dominant vegetation communities within the vegetation study area, these are also the communities that would be impacted most by the Proposed Build Alternatives. The Expressway Alternative would impact approximately 98 acres of wooded area, 118 acres of unmaintained vegetation (non-wooded), and 169 acres of maintained vegetation (primarily ROW that is mowed on a regular basis and residential/commercial landscaping); and the Elevated Expressway Alternative would impact approximately 80 acres of wooded area, 111 acres of unmaintained vegetation and 170 acres maintained vegetation.

The removal of approximately one acre of fence line vegetation would be necessary for either Proposed Build Alternative during construction in areas where new ROW would be acquired.

Riparian areas would only be removed where necessary within the existing and proposed ROW. Impacts to riparian habitat would be approximately 0.6 acre for either Proposed Build Alternative located at stream crossings located on Mud Creek. More information on impacts to stream crossing is included in **Section 3.9.1 .**

Karst features would be impacted by either of the Proposed Build Alternatives. The Expressway Alternative would impact 55 features and the Elevated Expressway Alternative would impact 54 features. More information on these features is included in **Section 3.9.1** and **Appendix I2**.

Expansion of road cuts would be necessary in the Expressway Alternative, but not in the Elevated Expressway Alternative because the existing US 281 lanes would remain in place.

The approximately 0.1 acre man-made pond will likely be removed by either of the Proposed Build Alternatives.

Two springs (#281-002 and #281-003) would be impacted by either of the Proposed Build Alternatives. They would be potentially impacted by alternation of the local hydrogeology or covering the spring orifice. More information about the karst feature survey where these springs were located can be found in the **Appendix I2** and **Appendix J1**.

Both of the snags would be removed by either of the Proposed Build Alternatives.

Impacts to water crossings would be necessary due to roadway expansion and improvements to drainage structures. The Expressway Alternative has the potential to permanently impact nine water crossings and the Elevated Expressway Alternative has the potential to permanently impact a total of six water crossings. More information on impacts to stream crossing is included in **Section 3.9.1 .**

The two barn swallow nests located at US 281/Sonterra Boulevard would remain place during construction of either of the Proposed Build Alternatives. The overpass at Sonterra Boulevard will not be affected by the US 281 improvements.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for both alternatives are the same, therefore the impacts to vegetation would not change based on funding options.

3.14.4 Conclusion and Proposed Mitigation Measures

The vegetation communities occurring within and adjacent to the proposed ROW for each of the Proposed Build Alternatives would be directly impacted by construction related activities.

Both Proposed Build Alternatives would have generally similar impacts to vegetation. For safety reasons there is typically a clear zone boundary between the edge of the

pavement and the ROW line, where vegetation is removed. While it is not known at this time what width the clear zone will be, every effort would be made to preserve trees between the boundary of the clear zone and the ROW line where it neither compromises safety nor substantially interferes with the construction of the US 281 Corridor Project. Also, after construction is complete, similar tree and groundcover species from the surrounding area would be used to revegetate disturbed areas outside the clear zone.

In accordance with Provision (4)(A)(ii) of the TxDOT-TPWD MOU and the MOA, the following habitats were given consideration for non-regulatory mitigation during project planning:

- habitat for federal candidate species if mitigation would assist in the prevention of the listing of the species
- rare vegetation series (S1, S2, or S3) that also locally provide habitat for a state listed species
- all vegetation communities listed as S1 or S2, regardless of whether the series in question provide habitat for state listed species
- bottomland hardwoods, native prairies and riparian sites
- any other habitat feature considered to be locally important

None of the vegetation communities along the US 281 project corridor provide habitat for federal candidate species. In addition, according to *Plant Communities of Texas (Series Level)* (Texas Natural Heritage Program 1993), none of the plant communities in the vegetation study area listed as S1, S2, or S3. Bottomland hardwoods and native prairies were not found during field surveys in May 2012. The vegetation habitats in the vegetation study area are relatively common for South-central Texas.

Riparian areas would only be removed where necessary within the existing and proposed ROW. Mitigation for impacts to 0.6 acre of riparian areas will be considered and coordinated with TCEQ for the Preferred Alternative. The details of the proposed mitigation will be described in the Final EIS.

Beneficial Landscape Practices

The Executive Memorandum dated April 29, 1994, on Beneficial Landscaping Practices was published in the August 10, 1995, Federal Register. It requires that all agencies comply with NEPA as it relates to vegetation management and landscape practices for all federally assisted projects. The Executive Memorandum directs that where cost-effective and to the extent practicable, agencies will (1) use regionally native plants for landscaping; (2) design, use, or promote construction practices that minimize adverse effects on natural habitat; (3) seek to prevent pollution by, among other things, reducing fertilizer and pesticide use; (4) implement water-efficient and runoff reduction practices; and (5) create demonstration projects employing these practices. Seeding and replanting would be completed according to TxDOT and Alamo RMA specifications and in compliance with the Executive Memorandum on Beneficial Landscaping.

Invasive Species

Executive Order 13112 on Invasive Species requires that federal agencies identify actions that can affect the disposition or introduction of invasive species, monitor known populations of invasive species, and restore areas that have been affected by such species. Seeding and replanting would be completed according to TxDOT and Alamo RMA specifications and in compliance with Executive Order 13112.

3.15 WILDLIFE

This section describes the existing conditions concerning wildlife habitats in Bexar County and the US 281 biological study area and discusses the potential consequences to wildlife habitats resulting from the US 281 Corridor Project. The US 281 biological study area is defined as the existing ROW of the US 281 project corridor and 500-feet beyond the proposed ROW for the Proposed Build Alternatives.

3.15.1 Methodology

Site-specific wildlife habitats in the US 281 biological study area were assessed by reviewing aerial photography and topographic and soil survey maps, and by conducting field investigations.

3.15.2 Affected Environment

Terrestrial

Native wildlife populations of Bexar County have been largely displaced by land fragmentation from commercial and residential development and land clearing for agricultural purposes. Bexar County exhibits a variety of upland, wetland, and fragmented bottomland vegetative habitats that may support numerous species of terrestrial wildlife (mammals, birds, reptiles, and amphibians). The diversity of species has been negatively impacted by years of extensive conversion of natural habitat to urban development, consisting of residential and commercial properties. Mammals most likely to occur in the region include the Virginia opossum (*Didelphis virginiana*), nine-banded armadillo (*Dasypus novemcinctus mexicanus*), raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), eastern mole (*Scalopus aquaticus*), eastern gray squirrel (*Sciurus carolinensis*), eastern flying squirrel (*Glaucomys volans*), Baird's pocket gopher (*Geomys breviceps*), and several species of bats, rats, and mice. The white-tailed deer (*Odocoileus virginianus*), cottontail (*Sylvilagus floridanus*), and grey fox (*Urocyon cinereoargentus*) were observed during on-site habitat observations. A diversity of birds, both migratory and non-migratory, either nests within areas of suitable habitat or temporarily uses areas of suitable habitat for forage during their migration. The most common avian species observed during on-site habitat assessments included Carolina chickadee (*Poecile carolinensis*), black-crested titmouse (*Baeolophus bicolor*), Carolina wren (*Thryothorus ludovisicanus*), Bewick's wren (*Thryomanes bewickii*), Northern mockingbird (*Mimus polyglottus*), Rufous-crowned sparrow (*Aimophila ruficeps*), Northern cardinal (*Cardinalis cardinalis*), brown-headed cowbird (*Molothrus ater*), and lesser goldfinch (*Carduelis psaltria*). Reptiles and amphibians indigenous to the area include several species of snakes, frogs and toads, and turtles. The Rio Grande leopard frog (*Rana berlandieri*) and the American bullfrog (*Rana catesbeiana*) tadpoles were observed during on-site habitat assessments. Reptiles and amphibians are relatively rare within developed tracts, in open grasslands without cover, and in areas recently disturbed by human contact. Common domesticated mammals found within the more urbanized segments include cats (*Felis domesticus*), dogs (*Canis familiaris*), cattle (*Bos taurus*), and horses (*Equus equine*).

The terms of the *Migratory Bird Treaty Act* (MBTA) of 1918 apply to the US 281 Corridor Project. The MBTA prohibits all negative impacts to birds, young, eggs, or occupied nests in part or whole for all birds on the migratory birds list, except as authorized by federal permit. Avoidance and mitigation measures proposed for migratory birds are described in **Section 3.16.5 .**

Karst

The US 281 biological study area is a karst landscape. In this type of terrain, limestone bedrock is dissolved by mildly acidic rain and groundwater to create caves and sinkholes. The US 281 biological study area has seen significant development in recent years, particularly in the form of increased impervious cover due to commercial infrastructure and residential developments. This impervious cover tends to reduce water and nutrient input into cave passages and mesocavernous voids, which in turn has the potential to negatively impact habitat and species within them. In karst areas, water enters the subsurface not only at obvious cave entrances and seemingly plugged sinkholes, but also generally across the landscape. This general recharge occurs at the soil/bedrock interface via the semi-dissolved upper layer of limestone known as epikarst. These epikarstic portals lead into the mesocavernous zone and also introduce nutrients such as organic debris, roots, and micro-fauna. The existing impervious cover along the US 281 project corridor inhibits these processes by diverting water from natural paths of flow.

Some cave entrances are known to have been destroyed along the US 281 project corridor. These include Tiny Town Sink, which was covered during widening of US 281 in the early 1970's (Veni 1988), and Voight Cave No. 1, which is in an area now covered by retail development. Other caves were impacted when they were opened up as a result of development activities, such as Power Pole Hole. This feature was intersected while drilling the foundation for a utility pole in 2007, at a depth of one meter. This void may actually have had a natural opening in the past that was covered either by shoulder grading activities, or by sewer line installation along the US 281 project corridor. At some time during these activities a large quantity of fill was dumped into it, primarily recycled asphalt. In addition, this cave is penetrated by small core holes into which copper ground rods for two power poles were inserted. A black tar-like material, possibly creosote, has dripped down into the cave through these holes. Both asphalt and creosote are potentially harmful to the cave ecosystem. The possibility exists that other caves in the US 281 project corridor were destroyed in the past, but for which there are no records. Prior to the establishment of required assessments for recharge features (by the TCEQ) and endangered karst invertebrates (by the USFWS), there were no regulatory requirements to record or preserve caves. Cave entrances allow surface species such as bats, porcupines, and cave crickets to enter the subsurface and thereby introduce energy in the form of waste and corpses. Organic debris such as leaf litter is also washed into cave entrances by flood waters. The input of organic debris and moisture are crucial to subterranean ecosystems.

Several large quarries are adjacent to the US 281 project corridor, and have likely resulted in the destruction of caves, given the observed density of cave entrances and karst features in the surrounding area, and considering the depth to which these quarries have cut into the bedrock. Quarry Bat Cave is located in a quarry wall northwest of the intersection of US 281 and Sonterra Boulevard. It was reported by a helicopter pilot who witnessed bats flying out of it. It is not known if this cave still exists,

or if it has been removed through continued quarrying. Cave-dwelling bat species nationwide have been severely impacted by a disease known as white-nose syndrome (WNS). Millions of bats have been killed in recent years by this disease in the northeastern US, resulting in catastrophic population declines, and may lead to local or widespread extinctions. In May 2010, the USFWS reported that WNS had reached Oklahoma, and could soon spread to Texas, which makes any potentially adverse impacts to bat caves an immediate concern.

A number of caves, verified karst features, and potential karst features (those not yet fully investigated) are known to occur within the of the US 281 project corridor. The number of features varies within the existing and the proposed ROW for each of the Proposed Build Alternatives. Beyond these known features, it is likely that additional features would be revealed during construction of either of the Proposed Build Alternatives.

Aquatic

The region does not support an extensive surface aquatic ecosystem, thereby limiting the potential to support diverse aquatic biota. In addition, a majority of the stream crossings within the project area are typically dry and only carry water after rain events further limiting the potential for a diverse aquatic ecosystem. Development of areas adjacent to the crossings has segmented those channels, further limiting the potential for diversity. Neither tidal influence nor cold water fishery conditions exist under normal circumstances along the US 281 project corridor. Therefore, the project is not subject to the Magnuson-Stevens Fishery Conservation and Management Act and would not impact Essential Fish Habitat as defined by 16 USC 1802. At this time, plans for the US 281 Corridor Project would not involve impounding, diverting or deepening; however, if these plans change, coordination would be conducted with USFWS and TPWD accordingly.

3.15.3 Environmental Consequences

No-Build Alternative

The No-Build Alternative would not result in impacts to any wildlife within the US 281 biological study area. However, other developments, including local roads, may further develop this area sometime in the future which could impact wildlife and their habitat.

The No-Build Alternative would have few effects on karst habitat beyond those already existing. Potential effects resulting from the No-Build Alternative include water runoff contamination from vehicles slowed or stopped by traffic congestion. Outdated, insufficient, or non-existent storm water runoff mitigation infrastructure on the current US 281 project corridor would not be improved under this alternative.

Proposed Build Alternatives

Construction of the US 281 Corridor Project would directly impact those animals that reside within the biological study area. As with the vegetation communities, wildlife communities are impacted by the permanent loss of habitat. In addition to direct construction-related mortality or injury, wildlife populations often suffer impacts associated with displacement into adjacent habitats, which often are already at carrying capacity for that species.

Considering potential impacts to wildlife, the primary concerns are impacts caused by disturbance and fragmentation of habitat, specifically to oak-Ashe juniper parks and endangered or threatened species habitat (karst features and golden-cheeked warbler [GCWA] habitat). These areas would change to roadway material and grassland (in unpaved portions of the ROW) and terrestrial wildlife would be displaced into an ever-decreasing habitat block as development continues to grow. These small, vegetated areas are becoming increasingly valuable to wildlife due to the continuing urban development within and surrounding the US 281 vegetation study area. **Table 3-46** shows the acreage of wooded ROW by Proposed Build Alternative that may be used by wildlife as habitat.

Table 3-46: Acreage of Wooded Areas in ROW

Alternative	Wooded Areas in ROW (in acres)
No-Build	35
Expressway	98
Elevated Expressway	80

Source: US 281 EIS Team, July 2011.

Potential impacts to karst habitat include additional impervious cover, exposure of karst voids in new road cut areas, and elimination of habitat due to bedrock removal. **Table 3-48** in **Section 3.16.3** shows the number of karst features that could be impacted by the Proposed Build Alternatives.

There are three types of impacts to aquatic habitats resulting from construction and use of the US 281 Corridor Project: physical alteration, sedimentation and water quality degradation due to increased vehicular traffic and non-point source runoff or point source toxic spills draining into the waterways.

Physical alteration can occur when a waterway is crossed or by the installation of a culvert. Typical short-term construction impacts are associated with excess turbidity and siltation. High levels of turbidity can clog the gills of fish and reduce their ability to extract oxygen from the water, as well as prevent some species that feed on plankton from feeding. High turbidity could also affect food supplies for those fish species that feed on prey. The high turbidity may impede the ability to locate prey. However, high turbidity is either tolerated by many species or the fish move away and return when acceptable levels are restored. While fish normally recover quickly from such stresses, such circumstances during spawning season may reduce reproductive success.

More typically, sedimentation can bury food supplies of benthic feeders. This is of limited concern in streams with mud or silt bottoms. If the degree of siltation is minimal, the benthic species often survive. In addition, many benthic species living in mud bottoms are very opportunistic and recolonization of such habitats is often quite rapid (Waters 1995).

Oil and grease are typically the petroleum products that are washed into a stream from a roadway. Such chemicals accumulate on the road during dry periods and are rinsed off when it rains. However, the most lethal fraction of petroleum products are the volatile compounds, which rapidly evaporate. Therefore, these volatiles are rarely washed into a stream. Since flows are generally high after a rain, the oil and grease are often diluted and washed away before there can be any impacts to the local aquatic life.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to wildlife would not change based on funding options.

3.15.4 Conclusion and Proposed Mitigation Measures

Construction of the US 281 Corridor Project would result in the loss of wildlife habitat. Wildlife inhabiting urban and residential communities would be temporarily displaced, but likely would assimilate into the surrounding developed areas. Thus, no major long-term effects to wildlife in the urban and residential areas are expected.

In the event that migratory birds are encountered on-site during construction, every effort would be made to avoid harm of protected birds, active nests, eggs, and/or young. The contractor would remove any old migratory bird nests between September 1 and January 31 from any structure where work will be done. In addition, the contractor would be prepared to prevent migratory birds from building nests between March 1 and August 31.

Primary measures to mitigate temporary adverse channel impacts include minimizing the area to be disturbed, replanting the areas cleared, and optimizing stream diversions to include low flow augmentation of intermittent streams. Permanent storm water management BMPs would also be implemented, they could include extended detention basins, grassy swales, vegetative filter strips, sand filter systems and bioretention.

3.16 THREATENED AND ENDANGERED SPECIES

The US Fish and Wildlife Service (USFWS) has legislative authority to list and monitor the status of species whose populations are considered to be imperiled. This federal legislative authority for the protection of vulnerable species is derived from the *Endangered Species Act* (ESA) of 1973, and its subsequent amendments. Regulations supporting this Act are codified and regularly updated in Sections 17.11 and 17.12 of Title 50 of the Code of Federal Regulations. Petitions for federal protection of species receive an initial review and if the USFWS finds that listing may be warranted, the species undergoes a thorough status review. After the status review is complete, vulnerable species that qualify for listing are either listed as threatened (T) or endangered (E) or categorized as candidates. Candidate species have been deferred from listing while the USFWS works on listing proposals for other species they determine are at greater risk. The vulnerability decision is based upon many factors affecting the species within its range and is always linked to the best current scientific data available to the USFWS. Fish and wildlife species listed as endangered or threatened by the USFWS are provided full protection. This protection includes a prohibition on direct "take" of the listed species in addition to indirect "take" such as destruction of habitat. As defined by the ESA, take means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." ESA does permit the incidental take of endangered species for certain activities through prescribed measures to mitigate or minimize harm. Federal prohibition of take of listed plants is limited to federal lands; however, federal law

federalizes state law prohibitions on the taking of plants. The ESA and accompanying regulations provide the necessary authority and incentive for the individual states to establish their own regulatory vehicle for the management and protection of threatened and endangered species.

The Texas Parks and Wildlife Department (TPWD) oversees endangered resources through the Wildlife Division's Wildlife Diversity Program. This program is responsible for maintaining county occurrence records for state and federal endangered and threatened species and maintaining the Texas Natural Diversity Database (TxNDD). This database provides site specific information and other species status tracking information on listed or rare animal and plant species, including unique or declining vegetation communities of concern. State endangered species have limited regulatory protection. While these species cannot be taken, collected, held, or possessed without a permit, their habitat is afforded no regulatory protection, except on tracts managed by state, federal, or private interests for conservation purposes.

3.16.1 Methodology

To determine the potential for federally listed, state listed, and other rare species to occur along the US 281 project corridor and be affected by the US 281 Corridor Project, background reviews and field investigations were conducted. To focus these efforts the US 281 biological study area was defined as the existing ROW of the US 281 project corridor and 500-feet beyond the proposed ROW for the Proposed Build Alternatives. The US 281 biological study area is depicted in **Figure 3-30**. Background reviews included the following:

1. Reviewed the USFWS and TPWD lists of threatened and endangered species for Bexar County.
2. Reviewed the TPWD's TxNDD for all previously recorded occurrences of threatened and endangered species in the project vicinity.
3. Conducted meetings with USFWS Ecological Services in January 2010, September 2010, and March 2011 to discuss the US 281 Corridor Project and its potential effects on federally listed threatened and endangered species. Coordination with USFWS regarding species surveys and methodologies is ongoing.
4. Conducted a literature review to identify habitat requirements, current distribution, and status of each listed species.
5. Reviewed the US 281 biological study area relative to vegetation communities, soil associations, topography, and aerial photography.

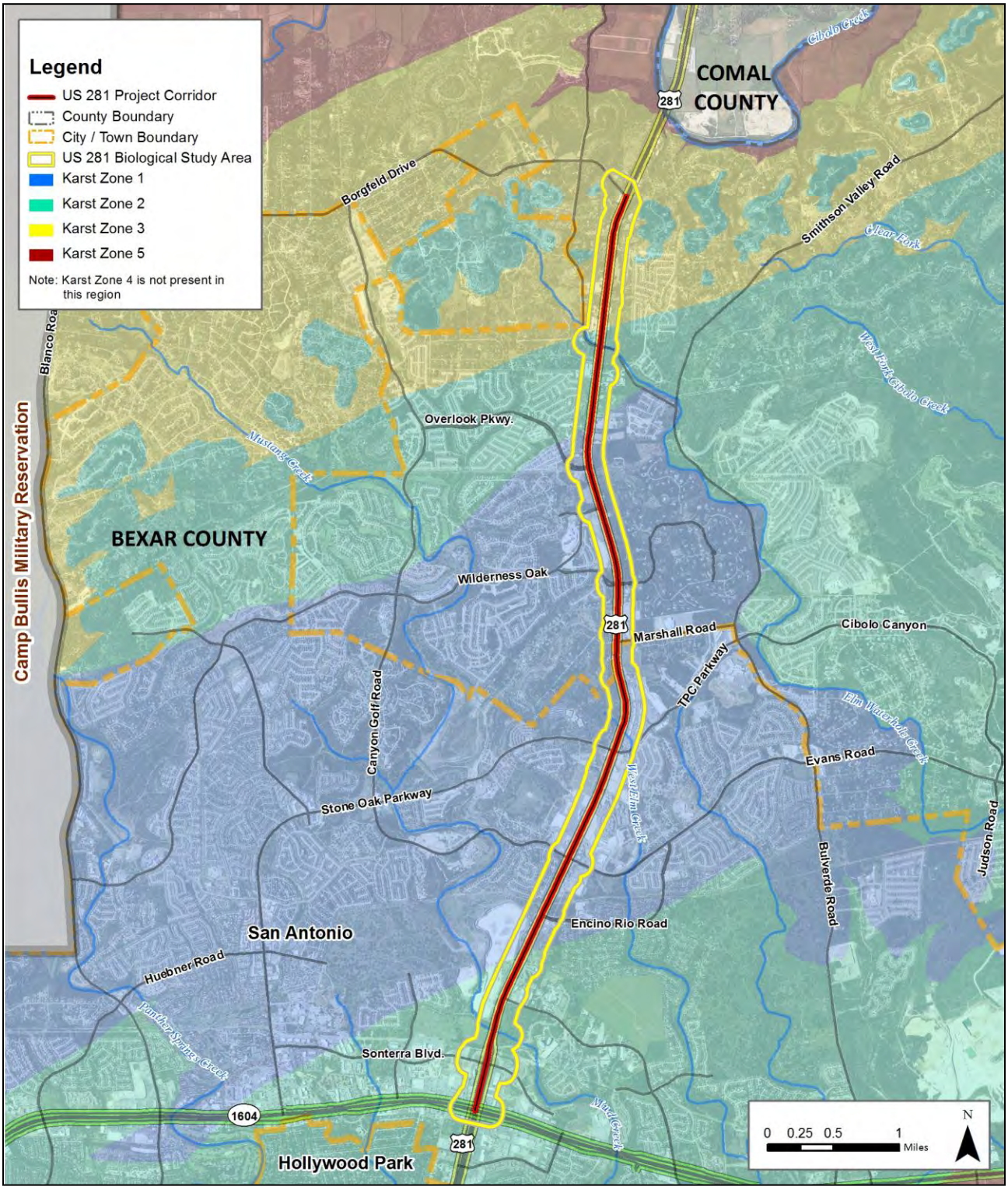
After review of available background information, project biologists conducted on-site habitat assessments within the US 281 biological study area for all federally listed, state-listed, and other listed rare species in Bexar County. In addition, presence-absence surveys were conducted using USFWS protocols for the federally listed Madla's Cave meshweaver (*Cicurina madla*), the ground beetle (*Rhadine exilis*), the ground beetle (*Rhadine infernalis*), and golden-cheeked warbler (*Setophaga chrysoparia*). The karst invertebrate survey was conducted in 2010 and the avian survey was conducted in 2009 and 2010. Although there is no USFWS survey protocol for *Eurycea* or the rare spring associated invertebrate species, the springs within the US 281 biological study area were surveyed in 2010 for the two state listed salamanders (*Eurycea latitans complex* and *Eurycea tridentifera*) and the rare Texas salamander (*Eurycea neotenes*) and spring

associated invertebrate species, using scientifically acceptable standard methods for spring surveys. A presence-absence or biological survey was used to determine whether or not a species was present in an area that provides suitable habitat. These surveys were completed in all potential habitat areas where right-of-entry (ROE) was granted. Standard surveys following established USFWS guidelines, or scientifically acceptable standard methods if no established guidelines exist, would be used to survey any areas for which ROE is granted in the future.

Methods for the avian surveys followed the most recent *USFWS Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Golden-cheeked Warblers*, (2006). Methods used for karst surveys followed the USFWS protocol outlined in *USFWS Section (10)(a)(1)(A) Scentific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas* (2006) and *Geologic Controls on Cave Development and the Distribution of Endemic Cave Fauna in San Antonio, Texas Region*, (Veni 1994).

A biological assessment will be completed and submitted, in consultation with USFWS, for the Preferred Alternative and impacts and mitigation will be analyzed in the Final EIS.

Figure 3-30: US 281 biological study area



Source: USFWS, 2006, US 281 EIS Team, July 2011.

3.16.2 Affected Environment

Databases of sensitive species maintained by the USFWS and TPWD identified 23 federally listed threatened, endangered, or candidate species that may occur or have historically occurred in Bexar County, including one plant, one crustacean, six arachnids, five insects, two fish, two amphibians, four birds, and two mammals. Additionally, 29 state-listed species (one plant, four mussels, one crustacean, four fishes, four amphibians, four reptiles, eight birds, and three mammals) potentially occur or have historically occurred in Bexar County. The state-listed plant, crustacean, two fishes, two amphibians, four birds, and two of the state-listed mammals are also federally listed. The TPWD and USFWS lists differ (see **Appendix I1**) due to differences in the procedures for collecting and disseminating data on recorded occurrences. **Table 3-47** presents the current status and habitat requirements along with potential occurrence within the US 281 biological study area of each of the federally listed threatened, endangered, or candidate species, and the bald eagle, which has been delisted but is still being monitored by the USFWS. **Table 3-47** also presents state-listed species and species with no regulatory status that are considered rare in Texas and could occur within Bexar County. A brief account of each federal and state-listed species listed by either agency as potentially occurring in Bexar County is summarized in the table below.

Table 3-47: Federal and State Listed Rare, Threatened and Endangered Species of Bexar County

Species	Federal Status	State Status	Habitat	Habitat Present?
Plants				
Big red sage *Salvia pentstemonoides*	----	----	Texas endemic; moist to seasonally wet, steep limestone outcrops on seeps within canyons or along creek banks; occasionally on clayey to silty soils of creek banks and terraces, in partial shade to full sun	Yes
Bracted twistflower *Streptanthus bracteatus*	----	----	Texas endemic; shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut formations	Yes
Correll's false dragon-head *Physostegia correllii*	----	----	Wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in Central Texas	Yes
Elmendorf's onion *Allium elmendorfii*	----	----	Texas endemic; grassland openings in oak woodlands on deep, loose, well-drained sands; to the north it occurs in post oak-black hickory-live oak woodlands over Queen City and similar Eocene formations; one anomalous specimen found on Llano Uplift in wet pockets of granitic loam	No
Hill Country wild-mercury *Argythamnia aphoroides*	----	----	Texas endemic; mostly in bluestem-grama grasslands associated with plateau live oak woodlands on shallow to moderately deep clays and clay loams over limestone on rolling uplands, also in partial shade of oak-juniper woodlands in gravelly soils on rocky limestone slopes	Yes
Parks' jointweed *Polygonella parksii*	----	----	Texas endemic; mostly found on deep, loose, whitish sand blowouts (unstable, deep, xeric, sandhill barrens) in Post Oak Savanna landscapes over the Carrizo and Sparta formations; also occurs in early successional grasslands, along ROW, and on mechanically disturbed areas	No

Table 3-47: Federal and State Listed Rare, Threatened and Endangered Species of Bexar County

Species	Federal Status	State Status	Habitat	Habitat Present?
Sandhill woollywhite *Hymenopappus carrizoanus*	----	----	Texas endemic; disturbed or open areas in grasslands and post oak woodlands on deep sands derived from the Carrizo Sand and similar Eocene formations	No
Texas wild-rice* *Zizania texana*	E	E	Perennial, emergent, aquatic grass known only from the upper 2.5 km of the San Marcos River in Hays County	No
Mollusks and Snails				
Creeper (squawfoot) *Strophitus undulatus*	----	----	Small to large streams, prefers gravel or gravel and mud inflowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins	No
False spike mussel *Quadrula mitchelli*	----	T	Possibly extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; one study indicated water lilies were present at the site; Rio Grande, Brazos, Colorado, and Guadalupe (historic) River basins	No
Golden orb *Quadrula aurea*	P	T	Sand and gravel in some locations and mud at others; intolerant of impoundment in most instances; Guadalupe, San Antonio, and Nueces River basins	No
Mimic cavesnail *Phreatodrobia imitata*	----	----	Subaquatic; only known from two wells penetrating the Edwards Aquifer	No
Pistolgrip *Tritogonia verrucosa*	----	----	Stable substrate, rock, hard mud, silt, and soft bottoms, often buried deeply; east and Central Texas, Red through San Antonio River basins	No
Rock pocketbook *Arcidens confragosus*	----	----	Mud, sand, and gravel substrates of medium to large rivers in standing or slow flowing water, may tolerate moderate currents and some reservoirs, east Texas, Red through Guadalupe River basins	No
Texas fatmucket *Lampsilis bracteata*	P	T	Streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and course gravel or sand in moderately flowing water; Colorado and Guadalupe River basins	No
Texas pimpleback *Quadrula petrina*	P	T	Mud, gravel and sand substrates, generally in areas with slow flow rates; Colorado and Guadalupe River basins	No
Crustaceans				
A cave obligate crustacean *Tethysbaena (=Monodella) texana*	----	----	Subaquatic, subterranean obligate; underground freshwater aquifers; has been collected from caves, springs and artesian wells	Yes
Texanobathynella bowmani	----	----	Subaquatic; underground freshwater aquifers; has been collected from cave streams, springs and wells	Yes
Cascade Cave amphipod *Stygobromus dejectus*	----	----	Subaquatic crustacean; subterranean obligate; has been collected from cave pools	No
Ezell's cave amphipod *Stygobromus flagellatus*	----	----	subaquatic, subterranean obligate amphipod; has been collected from caves, springs and artesian wells	Yes
Long-legged cave amphipod *Stygobromus longipes*	----	----	Subaquatic crustacean; subterranean obligate; found in subterranean streams	No

Table 3-47: Federal and State Listed Rare, Threatened and Endangered Species of Bexar County

Species	Federal Status	State Status	Habitat	Habitat Present?
Peck's cave amphipod* *Stygobromus pecki*	E	E	Small, aquatic crustacean; has been collected from two Edwards Aquifer springs in Comal County. There are no known localities in Bexar County.	No
Allotexiweckelia hirsuta	----	----	Small aquatic crustacean; has been collected from springs and artesian wells	Yes
Parabogidiella americana	----	----	Small aquatic crustacean; has been collected from artesian wells	No
Texas cave shrimp *Palaemonetes antrorum*	----	----	Subaquatic shrimp; has been collected from subterranean streams and pools and from artesian wells	No
Coahuila isopod *Mexistenasellus coahuila*	----	----	Subaquatic; has been collected from springs and wells south of Loop 410.	Yes
Speocirolana hardeni	----	----	Subaquatic, subterranean obligate; has been collected from springs, caves and artesian wells	Yes
Texiweckeliopsis insolita	----	----	subaquatic, deep subterranean obligate; has only been collected from high flow springs and artesian wells	Yes
Arachnids				
Braken Bat Cave meshweaver *Cicurina venii*	E	----	Small, eyeless, or essentially eyeless spiderknown only from Braken Bat Cave	Yes
Cokendolpher cave harvestman *Texella cokendolpheri*	E	----	Small, eyeless, or essentially eyeless harvestman; known only from Robber Baron Cave (a cave formed in the Austin Chalk)	No
Government Canyon Bat Cave meshweaver *Cicurina vespera*	E	----	Small, eyeless, or essentially eyeless spider; known only from Government Canyon Bat Cave.	Yes
Government Canyon Bat Cave spider *Neoleptoneta microps*	E	----	Small, eyeless or essentially eyeless spider; karst features in north and northwest Bexar County	Yes
Madla's Cave meshweaver *Cicurina madla*	E	----	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County	Yes
Robber Baron Cave meshweaver *Cicurina baronia*	E	----	Small, eyeless, or essentially eyeless spider; known only from Austin Chalk caves in the Alamo Heights KFR	No
Insects				
Comal Springs dryopid beetle* *Stygoparnus comalensis*	E	----	Dryopids usually cling to objects in a stream; dryopids are sometimes found crawling on stream bottoms or along shores; adults may leave the stream and fly about, especially at night	No
Comal Springs riffle beetle* *Heterelmis comalensis*	E	----	Comal and San Marcos Springs	No
Ground beetle *Rhadine exilis*	E	----	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County	Yes
Ground beetle *Rhadine infernalis*	E	----	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County	Yes

Table 3-47: Federal and State Listed Rare, Threatened and Endangered Species of Bexar County

Species	Federal Status	State Status	Habitat	Habitat Present?
Helotes mold beetle *Batrisodes venyivi*	E	----	Small, eyeless mold beetle; karst features in northwestern Bexar County and northeastern Medina County	No
Manfreda giant-skipper *Stallingsia maculosus*	----	----	Small and stout-bodied; fast erratic flight; skipper larvae usually feed inside a leaf shelter and pupate in a cocoon made of leaves fastened together with silk. The preferred habitat of this plant species is sand, sandy loam, sandy clay, or clay soils; in mesquite scrubland, in both moist and dry sites[1].	No
Rawson's metalmark *Calephelis rawsoni*	----	----	Moist areas in shaded limestone outcrops in Central Texas, desert scrub or oak woodland in foothills, or along rivers elsewhere; larval hosts are *Eupatorium havanense, E. greggii*	Yes
Fishes				
Fountain darter *Etheostoma fonticola*	E	E	Known only from the San Marcos and Comal Rivers; springs and spring-fed streams in dense beds of aquatic plants.	No
Guadalupe bass *Micropterus treculii*	----	----	Endemic to perennial streams of the Edwards' Plateau region; introduced in Nueces River system	No
San Marcos gambusia* *Gambusia georgei*	E	E	Extinct; endemic; formerly known from upper San Marcos River; restricted to shallow, quiet, mud-bottomed shoreline areas without dense vegetation in thermally constant main channel	No
Toothless blindcat *Trogloglanis pattersoni*	P	T	Troglobitic; blind catfish endemic to the San Antonio Pool of the Edwards Aquifer	No
Widemouth blindcat *Satan eurystomus*	P	T	Troglobitic; blind catfish endemic to the San Antonio Pool of the Edwards Aquifer	No
Amphibians				
Cascade Caverns salamander *Eurycea latitans complex*	----	T	Endemic; subaquatic; springs and caves in Medina River, Guadalupe River, and Cibolo Creek watersheds within Edwards Aquifer	Yes
Comal blind salamander *Eurycea tridentifera*	P	T	Endemic; semi-troglobitic, found in springs and waters of caves	Yes
San Marcos salamander* *Eurycea nana*	T	T	Headwaters of the San Marcos River downstream to ca. ½ mile past IH-35; water over gravelly substrate characterized by dense mats of algae (*Lyng bya*) and aquatic moss (*Leptodictym riparium*)	No
Texas blind salamander* *Eurycea rathbuni*	E	E	Troglobitic; water-filled subterranean caverns along a six mile stretch of the San Marcos Spring Fault, in the vicinity of San Marcos	No
Texas salamander *Eurycea neotenes*	P	----	Endemic; troglobitic; springs, seeps, cave streams, and creek headwaters; often hides under rocks and leaves in water; restricted to Helotes and Leon Creek drainages	Yes
Reptiles				
Spot-tailed earless lizard *Holbrookia lacerata*	----	----	Central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas	Yes
Texas garter snake *Thamnophis sirtalis annectens*	----	----	Wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover	Yes
Texas horned lizard *Phrynosoma cornutum*	----	T	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows in soil, enters rodent burrows, or hides under rock when inactive; breeds	Yes

Table 3-47: Federal and State Listed Rare, Threatened and Endangered Species of Bexar County

Species	Federal Status	State Status	Habitat	Habitat Present?
			March-September	
Texas indigo snake *Drymarchon melanurus erebennus*	----	T	Texas south of the Guadalupe River and Balcones Escarpment; thornbush-chaparral woodlands of south Texas, in particular dense riparian corridors; can do well in suburban and irrigated croplands if not molested or indirectly poisoned; requires moist microhabitat, such as rodent burrows for shelter	No
Texas tortoise *Gopherus berlandieri*	----	T	Open brush with a grass understory is preferred; open grass and bare ground are avoided; when inactive occupies shallow depressions at base of bush or cactus, sometimes in underground burrows or under objects; active March-November; breeds April-November	No
Timber/Canebrake rattlesnake *Crotalus horridus*	----	T	Swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto	Yes
Birds				
Bald eagle *Haliaeetus leucocephalus*	DL/M	T	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	No
Black-capped vireo *Vireo atricapilla*	E	E	Oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to the ground level for nesting cover; nesting season March-late summer	No
Golden-cheeked warbler *Setophaga chrysoparia*	E	E	Juniper-oak woodlands; dependent on Ashe juniper for long fine bark strips, only available from mature trees, only a few junipers or nearby cedar brakes are can provide nest material; nesting March-early summer	Yes
Interior least tern** *Sterna antillarum athalassos*	E	E	Nests along sand and gravel bars within braided streams, rivers; also known to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc.)	No
Mountain plover *Charadrius montanus*	P	----	Nests on high plains or shortgrass prairie, on ground in shallow depression; non-breeding habitat includes shortgrass plain and bare, dirt (plowed) fields	No
Peregrine falcon *Falco peregrinus*	----	T	Occupies a wide range of habitats during migration including urban, concentrations along the coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands	No
Sprague's Pipit** *Anthus spragueii*	P	----	Can be found in Texas during migration and winter. Strongly tied to native upland prairie, can be locally common in costal grasslands, uncommon to rare farther to the west. Sensitive to patch size and avoids edges.	No
Western burrowing owl *Athene cunicularia hypugaea*	----	----	Open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows	No
White-faced ibis *Plegadis chihi*	----	T	Prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats	No

Table 3-47: Federal and State Listed Rare, Threatened and Endangered Species of Bexar County

Species	Federal Status	State Status	Habitat	Habitat Present?
Whooping crane *Grus americana*	E	E	Potential migrant via plains throughout most of the state to coast; winters in coastal marshes in Aransas, Calhoun, and Refugio counties	No
Wood stork *Mycteria americana*	----	T	Forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes with other wading birds	No
Zone-tailed hawk *Buteo albonotatus*	----	T	Arid open country, including open deciduous or pine-oak woodland, mesa or mountain country, often near watercourses, and wooded canyons and tree-lined rivers; nests in various habitats and sites ranging from small trees in lower desert, giant cottonwoods in riparian areas, to mature conifers in mountain regions	No
Mammals				
Black bear *Ursus americanus*	----	T	Bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear, treat all east Texas black bears as federal and state listed Threatened	No
Cave myotis bat *Myotis velifer*	----	----	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter	Yes
Ghost-faced bat *Mormoops megalophylla*	----	----	Colonially roosts in cave crevices, abandoned mines, and buildings; insectivorous; breeds late winter-early spring; single offspring born per year	No
Gray wolf** *Canis lupus*	E	E	Extirpated; formerly known throughout the western two-thirds of the state in forests, brushlands, or grasslands	No
Plains spotted skunk *Spilogale putorius interrupta*	----	----	Catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges and woodlands; prefers wooded, brushy areas and tallgrass prairie	Yes
Red wolf** *Canis rufus*	E	E	Extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies	No

E – Endangered
T – Threatened
C – Candidate for listing as threatened or endangered
P – Petitioned for federal listing; USFWS has determined the species may warrant listing
DL – Federally De-listed; DM – Federally De-listed, monitoring
"---" – Rare, but with no current regulatory status
*These federally listed species are listed on the USFWS (December 2011) list of species of potential occurrence in Bexar County, but are not considered by TPWD as potentially occurring in this County.
**These federally listed species are listed on the TPWD (December 2011) list of species of potential occurrence in Bexar County, but are not considered by USFWS as potentially occurring in this County.

Descriptions of Federal and State Listed Species

The US 281 project corridor traverses an ecologically sensitive area and extensive field studies have been and continue to be conducted to determine whether threatened or endangered species or their habitats are present. These studies began in years prior under TxDOT oversight and continue under Alamo RMA oversight. Specifically,

endangered avian and karst invertebrate habitat assessments and surveys have been conducted. These surveys are documented in reports included in **Appendix I2** and **Appendix I3**.

Below are brief descriptions of the federally and state-listed threatened and endangered wildlife species with habitat present in the US 281 biological study area.

Arachnids

Braken Bat Cave Meshweaver (Cicurina venii):
The Braken Bat Cave meshweaver is a small, eyeless, or essentially eyeless troglobitic spider found in Braken Bat Cave in western Bexar County (USFWS 2011). Troglobitic species are species that have adapted to and are restricted to a cave environment for survival. Braken Bat Cave is located within a low-density, semi-urban neighborhood. The cave was filled in during the building of a home in 1990 and the effects to the cave fauna are unknown at this point. It has been reported that there could be a small opening in the area that may possibly be a source of nutrients for the spider (USFWS 2000). Troglobitic *Cicurina* sp. in Central Texas live in webs built under and among rocks, and can tolerate a wide range of temperatures but are unable to survive long in low humidity environments. Braken Bat Cave is located approximately 20 miles southwest of the US 281 biological study area; therefore the US 281 Corridor Project appears to be outside of the currently understood range of the species.

Government Canyon Bat Cave Meshweaver (Cicurina vespera):
The Government Canyon Bat Cave meshweaver is a pale, eyeless, troglobitic spider. The species is currently known from only Government Canyon Bat Cave in Government Canyon State Natural Area (USFWS 2011). A second cave, called "unnamed cave five miles northeast of Helotes", was once thought to also contain the species but was subsequently ruled out as a locality. The specimen collected from this unnamed cave was determined to be a new species, *Cicurina neovespera* (Reddell and Cokendolpher 2004). The currently understood range of *Cicurina vespera* is near the western border of Bexar County and outside the US 281 biological study area.

Government Canyon Bat Cave Spider (Neoleptoneta microps):
The Government Canyon Bat Cave spider is a small, short-legged, essentially eyeless spider. It was first collected on August 11, 1965 by J. Reddell and J. Fish (Reddell 1993). The species was initially reported from two caves in Government Canyon State Natural Area: Government Canyon Bat Cave and Surprise Sink. The specimen collected from Surprise Sink, however, has not been confirmed as *Neoleptoneta microps* (Ledford 2010). The current known range of this species is near the western border of Bexar County, approximately 18 miles west of US 281 biological study area.

Madla's Cave Meshweaver (Cicurina madla):
The Madla's Cave meshweaver is a pale, eyeless, troglobitic spider first collected on October 4, 1963 by J. Reddell and D. McKenzie (Reddell 1993) and described by Gertsch (1992). The Madla's Cave meshweaver has been confirmed in eight Bexar County caves. Molecular markers were used to identify juvenile specimens at eleven additional sites in Bexar County (Paquin and Hedin 2004). Eight of these eleven additional sites are caves that include other listed species and are either located within critical habitat areas or areas that are not included in the critical habitat designation due to the provision of adequate special management. The remaining three of the eleven additional sites are

caves where authorization for take of *Cicurina madla* was granted to La Cantera under a Section 10(a)(1)(B) permit (USFWS 2001). These three latter caves have been, or will be, heavily impacted and are not expected to contribute to the species' recovery (USFWS 2011). The eastern limit of the currently understood range for this species is located near the US 281 biological study area, but there are no known localities within the US 281 biological study area. Presence-absence surveys performed in 2010 within potential habitat in the US 281 biological study area did not result in any observations or collections of this species.

Madla's Cave Meshweaver

Photo: Dr. Jean Krejca

Insects

Ground Beetle (Rhadine exilis):

The ground beetle, *Rhadine exilis*, is a small, slender-bodied, essentially eyeless, troglobitic ground beetle. It was first collected in 1959 and described as *Agonum exile* but later assigned to the genus *Rhadine* (Barr 1974). The species is currently known from more than 50 caves in Bexar County (USFWS 2011). The currently understood range of this species overlaps with the US 281 biological study area, but there are no known localities within the US 281 biological study area and presence-absence surveys performed in 2010 within potential habitat did not result in any observations or collections of this species.

Ground Beetle (Rhadine infernalis):

The ground beetle, *Rhadine infernalis*, is a small, slender-bodied, essentially eyeless, troglobitic ground beetle. It was first collected in 1959 and initially described by Barr and Lawrence (1960) as *Agonum infernale*, but later assigned to the genus *Rhadine* (Barr 1974). This species is known from 36 caves located in Bexar County (USFWS 2011). The current known range of this species is located west of the US 281 project corridor, and there are no known localities within the US 281 biological study area. Presence-absence surveys performed in 2010 within potential habitat did not result in any observations or collections of this species.

Amphibians

Cascade Caverns Salamander (Eurycea latitans complex) group:

The species group containing the Cascade Caverns salamander and Comal blind salamander, *Eurycea latitans* group, is a member of the Blepsimolge clade. The taxonomic history of *Eurycea latitans* is complicated, and was once regarded as a hybrid swarm between *Eurycea neotenes*, a species with epigean (surface-dwelling, typically found in springs) morphology, and *Eurycea tridentifera* (Comal blind salamander), which exhibited characteristics of subterranean species (Sweet 1984). Chippindale (2000) extended the range of *Eurycea latitans* from the type locality at Cascade Caverns in Kendall County to include spring and cave systems in the Cibolo and Guadalupe drainage basins. Bendik (2006) used mtDNA sequencing data to show that *Eurycea latitans* was conspecific with *Eurycea tridentifera* and belonged in a paraphyletic group which may also include *Eurycea pterophila*. *Eurycea latitans* is on the State of Texas threatened species list. No observations or collections of this species occurred during biological surveys in springs located within the US 281 biological study area in 2010, and there are currently no known localities for this species within the US 281 biological study area.

Comal Blind Salamander (Eurycea tridentifera):

This salamander is a member of the Blepsimolge clade, a group of neotenic salamanders endemic to Central Texas spring outflows and caves containing permanent water. Neotenic is defined as the retention of juvenile characteristics in the adults of a species. This species exhibits the most strongly cave adapted morphology (shovel-nose, lack of pigment, and long, slender appendages) in the Blepsimolge clade (Bendik 2006). Like most other Central Texas *Eurycea*, this species retains external gills and other larval features associated with a strictly aquatic life history, even after it reaches reproductive maturity. This species was originally described from Honey Creek Cave in Comal County (Mitchell and Reddell 1965). The species range was extended to include several caves in the Cibolo Sinkhole Plain in Comal and Bexar Counties (Sweet 1984, Chippindale et al. 2000). Recent genetic work suggests that this species be synonomized with the state-listed threatened Cascade Caverns salamander (*Eurycea latitans*) (Bendik 2006). Many taxonomists recognize *Eurycea tridentifera* only as a cave adapted morph of *Eurycea latitans* and not as a distinct species (Andrew Gluesenkamp, pers. comm.). The USFWS has determined that this species may warrant listing as an endangered species (as of December 16, 2009). No observations or collections of this species occurred during biological surveys in springs located within the US 281 biological study area in 2010, and there are currently no known localities for this species within the US 281 biological study area.

Texas Salamander (Eurycea neotenes):

The Texas salamander is a member of the Blepsimolge clade, a group of neotenic salamanders endemic to Central Texas spring outflows and caves containing permanent water. *Eurycea neotenes* was originally described from Culebra Creek in Bexar County (Bishop and Wright 1937). The range was extended numerous times as more spring and cave populations of *Eurycea* in Central Texas were assigned to the species, which was thought to be widespread throughout Central Texas (Sweet 1978) and include populations in Gillespie, Kerr (Brown 1942), Kendall (Bishop 1943), Travis and Hays Counties (Brown 1950). Molecular evidence then led to a re-evaluation by Chippindale et al. (2000), who described the range as being restricted to springs in northwestern Bexar County. Later work re-extended the range of this species to include parts of Comal County (Bendik 2006). The USFWS has determined that this species may warrant listing as an endangered species (as of December 16, 2009). No observations or collections of this species occurred during biological surveys (2010) in springs located within the US 281 biological study area, and there are currently no known localities for this species within the US 281 biological study area.

Texas Salamander

Photo: U.S. Fish & Wildlife Service

Reptiles

Texas Horned Lizard (Phrynosoma cornutum):

The Texas horned lizard is a wide-bodied spiny lizard that inhabits open arid and semiarid regions with sparse vegetation such as prairies, deserts, and foothills with grass, cactus, or scattered brush or shrubby trees. The soil ranges from sandy to rocky and when inactive, individuals burrow into the soil, enter rodent burrows, or hide under rocks. They have also been documented climbing three or more feet up tree trunks to escape moist soil after a rain event. Their diet consists primarily of ants, but they are known to eat other small insects. They lay their eggs from March through July in nests dug in the soil or under rocks and have clutch sizes ranging from 14 to 60 eggs (NatureServe 2009). The Texas horned lizard is considered widespread and relatively common in some areas of the south-central US and northern Mexico; however, declines have been documented in portions of their range, including Central Texas. Threats to the lizard include fire ants, insecticides, habitat loss, and over collecting; however, it is listed as threatened in the State of Texas which prohibits collection although enforcement isn't rigorous. The species seems to be particularly vulnerable to the loss of native harvester ants, which comprise up to 68 percent of their diet. Additionally, mortality from road traffic is also an important local threat in some areas where high road mortality may lead to significant local declines (NatureServe 2009). Habitat for the Texas horned lizard was identified during on-site habitat assessments (2010) in the US 281 biological study area, yet no observations of individuals were made.

Texas Horned Lizard

Photo: U.S. Fish & Wildlife Service

Timber/Canebrake Rattlesnake (Crotalus horridus):

The timber rattlesnake is a poisonous snake that can reach almost five feet in length. Its range extends from central New England to northern Florida, and west to eastern Texas, central Oklahoma, eastern Kansas, southeastern Nebraska, southern and eastern Iowa, and southeastern Minnesota. In the southern portion of its range, the snake primarily inhabits hardwood woodlands, riparian areas, swampy areas and floodplains, wet pine woodflats, cane fields, and agricultural fields. Underground crevices are used during winter as a retreat for hibernation. Mating occurs in summer through late September with the young born in the fall (NatureServe 2009). The timber rattlesnake is declining or extirpated in all northeastern states and is state-listed as threatened in Texas. The major threats facing the species across its range include loss of habitat, habitat fragmentation, commercial collecting, and direct mortality caused by hunting and vehicles (NatureServe 2009). Habitat for the timber rattlesnake was identified during on-site habitat assessments (2010) within the US 281 biological study area, yet no observations of individuals were made.

Birds

Golden-cheeked Warbler (Setophaga chrysoparia):

The state and federally endangered GCWA is a small insectivorous neotropical and migratory songbird. Males have a black back, throat, upper breast, and crown, white belly, black-streaked sides, white wing bars, and a black line through the eye with large yellow patches both above and below the eye. Females and immatures are duller, with olive upperparts with dark streaks and a yellowish or white chin (NatureServe 2009). This songbird nests only in the mixed juniper-oak woodlands of the Balconian biotic

province of Central Texas. This species, which winters in southern Mexico and the Central American countries of Guatemala, Honduras, and Nicaragua, is the only Texas species whose breeding range is entirely confined to the state's boundaries. The known breeding range of the GCWA includes 37 Texas counties on the Lampasas Cut Plain, Edwards Plateau and Llano Uplift regions of the state (USFWS 1991). They breed in woodlands characterized by a mix of ashe juniper and various deciduous trees including Texas oak, plateau live oak, cedar elm, Texas persimmon, hackberry (*Celtis* spp.), evergreen sumac (*Rhus virens*), Texas ash (*Fraxinus texensis*), redbud (*Cercis canadensis*), and escarpment black cherry (*Prunus serotina*) (USFWS 1991b). Ashe juniper is often the dominant woody plant and occurs at all sites occupied by the bird. Females construct nests from ashe juniper bark, which exfoliates in the form of strips, especially in more mature trees (Pulich 1976).

Golden-cheeked Warbler

Photo: U.S. Fish & Wildlife Service

Golden-cheeked warblers return from their winter range to Texas by mid-March each year. Most leave the breeding grounds by the end of July (Pulich 1976). The principal threat to the GCWA (and the reason for the species' emergency listing in 1990) is habitat alteration and fragmentation resulting from urbanization and certain range management practices. The USFWS (1991) shows a 35 percent loss of range-wide available habitat since 1962. Other factors that have been implicated in the decline of this species include low oak regeneration rates, oak wilt disease, nest parasitism by the brown-headed cowbird, and increased urbanization, with resulting brush clearing and habitat loss.

A habitat assessment performed in 2009 identified potential GCWA habitat in the US 281 biological study area. After two years of rigorous effort, no GCWA have been detected; however, habitat losses continue due to current and pending development in the US 281 project corridor. In addition, nesting deterrents for the warbler are prevalent and likely increasing due to urbanization, including typical nest predator and social parasite species such as the great-tailed grackle and brown-headed cowbird. Given the negative survey findings to date and increasing reduction of habitat quality, it is not likely that the GCWA will utilize the US 281 biological study area. The results of the 2009 and 2010 presence-absence surveys for the GCWA are included in **Appendix I3**.

Critical Habitat

Critical habitat is defined in Section 3(5)(A) of the ESA as "(i) the specific areas within the geographical area occupied by the species . . . on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species . . . upon a determination by the Secretary of Commerce (Secretary) that such areas are essential for the conservation of the species" (see 16 U.S.C. 1532(5)(A)). The term 'conservation', as defined in Section 3(3) of the ESA, means ". . . to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary" (see 16 U.S.C. 1532(3)). Therefore, critical habitat is the geographic area and habitat functions necessary for the recovery of the species. Section 4(a)(3)(A) of the ESA requires that, to the "extent prudent and determinable", critical habitat be designated concurrently with the listing of a species.

Near the US 281 Corridor Project critical habitat has been designated for karst invertebrates. Critical Habitat Unit (CHU) 12, located approximately 0.15 miles west of the US 281 project corridor near Evans Road, originated with the USFWS proposed rule in (USFWS 2009). Originally 258 acres, CHU 12 was delineated to encompass 90 acres of vegetation surrounding Hairy Tooth Cave and Ragin' Cajun Cave, much of the Karst Zone 2 territory around the cave, and to maximize undisturbed woodland components. Following public comments, CHU 12 was reduced in size to 51 acres in the final rule (USFWS 2009). Subsequent to a lawsuit, USFWS agreed to review the size of the CHUs, and in February 2011 proposed revisions that enlarged CHU 12 to 371 acres (USFWS 2011), now crossing over US 281 project corridor at the southeast corner.

In the original proposed rule, CHU 12 was bounded on the east side by US 281. One respondent during the original rule comment period brought up a concern about using roads as CHU boundaries. Roads were not used as boundaries in the subsequent final rule.

In the 2011 proposed rule, the rationale for expanding CHU 12 over US 281 was to delineate an area out to 0.3 mile from the entrance to Ragin' Cajun Cave for the protection of mesocavernous habitat. Mesocavernous habitat is the porous karstic limestone beyond the limits of humanly-accessible caves through which karst species may travel and forage. USFWS utilized the mesocavern protection radius used in the Bexar County Karst Invertebrates Draft Recovery Plan.

A final rule on the revised CHU boundaries was issued on February 14, 2012. In it, CHU 12 was reduced from 371 acres to 166 acres. The 0.3 mile mesocavern protection radius was removed. The 166 acre size was determined by drawing 100 acre circles around the two caves and joining the edges of the two overlapping circles, then subtracting out a quarried-away segment at the south end. The 100 acre circle was based on preserve design recommendations contained in the Bexar County Karst Invertebrates Recovery Plan, which describes 100 acres of undisturbed or restorable vegetation around caves as a requirement for maintaining a healthy karst ecosystem. However, USFWS characterizes CHU 12 as a low quality unit due to heavy urbanization and quarrying, inadequate for contributing to recovery but still needed for long-term survival of *Rhadine exilis*.

CHU 12 is characterized as a low quality unit due to heavy urbanization and quarrying within its boundaries. Areas of undisturbed, native vegetation and associated surface wildlife, both of which are considered to be primary constituent elements (PCEs) for karst species habitat, are sparse within CHU 12. The unit boundaries reach the edge of the ROW at one point, and cross into it only to an insignificant degree. Therefore, direct physical disturbance to the CHU and to karst species is not anticipated. Indirect disturbance to the PCEs could include increased noise levels and vibration from construction equipment, which may drive away small mammals. This potential disturbance would mainly have the potential to affect the one area where the CHU touches the US 281 ROW, and the disturbance intensity relative to the overall size of the CHU would be low. No effect on vegetation within the CHU is anticipated. The route of Evans Road to the west of US 281 crosses through CHU 12, and construction activities on US 281 have the potential to result in increased traffic backups. This activity may have the potential to impact surface wildlife. This would be a short duration disturbance, once construction ends and traffic flow is improved on US 281, traffic congestion on Evans Road should also improve. Rebound of small mammal populations from temporary noise level increase is anticipated to be rapid.

Texas Natural Diversity Database Observations

TPWD's Texas Natural Diversity Database (TxNDD) is a database of observations of rare, threatened and endangered species and communities throughout the state. The TxNDD identified several species that occur or have historically occurred in Bexar County. The TxNDD was searched July 1, 2011 for Element of Occurrence Records (EORs) to determine if any reports of species have occurred within a 10 mile radius of the US 281 biological study area.

According to the TxNDD search, 27 occurrences of the federally endangered GCWA have been recorded within 10 miles of the US 281 biological study area. The closest occurrence was recorded in 2001 approximately 1.4 miles east of the US 281 biological study area between Bulverde Road and the West Fork of Cibolo Creek. This area is part of the Cibolo Canyon property and is covered for impacts to the warbler associated with the construction and operation of a mixed use community under the Cibolo Canyon Master Phase II EA/HCP and associated 10(a)(1)(B) incidental take permit issued by the USFWS in 2006.

More than half of the recorded occurrences for the GCWA were recorded approximately four to nine miles west and northwest of the US 281 project corridor on Camp Bullis Military Reservation. Most of these recordings are from 1990-1992; however, to date, Camp Bullis Military Reservation has been conducting their own surveys for the warbler that the TxNDD dataset does not include. Another occurrence of the warbler was recorded in 2000 approximately eight miles northwest of the US 281 project corridor in the Guadalupe River State Park. The rest of the GCWA occurrences were recorded between 1990 -2001 and were located four to ten miles west of the US 281 biological study area, south/southwest of Camp Bullis Military Reservation. Potential habitat for the GCWA was identified during field investigations within the US 281 biological study area; however, two years (2009 and 2010) of presence/absence surveys have resulted in negative findings.

The TxNDD search also revealed two occurrences of the federally endangered black-capped vireo within 10 miles of the US 281 biological study area. Both occurrences were approximately 10 miles west of the US 281 biological study area in Friedrich Park, one occurrence was recorded in 1991 and the other in 1999. No habitat for the black-capped vireo was identified during on-site habitat assessments in 2009 and 2010.

Additionally, the TxNDD search revealed occurrences of four federally endangered karst invertebrate species within 10 miles of the US 281 biological study area. The ground beetle, *Rhadine exilis*, has been documented approximately two miles east of the US 281 biological study area. This area has been designated by the USFWS as Critical Habitat for *Rhadine exilis*. This species has also been recorded approximately six miles west of the US 281 biological study area in Camp Bullis Military Reservation along with another endangered ground beetle, *Rhadine infernalis*. Although not captured in the TxNDD data, several other areas within 10 miles of the US 281 biological study area have been designated as Critical Habitat for either *Rhadine exilis* or *Rhadine infernalis.* *Rhadine exilis* has additional Critical Habitat designations approximately 0.15 mile west of the project, south of Evans Road, approximately one mile west along Mustang Creek north of Stone Oak Parkway, and approximately nine miles southwest along Loop 1604 west of I-10. *Rhadine infernalis* has Critical Habitat designated approximately 1.5 miles west along Stone Oak Parkway, north of Loop 1604. Although appropriate habitat for these two ground beetles may be present in the US 281 biological study area, this species

was not encountered during biological investigations. In addition to these two ground beetles, the TxNDD revealed an occurrence of the federally endangered Robber Baron Cave meshweaver (*Cicurina baronia*) along with an occurrence of the federally endangered Cokendolpher Cave harvestman (*Texella cokendolpheri*) from a cave system located approximately seven miles south of the US 281 biological study area near the intersection of Loop 410 and US 281. The USFWS designated Critical Habitat for both of these species at this same location. There are no caves formed in the Austin Chalk in the US 281 biological study area, therefore the occurrence of these two species is unlikely.

The TxNDD revealed six occurrences of the state-listed threatened Comal blind salamander (*Eurycea tridentifera*) and four occurrences of the state-listed threatened Cascade Caverns salamander (*Eurycea latitans complex*) within 10 miles of the US 281 biological study area. The closest occurrence of the Comal blind salamander was recorded in 1978 approximately three miles northwest of the US 281 biological study area between Blanco Road and Bulverde Road, south of the Comal County line. Two additional occurrences of the Comal blind salamander were recorded in the Shavano Park area of San Antonio, south of Loop 1604, approximately four and five miles southeast of the US 281 biological study area. The salamander was also recorded approximately four miles northeast of the US 281 biological study area east of Lewis Creek near the intersection of FM 1863 and FM 3159 and nearby, approximately five miles northeast of the US 281 biological study area close to Dripping Springs Creek. The sixth TxNDD occurrence of the Comal blind salamander was recorded approximately ten miles northwest of the US 281 biological study area in the Honey Creek Wildlife Management Area. Three of the four occurrences of the Cascade Caverns salamander were recorded approximately from three to four miles east of the US 281 biological study area along tributaries to Cibolo Creek. The fourth occurrence was recorded approximately ten miles northwest in Guadalupe River State Park. Neither of the two salamanders was detected in the springs within the US 281 biological study area during field investigations conducted in 2010.

Bracken Bat Cave is located on the 697-acre Bracken Bat Cave and Nature Reserve approximately six miles east outside of the US 281 biological study area, and it contains the largest Mexican free-tailed bat colony known, with estimates of up to 40 million bats arriving every spring. In the TxNDD database, it is listed as last seen in 1985; however it is known to be a long-known and well-studied colony protected and managed by Bat Conservation International. No Mexican free-tails or other bats were observed during on-site habitat assessments conducted in 2010.

Several rare vegetative series and plant species have also been documented within 10 miles of the US 281 biological study area. An occurrence of the plateau live oak/curly mesquite (*Quercus fusiformes*/*Hilaria belangeri*) series was recorded within the US 281 biological study area in 1992; however, that series was not located during recent field investigations. The bracted twistflower (*Streptanthus bracteatus*) was recorded from two to ten miles west of the US 281 biological study area around Camp Bullis and approximately seven miles west in Eisenhower Park, which is adjacent to an immediately south of Camp Bullis. Additionally, an occurrence of the rare Texas mock-orange (*Philadelphus texensis*) has been recorded as close as seven miles northwest of the US 281 biological study area near the Comal County line. Lastly, the rare bald cypress/sycamore (*Taxodium distichum*/*Platanus occidentalis*) vegetative series was noted approximately 10 miles northwest in Guadalupe River State Park and the rare plateau

live oak/little bluestem (*Quercus fusiformes/Schizachyrium scoparium*) series has been recorded approximately 10 miles in the nearby Honey Creek Wildlife Management Area. None of these species were identified during on-site habitat assessments of the US 281 biological study area.

3.16.3 Environmental Consequences

This section defines the potential direct impacts to the threatened, endangered and rare species and their habitat that could result from implementation of the US 281 Corridor Project. In order to distinguish between federal regulatory requirements and voluntary measures, this discussion of impacts will use the following terms:

Potential impacts to species not protected under the ESA are described by stating that the US 281 Corridor Project will have "no impact" to the species, "may impact" the species, or "would impact" the species.

Assessment determinations for species under the regulatory protection of the ESA, and that are listed by the USFWS as occurring in Bexar County are described using one of the following: "no effect"; "may affect, is not likely to adversely affect"; or "may affect, is likely to adversely affect." These terms are used in this section using the following definitions:

"No effect" means that there is absolutely no effect, positive or negative, to the species or habitat.

"May affect, is not likely to adversely affect" means that all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact and would not reach the scale where take would occur. Discountable effects are those extremely unlikely to occur.

"May affect, is likely to adversely affect" means that there is at least one adverse effect. This determination means that effects on species and habitat (1) are not insignificant in size and avoidance of take cannot be guaranteed; and (2) discountable effects are not unlikely to occur.

No-Build Alternative

The No-Build Alternative would not affect any federally or state-listed threatened or endangered species with the exception that continued traffic congestion and crashes could potentially result in exacerbated vehicle emission and highway run-off conditions which would negatively affect air and water quality along the US 281 project corridor over time.

Proposed Build Alternatives

Of the species and vegetative series documented by USFWS and TPWD as potentially occurring in the US 281 biological study area, potential habitat for four federally listed species, four state-listed species, and 17 rare but unlisted species was identified within the US 281 biological study area. **Table 3-47** displays seven federally listed species that may have habitat present; however, geologic restrictions between karst fauna regions (KFRs) act as a barrier to three of those species. The Braken Bat Cave meshweaver, Government Canyon Bat Cave meashweaver and the Government Canyon Bat Cave

spider occur in different KFRs than the Stone Oak KFR (where the US 281 biological study area is located); therefore while cave habitat is present in the US 281 biological study area, those species are unlikely to occur there. The following assessment evaluates impacts of the US 281 Corridor Project upon rare, threatened and endangered species, critical habitat and provides an overview of potential species and habitat impacts in the US 281 biological study area in general.

Impacts to Federally Listed Species

Habitat for four federally listed species was identified within the existing and proposed ROW of both Proposed Build Alternatives. These species include the Madla's Cave meshweaver, the ground beetles *Rhadine exilis* and *Rhadine infernalis* (all three are known from the Stone Oak KFR), and the GCWA.

Karst Invertebrates

The USFWS utilizes the Bexar County karst zones as modified from Veni (1994) to predict where listed karst invertebrates are likely to occur. These zones are depicted in the US 281 biological study area in **Figure 3-30**. The probability of detecting listed invertebrate species varies by karst zone. The acreage of each karst zone contained, as well as the total number of karst features that would be impacted as a result of the Proposed Build Alternatives are listed in **Table 3-48**. Note that some of the features occur in more than one Proposed Build Alternative, and the number indicated does not include wells, faults, or potential karst features that were determined not to have been formed by karst processes. The *2011 Draft Karst Invertebrate Technical Report* (included in **Appendix I2**) details the karst feature investigations and determinations related to each feature.

The karst zones, as defined in USFWS (2006), are:

- Zone 1: Areas known to contain endangered karst invertebrate species.
- Zone 2: Areas having a high probability of containing suitable habitat for endangered karst invertebrate species.
- Zone 3: Areas that probably do not contain endangered karst invertebrate species.
- Zone 4: Areas that require further research but are generally equivalent to Zone 3, although they may include sections that could be classified as Zone 2 or Zone 5 as more information becomes available.
- Zone 5: Areas, both cavernous and non-cavernous, that do not contain endangered karst invertebrate species.

Table 3-48: Bexar County Karst Zone Acreage and the Number of Karst Features Located within the ROW by Alternative

Alternatives	Karst Zone 1		Karst Zone 2		Karst Zone 3		Karst Zone 4		Karst Zone 5	
	acres	features	acres	features	acres	features	acres	features	acres	features
No-Build	181	36	129	5	71	7	0	0	3	0
Expressway	242	36	165	9	102	10	0	0	3	0
Elevated Expressway	238	36	149	8	92	10	0	0	3	0

Source: USFWS 2006 and Zara Environmental 2010.

The entirety of the US 281 biological study area is contained with the Stone Oak KFR, which is known to contain the following federally karst invertebrate listed species:

Madla's Cave meshweaver and two ground beetles, *Rhadine exilis* and *Rhadine infernalis.*

Karst feature surveys were conducted within the US 281 biological study area using USFWS survey protocol (USFWS 2006), where landowners granted access. The *2011 Karst Invertebrate Technical Report* is included in **Appendix I2**. Karst feature surveys were performed between February 26, 2010 and November 16, 2010. Researchers recorded 116 features during these surveys, and identified 60 of them that had the potential to contain karst invertebrate habitat. Fifteen landowners that had granted access for initial karst feature surveys subsequently did not grant access to their property for excavation of recorded features. The remaining 45 features that had potential to contain karst invertebrate habitat were excavated and re-evaluated for their habitat potential. These re-evaluations led to the identification of 13 caves and karst features that were determined to contain potential habitat and were therefore surveyed for listed karst invertebrate species. Presence/absence surveys for federally listed karst invertebrates were conducted in the features between June 14, 2010 and October 10, 2010. Background literature searches provided information on one cave where ROE was not obtained, but where previously conducted fauna surveys did not detect any endangered karst invertebrate species. Three caves that appear to have been covered up by roadways or development are no longer accessible, and no fauna surveys are known from them. Karst features known to exist on properties where right of entry was not available can be assessed if access becomes available. Furthermore, only features occurring within the US 281 biological study area are discussed here; features occurring outside the US 281 biological study area are discussed in the indirect and cumulative impacts sections (**Chapter 4 - Indirect Effects** and **Chapter 5 - Cumulative Effects**).

No federally listed karst invertebrate species were detected during presence-absence surveys in 2010 for the US 281 Corridor Project and none are known to historically occur within the US 281 biological study area. The nearest recorded localities of federally listed karst species in the area are for *Rhadine exilis,* which is known from Ragin' Cajun Cave and Hairy Tooth Cave. These caves lie within Critical Habitat Unit 12 (USFWS 2009, 2012), the edge of which slightly impinges on the US 281 project corridor ROW. The Proposed Build Alternatives may affect, but are not likely to adversely affect, the Madla's Cave meshweaver and two ground beetles, *Rhadine exilis* and *Rhadine infernalis,* or their habitat.

Caves and karst features are known to exist on some of the properties where landowners were unresponsive to requests for or denied access. Conclusions about the status of listed karst invertebrate habitat in those areas cannot be made at this time. When access becomes available in the future, these features will be located and assessed for potential karst invertebrate habitat.

Mitigation measures are proposed for the federally listed karst invertebrates in **Section 3.16.5 .**

Golden-cheeked Warbler

A brief discussion of the range and life history of the federally endangered GCWA can be found in **Section 3.16.2** . A habitat assessment performed in 2009 identified potential GCWA habitat in the US 281 biological study area. Based upon this assessment, there are approximately 28 acres of GCWA habitat in the existing ROW of the US 281 project corridor. Assuming that all GCWA habitat in the existing ROW would be cleared in addition to the proposed ROW needed to construct the Proposed Build Alternatives, the

Expressway Alternative would impact approximately 65 acres, and the Elevated Expressway would impact approximately 56 acres. After two years of presence/absence survey using USFWS protocol (USFWS 2009 and USFWS 2010c) no GCWA have been detected. Habitat losses continue due to current and pending development along the US 281 project corridor. In addition, nesting deterrents for the warbler are prevalent and likely increasing due to urbanization, including effects from typical nest predator and social parasite species such as the great-tailed grackle and brown-headed cowbird. Given the negative survey findings to date and decline of habitat quality, it is not likely that the GCWA will utilize the US 281 biological study area and the US 281 Corridor Project may affect, but is not likely to adversely affect the GCWA. The USFWS concurred that based on the survey results from 2009 and 2010, there is sufficient data to conclude that the GCWA is not likely to occur within the US 281 biological study area. Therefore, a third year of bird surveys will not be conducted. This decision is documented in a letter dated May 11, 2011 between the USFWS and the Alamo RMA (**Appendix I3**). Presence/absence survey reports from 2009 and 2010 for the GCWA have been submitted to the USFWS and are included in **Appendix I3**. Indirect and cumulative impacts to the GCWA and/or its habitat are addressed in **Chapter - 4 Indirect Effects** and **Chapter 5 - Cumulative Effects**.

Table 3-49: Impacts to Golden-cheeked Warbler Habitat by Alternative

Alternative	Golden-cheeked Warbler Habitat (acres)
No-Build Alternative	0
Expressway Alternative	65
Elevated Expressway Alternative	56

Source: Blanton 2009 and Hicks 2010.

Mitigation measures are proposed for the GCWA in **Section 3.16.5 .**

Impacts to Critical Habitat

CHU 12 is characterized as a low quality unit due to heavy urbanization and quarrying within its boundaries. Areas of undisturbed, native vegetation and associated surface wildlife, both of which are considered to be primary constituent elements (PCEs) for karst species habitat, are sparse within CHU 12. The unit boundaries reach the edge of the ROW at one point, and cross into it only to an insignificant degree. Therefore, direct physical disturbance to the CHU and to karst species is not anticipated. Indirect disturbance to the PCEs could include increased noise levels and vibration from construction equipment, which may drive away small mammals. This potential disturbance would mainly have the potential to affect the one area where the CHU touches the US 281 ROW, and the disturbance intensity relative to the overall size of the CHU would be low. No effect on vegetation within the CHU is anticipated. The route of Evans Road to the west of US 281 crosses through CHU 12, and construction activities on US 281 have the potential to result in increased traffic backups. This activity may have the potential to impact surface wildlife. This would be a short duration disturbance, once construction ends and traffic flow is improved on US 281, traffic congestion on Evans Road should also improve. Rebound of small mammal populations from temporary noise level increase is anticipated to be rapid.

Impacts to State Listed Species

Habitat for four state-listed species, two salamanders and two reptiles, occurs within the US 281 biological study area for the Proposed Build Alternatives.

The two salamander species include the Cascade Caverns salamander and the Comal blind salamander. Four springs were identified during karst feature surveys (2010), and one of the springs is located within the existing ROW (#281-002), one is located within the proposed ROW (#281-003) of both Proposed Build Alternatives and the other two springs are located outside of the proposed ROW (#281-010 and #281-012). All four springs are located between Trinty Park and Borgfeld Drive. Only one of the four springs were surveyed in 2010 for salamanders (#281-002) due to ROE, however none were found. This spring (#281-002) is less than ideal habitat for these salamander species, which are most often encountered in water filled caves or in clean springs, because it emerged from a mud bank and lacked an open bedrock conduit through which salamanders could pass. The spring located within the proposed ROW (#281-003) was observed from across the fence; however, no ROE was granted for that property and investigators were not able to evaluate the condition of the spring. At least one of the springs on private property (#281-012) appears to offer less degraded, more typical habitat for these salamander species; although no salamanders have been encountered during the course of this study. All four springs provide potential habitat, therefore the US 281 Corridor Project may impact the Cascade Caverns salamander and the Comal blind salamander, but is not likely to negatively impact them because the spring (#281-012) that was located on private property that may provide highest quality habitat relative to the others is approximately 196 feet from the proposed ROW, and at a higher elevation than the US 281 Corridor Project. More information about the karst feature survey can be found in the **Appendix I2** and **Appendix J1**.

Marginal habitat for the state-listed threatened Texas horned lizard and timber/canebrake rattlesnake was identified as potentially occurring within the US 281 biological study area; however, no opportunistic observations of individuals were made during the on-site habitat assessments in 2010. The Texas horned lizard may be found in sparsely vegetated, open, semi-arid areas within the US 281 biological study area and the timber/canebrake rattlesnake could potentially occur in US 281 biological study area floodplains, riparian zones, or abandoned farmland. The US 281 Corridor Project may impact the Texas horned lizard due to habitat loss, increased number of fire ants (often dominant in areas with recent vegetation removal), and/or increased road mortality from higher traffic loads. The US 281 Corridor Project may impact the timber/canebrake rattlesnake through habitat loss, habitat fragmentation, and/or increased road mortality from higher traffic loads. Because these species could be impacted by construction of the US 281 Corridor Project, coordination with TPWD would be completed once a Preferred Alternative is identified in the Final EIS.

Although marginal habitat for the Texas horned lizard and timber/canebrake rattlesnake occurs within the US 281 biological study area and individuals could potentially be impacted by the US 281 Corridor Project, it is not likely to negatively impact these species because the habitat is marginal, no individuals were observed in 2010, and the impacted potential habitat is common in the vicinity of the US 281 project corridor.

Mitigation measures are proposed for state-listed species in **Section 3.16.5 .**

Impacts to Rare Species (un-listed)

Habitat for 17 rare species (4 plants, 7 crustaceans, 1 insect, 1 amphibian,2 reptiles, and 2 mammals) that are not state or federally listed was identified as potentially occurring within the US 281 biological study area including: big red sage; bracted twistflower; Correll's false dragon-head; Hill Country wild-mercury; a cave obligate crustacean (*Tethysbaena* (=*Monodella*) *texana*); *Texanobathynella bowmani*; Ezell's cave amphipod; *Allotexiweckelia hirsuta*; *Coahila isopod*; *Speocirolana hardeni*; *Texiweckeliopsis insolita*; Rawson's metalmark; Texas salamander; spot-tailed earless lizard; Texas garter snake; cave myotis bat; and Plains spotted skunk. No observations of big red sage, bracted twistflower, Correll's false dragon-head, Hill Country wild-mercury, Rawson's metalmark, spot-tailed earless lizard, Texas garter snake, cave myotis bat, or the Plains spotted skunk were made during on-site habitat assessments in 2010 within the US 281 biological study area. Therefore, the US 281 Corridor Project may impact these species, but with the mitigation measures proposed in **Section 3.16.5** , it is not likely to negatively impact these species. The spring that is most likely to have the potential to provide habitat to the seven crustaceans (cave obligate crustaceans (*Tethysbaena* (=*Monodella*) *texana*) and *Texanobathynella bowmani*, Ezell's cave amphipod, *Allotexiweckelia hirsuta*, *Conhuila isopod*, the isopod *Speocirolana hardeni* and *Taxiweckeliopsis insolita*) is located on private property where ROE was revoked in 2010, and it was therefore not surveyed for these species. Scientifically acceptable methods for spring surveys would be used for surveying this spring, should access be granted at some point in the future. The US 281 Corridor Project may impact these species, but the spring is located 60 meters from the existing ROW that would be required for the Proposed Build Alternatives and at a higher elevation, thus the US 281 Corridor Project is not likely to negatively impact these species.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to threatened and endangered species would not change based on funding options.

3.16.4 Conclusion

This section summarizes the potential direct impacts to the threatened, endangered and rare species and their habitat that could results from the US 281 Corridor Project.

Table 3-50: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Direct Effect/Impact Determination
Plants			
Big red sage *Salvia pentstemonoides*	----	----	Habitat for the big red sage is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. The US 281 Corridor Project ***may impact*** this species.
Bracted twistflower *Streptanthus bracteatus*	----	----	Habitat for the bracted twistflower is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. The US 281 Corridor Project ***may impact*** this species.

Table 3-50: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Direct Effect/Impact Determination
Correll's false dragon-head *Physostegia correllii*	----	----	Habitat for the Correll's false dragon-head is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. The US 281 Corridor Project ***may impact*** this species.
Elmendorf's onion *Allium elmendorfii*	----	----	There are no deep, loose, well-drained sands in the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Hill Country wild-mercury *Argythamnia aphoroides*	----	----	Habitat for the Hill Country wild-mercury is found within the US 281 biological study area, yet no specimens were observed during on-site habitat assessments in 2010. This US 281 Corridor Project ***may impact*** this species.
Parks' jointweed *Polygonella parksii*	----	----	There are no sandy areas within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Sandhill woollywhite *Hymenopappus carrizoanus*	----	----	There are no sandy areas within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Texas wild-rice* *Zizania texana*	E	E	This species is only known from the upper 1.6 miles of the San Marcos River in Hays County. The US 281 Corridor Project would have ***no effect*** on this species.
Mollusks and Snails			
Creeper (squawfoot) *Strophitus undulatus*	----	----	There are no perennial streams within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
False spike mussel *Quadrula mitchelli*	----	T	There are no medium to large rivers within the US 281 biological study area, thus the project would have ***no impact*** on this species.
Golden orb *Quadrula aurea*	P	T	There are no perennial streams within the project area within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Mimic cavesnail *Phreatodrobia imitata*	----	----	There are no known artesian wells within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Pistolgrip *Tritogonia verrucosa*	----	----	There are no perennial streams within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Rock pocketbook *Arcidens confragosus*	----	----	There are no medium to large rivers within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Texas fatmucket *Lampsilis bracteata*	P	T	The US 281 biological study area falls within the San Antonio River basin and is out of the range for this species, thus the US 281 Corridor Project would have ***no impact*** on this species.
Texas pimpleback *Quadrula petrina*	P	T	The US 281 biological study area falls within the San Antonio River basin and is out of the range for this species, thus the US 281 Corridor Project would have ***no impact*** on this species.
Crustaceans			
A cave obligate crustacean *Tethysbaena (=Monodella) texana*	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project ***may impact*** this species.
Texanobathynella bowmani	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project ***may impact*** this species.
Cascade Cave amphipod *Stygobromus dejectus*	----	----	To date this species has only been collected from cave pools, and no caves containing water are currently known to occur in the US 281 biological study area. Although a direct impact is not anticipated there is potential for an indirect impact to species dependant on Comal Springs. Therefore this project ***may impact*** this species.***

Table 3-50: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Direct Effect/Impact Determination
Ezell's cave amphipod *Stygobromus flagellatus*	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project ***may impact*** this species.
Long-legged cave amphipod *Stygobromus longipes*	----	----	There are no known subterranean streams or water filled caves within the US 281 biological study area. Although a direct impact is not anticipated there is potential for an indirect impact to species dependant on Comal Springs. Therefore this project ***may impact*** this species.***
Peck's cave amphipod *Stygobromus pecki*	E	E	This species is found only in the region of Comal Springs and Hueco springs in Comal County, thus the US 281 biological study area is outside the known range of this species. Although the US 281 Corridor Project would have no direct effect on this species, there is potential for an indirect effect to species dependant on Comal Springs. Therefore this project ***may affect, but is not likely to adversely affect*** this species.***
Allotexiweckelia hirsuta	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project ***may impact*** this species.
Parabogidiella americana	----	----	There are no known artesian wells within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Texas cave shrimp *Palaemonetes antrorum*	----	----	There are no known artesian wells or water-filled caves within the US 281 biological study area, thus it is anticipated that the US 281 Corridor Project would have ***no impact*** on this species.
Coahuila isopod *Mexistenasellus coahuila*	----	----	One spring located within the US 281 biological study area may provide habitat, thus the US 281 Corridor Project ***may impact*** this species.
Speocirolana hardeni	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project ***may impact*** this species.
Texiweckeliopsis insolita	----	----	One spring located within the US 281 biological study area may provide suitable habitat, thus the US 281 Corridor Project ***may impact*** this species.
Arachnids			
Braken Bat Cave meshweaver *Cicurina venii*	E	----	While appropriate habitat may be present, the US 281 biological study area is more than 20 miles east of the currently understood distribution of this species. The US 281 Corridor Project is expected to have ***no effect*** on this species.
Cokendolpher cave harvestman *Texella cokendolpheri*	E	----	There are no caves formed in the Austin Chalk occurring within the US 281 biological study area, therefore the US 281 Corridor Project would have ***no effect*** on this species.
Government Canyon Bat Cave meshweaver *Cicurina vespera*	E	----	While appropriate habitat may be present, the US 281 biological study area is approximately 18 miles east of the currently understood distribution of this species. This US 281 Corridor Project is expected to have ***no effect*** on this species.
Government Canyon Bat Cave spider *Neoleptoneta microps*	E	----	While appropriate habitat may be present, the US 281 biological study area is approximately 18 miles east of the currently understood distribution of this species. This US 281 Corridor Project is expected to have ***no effect*** on this species.
Madla's Cave meshweaver *Cicurina madla*	E	----	Although appropriate habitat for this species may be present, this species was not encountered during the 2010 presence-absence surveys and none are historically known to occur in the US 281 biological study area. This US 281 Corridor Project ***may affect, but is not likely to adversely affect*** this species.
Robber Baron Cave meshweaver *Cicurina baronia*	E	----	There are no caves formed in the Austin Chalk occurring within the US 281 biological study area, therefore this US 281 Corridor Project would have ***no effect*** on this species.

Table 3-50: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Direct Effect/Impact Determination
Insects			
Comal Springs dryopid beetle* *Stygoparnus comalensis*	E	----	The US 281 biological study area is outside the known range of this species, thus the US 281 Corridor Project would have no direct effect on this species. However there is potential for an indirect effect to species dependant on Comal Springs. Therefore this project ***may affect, but is not likely to adversely affect*** this species.***
Comal Springs riffle beetle* *Heterelmis comalensis*	E	----	The US 281 biological study area is outside the known range of this species, thus the US 281 Corridor Project would have no direct effect on this species. However there is potential for an indirect effect to species dependant on Comal Springs. Therefore this project ***may affect, but is not likely to adversely affect*** this species.***
Ground beetle *Rhadine exilis*	E	----	Although appropriate habitat for this species may be present, this species was not encountered during the 2010 presence-absence surveys and none are historically known to occur in the US 281 biological study area. This US 281 Corridor Project ***may affect, but is not likely to adversely affect*** this species.
Ground beetle *Rhadine infernalis*	E	----	Although appropriate habitat for this species may be present, this species was not encountered during the 2010 presence-absence surveys and none are historically known to occur in the US 281 biological study area. This US 281 Corridor Project ***may affect, but is not likely to adversely affect*** this species.
Helotes mold beetle *Batrisodes venyivi*	E	----	The US 281 biological study area is outside the known range of this species, thus the US 281 Corridor Project would have ***no effect*** on this species.
Manfreda giant-skipper *Stallingsia maculosus*	----	----	There are no mesquite scrublands within the US 281 biological study area and no verified records of this insect since 1980[1], thus the US 281 Corridor Project would have ***no impact*** to this species.
Rawson's metalmark *Calephelis rawsoni*	----	----	Moist areas in shaded limestone outcrops are found within the US 281 biological study area, yet no Rawson's metalmarks were observed during on-site habitat assessments. This US 281 Corridor Project ***may impact*** this species.
Fishes			
Fountain darter *Etheostoma fonticola*	E	E	This species is known only from the San Marcos and Comal Rivers, thus the US 281 biological study area falls outside the range for this species. The US 281 Corridor Project would have no direct effect on the Fountain darter. However there is potential for an indirect effect to species dependant on Comal Springs. Therefore this project ***may affect, but is not likely to adversely affect*** this species.***
Guadalupe bass *Micropterus treculii*	----	----	No perennial streams are found within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** to this species.
San Marcos gambusia* *Gambusia georgei*	E	E	This species is considered extinct and its previous range is outside of the US 281 biological study area. Thus, the US 281 Corridor Project would have ***no effect*** on the San Marcos gambusia.
Toothless blindcat *Trogloglanis pattersoni*	P	T	The toothless blindcat is known only from wells south of the US 281 biological study area and no artesian wells are located within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** to this species.
Widemouth blindcat *Satan eurystomus*	P	T	The widemouth blindcat is known only from wells south of the US 281 biological study area and no artesian wells are located within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** to this species.
Amphibians			
Cascade Caverns salamander *Eurycea latitans complex*	----	T	Although this species was not detected in springs during 2010 biological surveys, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project ***may impact*** this species.

Table 3-50: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Direct Effect/Impact Determination
Comal blind salamander *Eurycea tridentifera*	P	T	Although this species was not detected in springs during 2010 biological surveys, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project ***may impact*** this species.
San Marcos salamander* *Eurycea nana*	T	T	The US 281 biological study area is outside the known range of this species, thus the US 281 Corridor Project would have ***no effect*** on the San Marcos salamander.
Texas blind salamander* *Eurycea rathbuni*	E	E	The US 281 biological study area is outside the known range of this species, thus the US 281 Corridor Project would have ***no effect*** on this species.
Texas salamander *Eurycea neotenes*	P	----	This species was not detected in springs during 2010 presence-absence surveys within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Reptiles			
Spot-tailed earless lizard *Holbrookia lacerata*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project ***may impact*** this species.
Texas garter snake *Thamnophis sirtalis annectens*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the project ***may impact*** this species.
Texas horned lizard *Phrynosoma cornutum*	----	T	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project ***may impact*** this species.
Texas indigo snake *Drymarchon melanurus erebennus*	----	T	The range of this species is south of the US 281 biological study area and habitat for this species was not observed during 2010 on-site habitat assessments, thus the US 281 Corridor Project would have ***no impact*** on this species.
Texas tortoise *Gopherus berlandieri*	----	T	The range of this species is south of the US 281 biological study area and habitat for this species was not observed during 2010 on-site habitat assessments, thus the US 281 Corridor Project would have ***no impact*** to this species.
Timber/canebrake rattlesnake *Crotalus horridus*	----	T	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project ***may impact*** this species.
Birds			
Bald eagle *Haliaeetus leucocephalus*	DL/DM	T	The US 281 biological study area contains no large rivers or lakes close enough for this species. Thus, the US 281 Corridor Project would have ***no impact*** to this species.
Black-capped vireo *Vireo atricapilla*	E	E	The appropriate shrub and tree layer with open, grassy spaces required by the Black-capped Vireo does not exist within the US 281 biological study area, thus the US 281 Corridor Project would have ***no effect*** on this species.
Golden-cheeked warbler *Setophaga chrysoparia*	E	E	Potential habitat for this species exists within the US 281 biological study area, however, this species was not observed during the 2009 and 2010 presence/absence surveys. Thus, the US 281 Corridor Project ***may affect, but is not likely to adversely affect*** the GCWA.
Interior least tern** *Sterna antillarum athalassos*	E	E	No sand or gravel bars within streams or inland beaches, wastewater treatment plants of gravel mines exist within the US 281 biological study area, thus the US 281 Corridor Project would have ***no effect*** on the Interior Least Tern.
Mountain plover *Charadrius montanus*	----	----	No nesting habitat, shortgrass plains, or plowed fields exist within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Peregrine falcon *Falco peregrinus*	----	T	Potential migrant; any use of the US 281 biological study area would be incidental. The US 281 Corridor Project would have ***no impact*** on this species.

Table 3-50: Summary Table of Threatened and Endangered Species and Potential for Effect/Impact by the US 281 Corridor Project

Species	Federal Status	State Status	Direct Effect/Impact Determination
Western burrowing owl *Athene cunicularia hypugaea*	----	----	The US 281 biological study area contains no open grasslands and is too rocky for this species to burrow. Thus, this US 281 Corridor Project would have ***no impact*** on this species.
White-faced ibis *Plegadis chihi*	----	T	There are no freshwater marshes, sloughs, or irrigated rice fields in the US 281 biological study area. The project would have ***no impact*** on this species.
Whooping crane *Grus americana*	E	E	Potential migrant; any use of the US 281 biological study area would be incidental. The US 281 Corridor Project would have ***no effect*** on this species.
Wood stork *Mycteria americana*	----	T	There are no areas of shallow standing water within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Zone-tailed hawk *Buteo albonotatus*	----	T	The northern limit of the breeding range for this species is southwest of the US 281 biological study area and any use of this area would be considered incidental. It is anticipated that the US 281 Corridor Project would have ***no impact*** on this species.
Mammals			
Black bear *Ursus americanus*	----	T	No large tracts of inaccessible forested areas exist within the US 281 biological study area, thus the US 281 Corridor Project would have ***no impact*** on this species.
Cave myotis bat *Myotis velifer*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project ***may impact*** this species.
Ghost-faced bat *Mormoops megalophylla*	----	----	There are no known caves, abandoned mines or abandoned buildings within the US 281 biological study area that are inhabited by bats, thus the US 281 Corridor Project would have ***no impact*** on this species.
Gray wolf** *Canis lupus*	E	E	This species is considered extirpated from Texas. The US 281 Corridor Project would have ***no effect*** on this species.
Plains spotted skunk *Spilogale putorius interrupta*	----	----	Although not observed during 2010 on-site habitat assessments, habitat for this species exists within the US 281 biological study area. Thus, the US 281 Corridor Project ***may impact*** this species.
Red wolf** *Canis rufus*	E	E	This species is considered extirpated from Texas. The US 281 Corridor Project would have ***no effect*** on this species.

E – Endangered, T – Threatened, C – Candidate for listing as threatened or endangered
P – Petitioned for federal listing; USFWS has determined the species may warrant listing
DL – Federally De-listed; DM – Federally De-listed, monitoring, "---" – Rare, but with no current regulatory status
*These federally-listed species are listed on the USFWS list of species of potential occurrence in Bexar County, but are not considered by TPWD as potentially occurring in this County.
**These federally-listed species are listed on the TPWD list of species of potential occurrence in Bexar County, but are not considered by USFWS as potentially occurring in this County.
Note - Potential impacts to species not protected under the ESA are described by stating that the US 281 Corridor Project would have "no impact" to the species, "may impact" the species, or "would impact" the species. Assessment determinations for species under the regulatory protection of the ESA, and that are listed by the USFWS as occurring in Bexar County are described using one of the following: "no effect"; "may affect, is not likely to adversely affect"; or "may affect, is likely to adversely affect."
***There is a potential for encroachment-alteration effects to species dependant on Comal Springs as a result of groundwater pollutant transport via sub-surface flow paths. More information on this topic can be found in **Section 4.5**.

In summary, based on background reviews, field investigations, and coordination with USFWS the US 281 Corridor Project "may impact" 22 state-listed or rare (un-listed) species and "may affect, but is not likely to adversely affect" 8 federally-listed species. Of these 30 species, 6 of them are dependent on Comal Springs (Cascade cave amphipod, Peck's cave amphipod, Long-legged cave amphipod, Comal Springs riffle beetle, Comal Springs dryopid beetle and the Fountain Darter) and would not be directly impacted by

this project, but there is potential for an indirect impact as a result of subsurface flow paths (See **Section 4.5**). Measures proposed to mitigate for these potential impacts to federally-listed, state-listed and rare species are described in **Section 3.16.5 .** The US 281 Corridor project also slightly impinges upon CHU 12 (USFWS 2012). The USFWS characterizes this CHU as a low quality unit due to heavy urbanization and quarrying, inadequate for contributing to recovery but still needed for long-term survival of *Rhadine exilis*. The potential impacts from the US 281 Corridor Project will be analyzed and documented in the Final EIS.

3.16.5 Proposed Mitigation Measures

Federal Listed Species

To avoid/minimize any potential impacts to the GCWA, the following guidelines would be followed during construction:

- Limiting the vegetation removal in wooded areas to outside of the breeding and nesting season, which lasts from March 1 to September 1
- Limiting removal of vegetation to that necessary for constructing the US 281 Corridor Project
- Locating construction staging areas away from known or potential GCWA habitat
- Re-seeding with native vegetation after construction

It is possible that other potential karst features or caves may be revealed if any excavation occurs below the current grade or further into existing road cuts during the US 281 Corridor Project. If this occurs, work will immediately cease within 344 feet of the feature, the feature should be covered, and a Section 10(A)(1)(a) permitted karst biologist will inspect the site as soon as possible in order to evaluate potential species habitat (USFWS 2011).

Caves and karst features are also known to exist on some of the properties where landowners were unresponsive to requests for or denied access. Conclusions about the status of listed karst invertebrate habitat in those areas cannot be made at this time. When access becomes available in the future, these features will be located and assessed for potential karst invertebrate habitat.

State-Listed Species

In accordance with TPWD regulations, efforts will be made to avoid direct harm to individuals of state-listed species during construction. Specific notes will be inserted into construction plans that indicate the potential presence of these species and instruct the contractors/workers to avoid impacting them. Contractors/workers will be briefed on the species appearance and habitat preferences prior to construction and instructed to cease activities in the vicinity of the protected species, if encountered, for a sufficient amount of time to enable escape or relocation.

Rare Species (un-listed)

During construction, efforts will be made to avoid direct harm to individuals of rare species; particularly those most vulnerable to earth moving equipment and water quality impacts. Specific notes will be inserted into construction plans that indicate the potential presence of these species and instruct the contractors/workers to avoid

impacting them. Contractors/workers will be briefed on the species appearance and habitat preferences prior to construction and instructed to cease activities in the vicinity of the protected species, if encountered, for a sufficient amount of time to enable escape or relocation. To avoid and/or minimize impacts to aquatic species, waterways will be spanned whenever possible and appropriate best management practices put in place. If any waterway must be de-watered, the work site will be isolated to prevent fish from moving into the construction zone and work activities in the channel conducted as quickly as possible to minimize the length of time that flow is modified or interrupted. Prompt and effective erosion control, re-vegetation and restoration of flow lines and grades should further minimize impacts and return the areas to pre-project conditions as soon as possible.

As a proactive mitigation measure a cave gate was installed in the ROW near US 281 and Sonterra Boulevard. This cave was found during the karst survey in 2010. Five subterranean karst invertebrate species were identified during investigations at this cave, including a Brackenridgia species (sp.) isopod, a Cicurina bullis spider, a Chinquipellobunus sp. harvestman, a Texoreddellia sp.silverfish, and a Cambala speobia millipede. While none of these species are federally or state listed, Cicurina bullis is known from only a few localities and is being managed as endangered by the Department of Defense on Camp Bullis. This cave gate was designed to prevent unauthorized entry while maintaining nutrient and moisture flow. Nutrient input from trogloxenes such as cave crickets and small mammals as well as organic debris is an important element of a functioning cave ecosystem. The most reliable way to return the site to the original condition is to place a gate at grade on the entrance.

3.17 CULTURAL RESOURCES

Cultural resources are structures, buildings, archeological sites, districts (a collection of related structures, buildings, and/or archeological sites), cemeteries and objects. Both federal and state laws require consideration of cultural resources during project planning. At the federal level, NEPA and Section 106 of the *National Historic Preservation Act* (NHPA) of 1966 (Section 106), among others, apply to transportation projects such as this one. In addition, state laws such as the *Antiquities Code of Texas* apply to these projects. Compliance with these laws requires the federal agency to consult with the Texas Historical Commission (THC), State Historic Preservation Officer (SHPO) and federally recognized tribes to determine the project's effects on cultural resources. Review and coordination of the US 281 Corridor Project will follow approved procedures for compliance with federal and state laws.

Federally funded transportation projects are also subject to the requirements of Section 4(f) of the US Department of Transportation (USDOT) Act of 1966, which stipulates that the Federal Highway Administration (FHWA) and other USDOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless the following conditions apply:

- There is no feasible and prudent alternative to the use of land; and
- The action includes all possible planning to minimize harm to the property resulting from use.

Section 4(f) was set forth in Title 49 United States Code (USC), Section 1653(f). A similar

provision was added to Title 23 USC Section 138, which applies only to the Federal-Aid Highway Program.

The Draft EIS has relied on cultural resources studies performed in support of the 2007 Environmental Assessment for US 281, under which Section 106 requirements were completed and which covers most of the current Area of Potential Effects (APE). The Draft EIS documents the effect of the Proposed Build Alternatives on cultural resources as determined by previous coordination with THC. Additionally a detailed desktop review and predictive model was prepared to determine potential for the project to affect resources that could be NRHP-eligible.

Based on the results of the desktop assessment and previous surveys it was determined that there is low potential for Section 4(f) to be triggered by either of the Proposed Build Alternatives. Therefore, supplemental field surveys for historic and archeological resources will be conducted for the Preferred Alternative only and documented in the Final EIS. Public Meeting #4 regarding the Preferred Alternative is scheduled to occur after the Draft EIS Public Hearing and prior to circulation of the Final EIS. Consultation for historic resources, as defined in 36 CFR 800.2, will be conducted following the surveys and used to refine the recommended alternative which will be presented in the Final EIS. If an NRHP-eligible resource is found during these surveys and may be adversely affected by the Preferred Alternative there may be a need to revisit previously eliminated alternatives.

This approach was developed through coordination with FHWA, TxDOT, Alamo RMA, the Peer Technical Review Committee, and all participating and cooperating agencies.

3.17.1 Historic Resources (Non-Archeological)

Methodology

The results from previous non-archeological historic resources investigations and THC coordination were used to evaluate the potential impacts that would result from the Proposed Build Alternatives in the Draft EIS.

The historic resources study area is defined as 1,300 feet beyond the proposed ROW for the Proposed Build Alternatives. TxDOT pre-certified architectural historians conducted a records review of the historic resources study area using historic aerial photographs, maps, previous survey reports and other archival sources to identify the locations of potential historic resources constructed between 1965 (the cut-off date for the last historic resources investigation in the US 281 project corridor in 2006) and 1973 (the cut-off date for the US 281 Corridor Project). Because the let date is currently scheduled for 2018, the cut-off date for historic-age resources is 1973 (2018 letting date minus 45 years).

Affected Environment

Previously Identified Historic Resources

A review of the National Register of Historic Places (NRHP), and the lists of State Archeological Landmarks (SAL), Recorded Texas Historic Landmarks (RTHL), and Official Texas Historical Markers (OTHM) indicates that there are no previously designated properties within the historic resources study area. There are also no City of San Antonio designated landmarks within the historic resource study area.

Previous Historic Resources Surveys and Section 106 Coordination

Historic resources surveys of the US 281 project corridor were conducted in 2000, 2004, and 2006.

1. In correspondences with the THC dated April 14, 2000, TxDOT reported that the cultural resources survey conducted in 2000 of the US 281 project corridor, from 0.6 miles north of Loop 1604 to 2.5 miles north of Loop 1604, found no buildings, structures, or objects within the study area (Bell 2000). The SHPO concurred with this finding on April 19, 2000.
2. The 2004 survey of the US 281 project corridor from Stone Oak Parkway to FM 306 in Comal County identified 136 historic-age resources within an APE that varied from 800 to 1,300 feet beyond the proposed ROW. TxDOT determined that none of the resources were eligible for NRHP listing due to a "lack of architectural significance, severe alterations, and loss of historic integrity" (Jensen 2004). The SHPO concurred with TxDOT's findings of eligibility on July 23, 2004.
3. The third historic resources survey was performed in 2006 along the US 281 project corridor from Loop 1604 to Borgfeld Drive (the project limits for the US 281 Corridor Project). The survey identified 18 properties built before 1965 within a study area extending 500 feet beyond the proposed ROW. The surveyed properties included twentieth-century residential and commercial buildings, a bridge, box culverts, agricultural-related resources, and a roadside park. TxDOT and SHPO historians have determined that the class of culvert identified in the project area is categorically ineligible for NRHP listing due to a lack of engineering complexity. A pre-1965 bridge over Mud Creek was also evaluated in compliance with Section 110 of the NHPA and the MOU between TxDOT and SHPO. In accordance with the registration evaluation criteria established by SHPO and TxDOT for the 1999 Non-Truss Bridge Inventory, this bridge was determined to be not eligible for the NRHP under Criterion C for Engineering at the state level of significance, due to a loss of engineering integrity. TxDOT consulted with the Bexar County Historical Commission (CHC) to evaluate the historic significance of the bridge under Criterion A. The CHC responded that they did not believe the bridge possessed historic significance. TxDOT endorsed the report's recommendation that none of the surveyed resources were eligible for NRHP listing.

Environmental Consequences

No-Build Alternative

With the implementation of the No-Build Alternative additional ROW would not be required; therefore, there would be no direct impacts.

Proposed Build Alternatives

The results from previous non-archeological historic resources investigation and THC coordination were used to evaluate the potential impacts that could result from the Proposed Build Alternatives in the Draft EIS. The APE for non-archeological historic resources for the US 281 Corridor Project is defined as 150 feet beyond the proposed ROW for all alternatives. A historic resources reconnaissance survey will be completed for the Preferred Alternative in coordination with the SHPO, and documented in the

Final EIS. This field survey will be performed to confirm the condition/presence of the previously surveyed resources and whether resources built between 1966 and 1970 are present within the APE of the Preferred Alternative.

Based on the previous surveys, TxDOT records show that the current proposed APE for the US 281 Corridor Project (except for a 0.6-mile segment north of Loop 1604 and a 0.3-mile segment south of Stone Oak Parkway) was surveyed between 2000 and 2004. A subsequent survey in 2006 extended from Loop 1604 to Borgfeld Drive, which includes the limits of the US 281 Corridor Project. As discussed above, TxDOT coordinated these survey results with the SHPO, and found that no NRHP-eligible properties are present.

None of the previous undertakings within the US 281 project corridor were found to have any effects on non-archeological historic resources.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to non-archeological historic resources would not change based on funding options.

Conclusion

In summary, there have been multiple historic resources surveys to date throughout the APE. None of these have identified historic properties eligible for listing in the NRHP. A historic resources reconnaissance survey will be conducted for the Preferred Alternative in coordination with the SHPO and documented in the Final EIS. Following TxDOT guidance, the architectural historian will prepare a Project Coordination Request and submit it to TxDOT for review and comment. The architectural historian will prepare a Research Design conforming to TxDOT's *Standards of Submission for Non-Archeological Historic-age Resource Research Designs* for TxDOT review and comment. The architectural historian will perform a historic resources reconnaissance survey conforming to TxDOT's *Submission Standards for Non-Archeological Historic-age Resources Reconnaissance Survey Reports*. To accommodate the US 281 Corridor Project, the survey area will include 150 feet beyond the proposed ROW for the Proposed Build Alternatives.

TxDOT will evaluate historic-age resources within the APE to determine NRHP eligibility. TxDOT will also determine effects to historic properties in compliance with Stipulation VI *Undertakings with Potential to Cause Effects* of the First Amended Statewide Programmatic Agreement for Cultural Resources (PA) between FHWA, SHPO, the Advisory Council on Historic Preservation, and TxDOT and the MOU.

A public meeting regarding the Preferred Alternative is scheduled after the Draft EIS Public Hearing. The results of the historic resources reconnaissance survey and Section 106 coordination will be shared with the public at this meeting.

3.17.2 Archeological Resources

Methodology

As specified in the First Amended Statewide Programmatic Agreement for Cultural Resources (PA), among the FHWA, the Texas State Historic Preservation Officer (SHPO),

the Advisory Council on Historic Preservation (ACHP), and TxDOT, the archeological area of potential effects (APE) consists of the existing ROW along the US 281 project corridor, the ROW for the Proposed Build Alternatives, and any other areas that could be impacted by the US 281 Corridor Project. Background research has been conducted to determine whether there are any archeological sites listed in the NRHP, designated as SALs, or any sites of archeological interest within the APE of the proposed US 281 Corridor Project. Research was conducted at the Texas Archeological Research Laboratory (TARL), the THC, and online at the Texas Historic Sites Atlas. Site files, relevant maps, and NRHP listings were examined. Aerial photographs and USDA Soil Conservation Service survey maps were also examined. A summary of this information is presented below.

Affected Environment

Previous Archeological Investigations in Northern Bexar County

There have been multiple previous archeological investigations in northern Bexar County. The extent of modern development in this area has resulted in the investigation of a number of prehistoric sites mostly in the past three decades. Often in response to the requirements of federal and state laws, full-scale archeological excavations have been conducted at prehistoric archeological sites in northern Bexar County beyond the ROW of the US 281 project corridor at 41BX52, 41BX126, 41BX228, 41BX300, and at the Walker Ranch National Register Archeological District. In addition, for nearly the last decade, George Veni and Associates (GV&A) in association with Prewitt and Associates Inc. (PAI) have conducted continual hydro-geological, biological, and archeological investigations at Camp Bullis Military Reservation, west of the US 281 project corridor. These investigations were concluded with the identification of numerous newly recorded archeological sites.

1. A pedestrian archeological survey conducted by PAI was undertaken in 2000 and covered 3,255 acres of the Camp Bullis Military Reservation. The investigations resulted in the identification of 39 new archeological sites, including 28 prehistoric sites, 8 historic sites, and 3 sites with both components. PAI archeologists also revisited and reassessed 26 previously recorded sites.

2. A large aerial survey in the vicinity of the US 281 project corridor was conducted by the University of Texas at San Antonio (UTSA) in 1977. The survey consisted of 2,000 acres that became the Encino Park subdivision and identified a number of small prehistoric lithic scatters, including sites 41BX90, 41BX91, 41BX99, 41BX121, 41BX749, and 41BX758, recorded near the US 281 project corridor (McGraw et. al 1977). Over two decades later, in 2000, a subsequent field inspection found that only 41BX90 extended into the ROW of the US 281 project corridor (Houk 2000). Due to the non-diagnostic nature and disturbance of materials, it was not considered eligible for listing in the NRHP. In addition, a partial archeological survey of the proposed 21.3-mile US 281 expansion project from Evans Road to FM 306 in Bexar and Comal counties was conducted by SWCA Environmental Consultants in 2005.

   In 2001, two other previously recorded sites, 41BX749 and 41BX758 were identified further northward near Elm Creek, in the vicinity of US 281 and Stone Oak Parkway (Young 2001). Neither of these sites was found to extend into the ROW of the US 281 project corridor. Further south along the US 281 project

corridor, near the southern terminus of the US 281 Corridor Project, only one prehistoric archeological site has been previously recorded. Site 41BX777 was found in 1987 near the right bank of Mud Creek adjacent and west of US 281. A surface scatter of lithic debris was observed in a cleared plowed field beyond the ROW. The margin of this site may have once extended into US 281 project corridor, as evidenced by an occasional fragment of burned rock, but shovel testing did not identify any evidence of subsurface deposits. The site was identified so that it could be addressed if future construction expanded beyond the current ROW. In the vicinity of 41BX777, the ROW of the US 281 project corridor was inspected in 1999 as part of the Sonterra Boulevard/US 281 Overpass project (CSJ: 0253-04-108). No evidence of the site was found within the extensively disturbed ROW.

In 2008, University of Texas at San Antonio conducted a survey (Permit No. 4182) along Loop 1604 in areas proposed for expansion. This survey documented two new archeological sites and re-evaluated two previously recorded sites, none of which are in the APE the US 281 Corridor Project.

Previous Archeological Studies along the US 281 Project Corridor

There have been a number of surveys along the US 281 project corridor in northern Bexar County.

1. The first archeological survey was initiated in December 1984, as improvements to US 281 took place. The 1984 survey likely consisted of visual and windshield inspection and resulted in a report of negative findings (CSJ: 2998-422-019). The US 281 project corridor was revisited in September 1987, with similar results (CSJ: 2998-422-024).
2. In December 1995 intersection improvements along a portion of the US 281 project corridor were coordinated under Section 106, resulting in a recommendation that no survey was warranted (CSJ: 0253-004-0102).
3. In 1999, an archeological survey was conducted from 0.34 to 0.47 mile north of Loop 1604 in the vicinity of an overpass improvement (CSJ: 0253-04-108), and a year later, a portion of US 281 from 0.6 to 2.5 miles north of Loop 1604 was surveyed (CSJ: 0253-04-089) under THC Antiquities Permit No. 2332. One prehistoric archeological scatter of chipped stone, designated site 41BX90, was found to extend within the APE of the road expansion project. Due to the lack of chronologically diagnostic material and the extent of modern disturbances, the SHPO concurred in May 19, 2000, that the portion of the site within the proposed ROW was not eligible for listing in the NRHP.
4. In the following year, the proposed widening of the southbound parallel partial access-controlled lanes from Loop 1604 to Henderson Pass (CSJ: 6066-02-001 part of a maintenance project) resulted in a recommendation of no archeological properties affected with a concurrence from the SHPO on April 23, 2001. By 2002, expansion at two additional segments was reviewed: the US 281 expansion projects at Stone Oak Parkway (CSJ: 0253-04-114) and at Borgfeld Drive (CSJ: 0253-04-112). The former received a SHPO concurrence of no effect on March 3, 2002 and the latter, conducted by an archeological consultant under THC permit No. 2651, received the same on February 12, 2002. The US 281/Stone Oak Parkway project also included a new CSJ number (0253-04-114) that combined a

new north terminus at Marshall Road with the Stone Oak Parkway interchange project for combined limits from Loop 1604 to Marshall Road.

5. In early January 2005, TxDOT conducted a reevaluation of a segment of US 281 previously assessed in May 2000 (CSJ: 0253-04-089). This included a small northward extension of the APE approximately 0.25 mile further northward. TxDOT recommended that no historic archeological properties would be affected and received THC concurrence on January 20, 2005. Later, in July 2005, SWCA Environmental Consultants, on behalf of TxDOT and under THC Antiquities Permit No. 3471, performed an archeological survey within accessible areas along US 281 from Evans Road to FM 306 in Bexar and Comal counties (CSJs: 0253-04-093, 0253-03-043, 0253-03-057 and 0253-03-058). This survey recorded one non-diagnostic lithic scatter (site 41BX1620) within the existing ROW that was recommended as not eligible for listing in the NRHP. The SHPO agreed with this recommendation in July 2005. However, this survey covered the existing ROW only and did not investigate any areas of proposed new ROW. The SHPO agreed that further Section 106 consultation would be needed for the proposed new ROW, as right of entry (ROE) becomes available. A reevaluation of US 281 at Borgfeld Drive (CSJ: 0253-04-093 and -112) also occurred in November 2005, with no change from the original archeological finding of no effect.

6. Finally, in 2006, PBS&J conducted impact evaluations along US 281 in support of road expansion at several parcels where ROE was available. This impact evaluation consisted of pedestrian inspection only and documented five new archeological sites, 41BX1695-1699, which were recommended for further survey. Additionally, it documented that two sites, 41BX90 and 41BX121, within the APE of the road expansion did not merit further investigations. A TxDOT archeologist subsequently reevaluated these sites in 2008 after the acquisition of right-of-entry. TxDOT's report of survey received SHPO concurrence on April 17, 2008 (CSJ 0253-04-093).

Archeological Sites Within One Kilometer (.62 miles) of the Area of Potential Effect

The APE for archeological resources for the US 281 Corridor Project is defined as the proposed ROW for the Proposed Build Alternatives. Background research has revealed that there are 36 archeological sites within one kilometer of the APE for the US 281 Corridor Project (shown in **Table 3-51**). They are all prehistoric sites representing lithic procurement areas or open campsites. Most are on the surface or shallowly buried, and a review of current aerial photography suggests that many have likely been completely destroyed due to recent development. Of the 36 sites recorded, 14 sites were originally recommended for further archeological work at the time of recording. Sites 41BX1695-1699, for instance, were recorded through an impact evaluation of specific project areas along US 281 in 2006 and then recommended for more detailed survey. These sites were subsequently evaluated and found to warrant no further work. Thirteen archeological sites (41BX90, 41BX91, 41BX107, 41BX121, 41BX746, 41BX749, 41BX777, 41BX1620, and 41BX1695-1699) are within the APE. Of these thirteen sites, sites 41BX1620, 41BX90 41BX91, 41BX121, 41BX746, 41BX777, and 41BX1695-1699 are not considered eligible for listing in the NRHP and no further work is warranted for these sites. Sites 41BX749 and 41BX777 could require further assessment. Given the high incidence of existing site locales along the US 281 project corridor, it would be anticipated that unsurveyed

portions of the APE could contain similar archeological sites. However, it should be noted that most of the APE falls within an upland setting where surface geology is dominated by shallow soils overlying Edwards and Glen Rose formation limestone bedrock. These are ancient formations typically overlain by very shallow soils.

Table 3-51: Previously Recorded Archeological Sites

Site Number	Record Date	Site Type and Description	Distance from APE	Eligibility Status
41BX100	1977	Prehistoric open campsite with 6 dart points/preforms collected, utilized and retouched flakes, bifaces, cores, and a quarry blank situated on the E bank of W Elm Creek	1,200 ft from APE	testing recommended
41BX1008	1994	Prehistoric open campsite with fire-cracked rock, debitage, thin biface fragments, and projectile points including Scallorn, Edwards, and 1 Angostura located on low hillside E of tributary to Mud Creek	2,880 ft from APE	site nearly destroyed by looting
41BX101	1977	Prehistoric lithic scatter with cores and retouched and utilized flakes on a sloping terrace on the E bank of W Elm Creek	1,280 ft from APE	no further work recommended
41BX102	1977	Prehistoric lithic scatter including bifaces, point midsection, utilized and retouched flakes, and 1 point on a terrace on the W bank of W Elm Creek	810 ft from APE	no further work recommended
41BX103	1977	Prehistoric lithic scatter with 1 biface and utilized and retouched flakes on a rocky terrace on the E bank of W Elm Creek	650 ft from APE	no further work recommended
41BX104	1977	Prehistoric lithic scatter including quarry blanks, modified and unmodified flakes, and spokeshaves-may be isolated occurrence; site situated on hilltop E of US 281	1,280 ft from APE	no further work recommended
41BX105	1977	Prehistoric lithic scatter on the slope of an unnamed drainage	790 ft from APE	no further work recommended
41BX106	1977	Prehistoric lithic scatter including 1 point, bifaces, scrapers, cores, and possible burned rock midden situated on flat hilltop E of US 281	660 ft from APE	additional survey recommended
41BX107	1977	Prehistoric lithic procurement site including a biface, scraper, quarry blanks, cores, and retouched flakes on the W sloping ridge of Classen Hill	in APE	SHPO concurred no further work
41BX108	1977	Prehistoric lithic procurement site at head of small drainage cut through by Marshall Rd	1,350 ft from APE	no further work recommended
41BX109	1977	Prehistoric lithic scatter on E slope near the top of Classen hill	1,200 ft from APE	no further work recommended
41BX121	1977	Prehistoric lithic procurement site with bifaces, cores, large flakes, and a chert outcrop located on the side of a hill and draw of a tributary to W Elm Creek	in APE	not eligible, no further work recommended

Table 3-51: Previously Recorded Archeological Sites

Site Number	Record Date	Site Type and Description	Distance from APE	Eligibility Status
41BX122	1977	Prehistoric lithic procurement site with bifaces, preforms, cores, large flakes, scrapers, and an extensive chert outcrop on a sloping hillside E of US 281	1,850 ft from APE	no further work recommended
41BX1620	2005	Prehistoric lithic procurement site located on a high, upland hilltop cut through by the highway	in APE	no further work recommended
41BX1673	2006	Prehistoric lithic scatter including one biface, tested cobbles, cores, and lithic debitage on a terrace on the S bank of Mud Creek	980 ft from APE	no further work recommended
41BX1674	2006	Prehistoric lithic scatter including large flake core, biface thinning flakes, and debitage on a terrace of Mud Creek	1,480 ft from APE	no further work recommended
41BX1675	2006	Prehistoric lithic scatter including cores, tested cobbles, and lithic debitage on a terrace of Mud Creek	1,980 ft from APE	no further work recommended
41BX1695	2006	Prehistoric lithic scatter including a biface and Plainview-like dart point base situated 100 meters W of unnamed drainage to Elm Creek	in APE	reevaluation and survey determined site not eligible
41BX1696	2006	Prehistoric lithic scatter with Pedernales-like dart point base located 60 meters E of Elm Creek	in APE	reevaluation and survey determined site not eligible
41BX1697	2006	Prehistoric lithic scatter located on upland slope W of US 281; artifacts clustered around small karst feature	in APE	reevaluation and survey determined site not eligible
41BX1698	2006	Prehistoric lithic scatter located in clearing W of US 281	in APE	reevaluation and survey determined site not eligible
41BX1699	2006	Prehistoric lithic scatter with distal fragment of a dart point and natural chert outcropping located in upland setting W of US 281; imported gravels noted	in APE	reevaluation and survey determined site not eligible
41BX449	1974	Prehistoric lithic scatter with flakes and cores located on a drainage to W Elm Creek	1,300 ft from APE	unknown
41BX746	Mid 1980s	Prehistoric campsite with burned rock midden and projectile points including Corner tang fragments, Nolan, Montell, Pedernales, and Scallorn/Edwards situated on first terrace above tributary to Cibolo Creek	in APE	destroyed within the existing ROW
41BX749	1987	Prehistoric open campsite with debitage, Angostura, Pedernales, Montell, and Scallorn points, a mano, and a large burned rock midden situated on a limestone outcrop above a spring fed creek	in APE	testing recommended
41BX750	1987	Prehistoric open campsite described as having early to middle archaic dart points; site situated on a hill W of US 281	2,680 ft from APE	no further work recommended

Table 3-51: Previously Recorded Archeological Sites

Site Number	Record Date	Site Type and Description	Distance from APE	Eligibility Status
41BX758	1987	Prehistoric open campsite with at least 3 separate burned rock middens situated on the 1st terrace above a spring -feed intermittent creek bed	530 ft from APE	testing recommended
41BX759	1987	Prehistoric open campsite described as having Tortugas and Travis like points; site set on a ridge W of US 281	2,370 ft from APE	additional survey recommended
41BX777	1987	Prehistoric open campsite consisting of a light scatter of lithic debitage located on a terrace of Mud Creek	in APE	SHPO concurred no further work
41BX90	1977	Prehistoric lithic procurement and open campsite consisting of cores, quarry blanks, utilized flakes, unifacial scrapers, bifacial scrapers, and 1 bifacially worked knife along the W ridge of a drainage to W Elm Creek	in APE	SHPO concurred no further work
41BX91	1977	Prehistoric lithic procurement and open campsite with cores, blanks, and heat treated chert located on a drainage of W Elm Creek	in APE	SHPO concurred no further work
41BX92	1977	Prehistoric lithic procurement and open campsite with cores, blanks, scrapers, bifaces, and several point fragaments along several drainages of W Elm Creek	990 ft from APE	additional survey recommended
41BX93	1977	Prehistoric lithic scatter with cores, flakes, retouched flakes, unifaces, a blade core, and quarry blanks situated on a flat limestone outcropping E of US 281	3,130 ft from APE	no further work recommended
41BX94	1977	Prehistoric lithic procurement and open campsite with cores, blanks, scrapers, and bifaces along the W bank of W Elm Creek	3,320 ft from APE	no further work recommended
41BX98	1977	Prehistoric lithic scatter consisting of flakes, scrapers, bifaces, and 2 points set on a terrace on the W bank of W Elm Creek	2,140 ft from APE	testing recommended
41BX99	1977	Prehistoric open campsite with large bifaces, scrapers, drills, dart points/frags., flakes, and cores situated on a slope and hill E of US 281	370 ft from APE	testing recommended

Source: US 281 EIS Team 2011.

Environmental Consequences

No Build Alternative

With the implementation of the No-Build Alternative additional ROW would not be required; therefore, there would be no direct impacts.

Proposed Build Alternatives

The results from previous archeological investigations and THC coordination were used to evaluate the potential impacts that could result from the Proposed Build Alternatives in the Draft EIS. An archeological field survey will be completed for the Preferred Alternative in coordination with the SHPO, and documented in the Final EIS.

Based on the background research it is estimated that the following portions of the proposed ROW for the Proposed Build Alternatives have been previously surveyed for archeological resources with no further work recommended:

Table 3-52: Previously Surveyed Areas within the APE

Proposed Build Alternatives	Previously Surveyed ROW
Expressway Alternative	63%
Elevated Expressway Alternative	67%

Source: US 281 EIS Team, July 2011.

None of the archeological sites indentified within the proposed APE of the US 281 Corridor Project during previous surveys were found to be eligible for the NRHP. Therefore, none of the previous undertakings within the US 281 project corridor were found to have any effects on archeological resources eligible for listing on the NRHP or for designation as SALs.

One site has been recommended for further work. Site 41BX749 is located within the proposed ROW for the Expressway Alternative and the Elevated Expressway Alternative. At that time is was recorded, the site was located more than 200 feet west of US 281. However, since that time the ROW has expanded toward the site, and as currently mapped, appears to be within both Proposed Build Alternatives. It was recorded as a burned rock midden during a survey that took place in 1987. At the time, it was recommended for testing to determine eligibility for the NRHP and as SALs.

Archeological sites have been recorded in most areas that have been previously surveyed along the US 281 project corridor. Of the recorded archeological sites, all of them are prehistoric. Typically sites are on the surface or shallowly buried, and most appear (from a review of sites forms) to represent lithic procurement areas, open campsites, or kill sites with no interpretable features that would warrant further investigations. However, one site within the APE and an additional seven sites within one kilometer of the APE have been recommended for further work. Moreover, many of the previously recorded sites within the APE could extend outside the existing ROW of the US 281 project corridor and archeological deposits associated with them have not been evaluated for significance. Based on the review of aerial photographs, previous studies, soils and geology, it can be concluded that potential for prehistoric sites in unsurveyed areas is high. However, these same sources also suggest that sites would likely be shallowly buried or entirely on the surface and would probably reflect lithic procurement areas and temporary campsites with limited features. Artifacts could reflect the Paleoindian through late Prehistoric periods. It would be unlikely that any of these resources would have enough integrity to rise to the level of NHRP-eligibility.

There is limited potential for historic period sites. This portion of the county was very lightly occupied through the middle of the 20th century. If historic sites are identified, they would likely relate to 19th or 20th century ranches.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to

archeological resources would not change based on funding options.

Conclusion

In summary, there have been multiple archeological surveys to date throughout the APE, covering more than 60 percent of the current APE. None of these have identified archeological properties eligible for listing in the NRHP, or that warrant designation as SALs. In addition, a thorough desktop review and predictive model was preformed suggesting a low overall potential for NRHP-eligible resources to be found for either build alternative. For these reasons a field survey was not preformed during the preparation of the Draft EIS, but will be conducted for the Preferred Alternative in coordination with the SHPO and documented in the Final EIS. As noted above, a portion of the APE for the US 281 Corridor Project has not been surveyed, and there remains some potential for archeological sites to be identified within these unsurveyed portions. If an NRHP-eligible resource is found during this survey and may be adversely affected by the Preferred Alternative, there may be a need to revisit previously eliminated alternatives. A public meeting regarding the Preferred Alternative is scheduled after the Draft EIS Public Hearing. The results of the archeological survey and Section 106 coordination will be shared with the public at this hearing.

The Alamo RMA in coordination with TxDOT will continue Section 106 consultation and will oversee all investigations, and complete consultations with the SHPO and other consulting parties, as required under the provisions of the PA and MOU.

Compliance with Section 106 of the NHPA also requires that FHWA consult with federally recognized Native American tribes regarding this undertaking. Consultation with federally recognized tribes with a demonstrated interest in the region has been initiated following the PA among TxDOT, the SHPO, ACHP and FHWA, and the MOU between TxDOT and the THC.

3.18 SECTION 4(F) & SECTION 6(F) PROPERTIES

Section 4(f) of the DOT Act of 1966 (Title 49 USC, Section 1653(f) as amended and codified in 49 USC, Section 303 in 1983, states the Secretary of Transportation may approve a transportation program or project requiring use of publicly owned land of a public park, recreation area, wildlife/waterfowl refuge, or land of a historic site of national, state, or local significance (as determined by the officials having jurisdiction over the park, recreation area, refuge or site) only if there is no prudent and feasible alternative to such use and the project includes all planning to minimize harm.

TPWD Code, Title 3, Chapter 26 contains similar language concerning the taking of park and recreational lands. TPWD restricts the use or taking of any public land designated and used as a park (recreation area, scientific area, wildlife refuge, or historic site) unless the department, agency, political subdivision, county, or municipality determines there is no feasible and prudent alternative and that the project/program includes all reasonable planning to minimize harm to the land.

Section 6(f) of the Land and Water Conservation Fund (LWCF) Act requires that any outdoor recreational facilities acquired with the Department of Interior (DOI) financial assistance under the LWCF Act, as allocated by the TPWD, may not be converted to

non-recreational use unless approval is granted by the Director of the National Park Service (NPS).

3.18.1 Methodology

Existing public parks, recreational areas, wildlife/waterfowl refuges within one-quarter mile on each side of the US 281 project corridor were identified via field investigations, internet research, project mapping, 2010 aerial photography, and property ownership research. Identified properties were evaluated in the context of surrounding neighborhoods and adjacent properties, ownership and/or jurisdiction, adjacency to the Proposed Build Alternatives and associated impacts.

3.18.2 Affected Environment

No public parks, recreational areas, wildlife or waterfowl refuges or historic sites were identified within one-quarter mile of the US 281 project corridor.

3.18.3 Environmental Consequences

No-Build Alternative

With the implementation of the No-Build Alternative additional ROW would not be required; therefore, there would be no direct impacts.

Proposed Build Alternatives

As there are no public parks, recreational areas, wildlife or waterfowl refuges, and no historic sites within one-quarter mile of the project corridor, neither of the Proposed Build Alternatives would have a direct impact.

Based on the results of the desktop assessment and previous surveys it was determined that there is low potential for Section 4(f) to be triggered by either of the Proposed Build Alternatives. Therefore, supplemental field surveys for historic and archeological resources will be conducted for the Preferred Alternative only and documented in the Final EIS. A Public Meeting regarding the Preferred Alternative is scheduled to occur after the Draft EIS Public Hearing and prior to circulation of the Final EIS. Consultation for historic resources, as defined in 36 CFR 800.2, will be conducted following the surveys and used to refine the Preferred Alternative which will be presented in the Final EIS. If an NRHP-eligible resource is found during these surveys and may be adversely affected by the Preferred Alternative there may be a need to revisit previously eliminated alternatives.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to parkland and recreational areas would not change based on funding options.

3.18.4 Conclusion and Proposed Mitigation Measures

The US 281 Corridor Project is not expected to impact any publicly owned park, recreational area, wildlife or waterfowl refuge or historic site; therefore, a Section 4(f) Statement would not be required. No ROW would be required from any public park or recreational areas within one-quarter mile of the project corridor for either of the Proposed Build Alternatives. No existing parkland and recreation areas identified within one-quarter mile of the US 281 project corridor meet the definition of a Section 6(f) property. As such, no mitigation measures are proposed.

3.19 HAZARDOUS/REGULATED MATERIALS

The Hazardous Materials Assessment was conducted using TxDOT standard search radii (typically 0.25 to 1 mile) for federal and state environmental databases.

The same method will be utilized to identify hazardous materials within standard search radii of the Preferred Alternative in the Final EIS.

This section describes hazardous and regulated materials sites that have been identified in regulatory listings adjacent to and in proximity to the US 281 project corridor. It then presents the potential effects to these sites as a result of the Proposed Build Alternatives, and the No-Build Alternative, and then, concludes with proposed mitigation measures that could be taken to prevent potential harm to human health and the environment along the US 281 project corridor.

3.19.1 Methodology

A regulatory database search was performed, in accordance with American Society for Testing and Materials (ASTM) Standards: E 1527-00 *Standard Practice for Environmental Site Assessment*, to identify hazardous and regulated materials along the US 281 project corridor; the search included a review of 34 federal, 23 state, 1 local and 4 tribal regulatory databases. Hazardous and regulated materials sites are defined as having conditions that indicate existing and past releases, or a material threat of release of any hazardous substance or petroleum products into the ground, ground water, or surface water. Hazardous and regulated material sites were identified within and in proximity to the US 281 project corridor, from Loop 1604 to Borgfeld Drive, by analyzing the database search in GIS. ASTM Standard E 1527-05 was used to establish search radii, or the recommended distance from the US 281 project corridor for each database search, in order to capture the potential harm to human health and the environment as regulated under applicable laws and regulations. A hazardous and regulated materials study area was established based on these search radii which are discussed in more detail in **Table 3-53.** In addition to the regulatory listings of hazardous and regulatory materials sites, a GIS search was conducted to identify the location of public water supply wells that could potentially be affected by the US 281 Corridor Project. And, a general oil and gas well and pipeline review was conducted using information provided by the Railroad Commission of Texas (RRC) to determine potential impacts of the US 281 Corridor Project. These database searches serves as an initial screening-type assessment to indicate areas of potential concern for further study or precautionary actions. These limitations should be recognized when consideration is given to the Proposed Build Alternatives.

Table 3-53: Federal, State, Local and Tribal Regulatory Listings and Search Radius

Database	Search Radius
Federal Regulatory Listings	
Aerometric Information Retrieval System / Air Facility Subsystem	US 281 Project Corridor
Biennial Reporting System	US 281 Project Corridor
Clandestine Drug Laboratory Locations	US 281 Project Corridor
EPA Docket Data	Existing US 281 ROW
Federal Engineering Institutional Control Sites	US 281 Project Corridor
Emergency Response Notification System	US 281 Project Corridor
Facility Registry System	US 281 Project Corridor
Hazardous Materials Incident Reporting System	US 281 Project Corridor
Integrated Compliance Information System	US 281 Project Corridor
Integrated Compliance Information System National Pollutant Discharge Elimination System	US 281 Project Corridor
Material Licensing Tracking System	US 281 Project Corridor
National Pollutant Discharge Elimination System	US 281 Project Corridor
PCB Activity Database System	US 281 Project Corridor
Permit Compliance System	US 281 Project Corridor
Cerclis Liens	US 281 Project Corridor
Section Seven Tracking System	US 281 Project Corridor
Toxics Release Inventory	US 281 Project Corridor
Toxic Substance Control Act Inventory	US 281 Project Corridor
No Longer Regulated RCRA Generator Facilities	US 281 Project Corridor and Adjacent Property
Resource Conservation & Recovery Act – Generator Facilities	US 281 Project Corridor and Adjacent Property
Brownfields Management System	0.50 miles from US 281 Centerline
Comprehensive Environmental Response, Compensation & Liability Information System	0.50 miles from US 281 Centerline
Land Use Control Information System	0.50 miles from US 281 Centerline
No Further Remedial Action Planned Sites	0.50 miles from US 281 Centerline
No Longer Regulated RCRA Non-CORRACTS TSD Facilities	0.50 miles from US 281 Centerline
Open Dump Inventory	0.50 miles from US 281 Centerline
Resource Conservation & Recovery Act – Treatment, Storage & Disposal Facilities	0.50 miles from US 281 Centerline
Delisted National Priorities List	1.0 mile from US 281 Centerline
Department of Defense Sites	1.0 mile from US 281 Centerline
Formerly Used Defense Sites	1.0 mile from US 281 Centerline
No Longer Regulated RCRA Corrective Action Facilities	1.0 mile from US 281 Centerline
National Priorities List	1.0 mile from US 281 Centerline
Proposed National Priorities List	1.0 mile from US 281 Centerline
Resource Conservation & Recovery Act – Corrective Action Facilities	1.0 mile from US 281 Centerline
Record of Decision System	1.0 mile from US 281 Centerline
State of Texas Regulatory Listings	
Groundwater Contamination Cases	US 281 Project Corridor
Historic Groundwater Contamination Cases	US 281 Project Corridor

Table 3-53: Federal, State, Local and Tribal Regulatory Listings and Search Radius

Database	Search Radius
TCEQ Liens	US 281 Project Corridor
Municipal Setting Designations	US 281 Project Corridor
Notice of Violations	US 281 Project Corridor
State Institutional/Engineering Control Sites	US 281 Project Corridor
Spills Listing	US 281 Project Corridor
Dry Cleaner Registration Database	0.25 miles from US 281 Centerline
Industrial and Hazardous Waste Sites	0.25 miles from US 281 Centerline
Permitted Industrial Hazardous Waste Sites	0.25 miles from US 281 Centerline
Petroleum Storage Tanks	0.25 miles from US 281 Centerline
Affected Property Assessment Reports	0.50 miles from US 281 Centerline
Brownfields Site Assessments	0.50 miles from US 281 Centerline
Closed & Abandoned Landfill Inventory	0.50 miles from US 281 Centerline
Innocent Owner / Operator Database	0.50 miles from US 281 Centerline
Leaking Petroleum Storage Tanks	0.50 miles from US 281 Centerline
Municipal Solid Waste Landfills	0.50 miles from US 281 Centerline
Railroad Commission VCP and Brownfield Sites	0.50 miles from US 281 Centerline
Radioactive Waste Sites	0.50 miles from US 281 Centerline
Tier II Chemical Reporting Program Facilities	0.50 miles from US 281 Centerline
State Superfund Sites	1.0 mile from US 281 Centerline
Local Regulatory Listing	
Edwards Aquifer Permits	US 281 Project Corridor
Tribal Regulatory Listings	
Underground Storage Tanks on Tribal Lands	0.25 miles from US 281 Centerline
Leaking Underground Storage Tanks on Tribal Lands	0.50 miles from US 281 Centerline
Open Dump Inventory on Tribal Lands	0.50 miles from US 281 Centerline
Indian Reservations	1.0 mile from US 281 Centerline

Source: GeoSearch Radius Report, May 2010.

3.19.2 Affected Environment

The database search identified 35 permitted and non-regulated facilities that currently store, have stored in the past, or have been impacted by hazardous and regulated materials along the US 281 project corridor, as shown in **Table 3-54**. A description of the databases and the detailed results of the search can be found in **Appendix H**.

Table 3-54: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
1	**Loop 1604 Toll Starter System** Loop 1604 – From west of NW Military to east of Judson Road San Antonio, TX 78258	0.001 miles E	Not Available	This facility is subject to environmental regulations. A site assessment was conducted in 2006 in association with an Edwards Aquifer Permit (EAP) which concluded that using a sand filter is the best management practice for this facility.
2	**US 281** Along US 281 - From Loop 1604 to Marshall Road.	0.001 miles NE	Not Available	A site assessment was completed in 2006 in association with an EAP which concluded that vegetative filter strips and swales are the best management practice for this facility. A compliance report was later issued for 1 acre of the 174 acre area.
3	**US 281 at Borgfeld Dr.** From north of Bulverde Road to the Bexar/Comal County line.	0.001 miles N	Not Available	A site assessment was completed in 2005 in association with an EAP which concluded that vegetative filter strips and swales are the best management practice for this facility.
4	**US 281 at Loop 1604** From 0.34 miles north of Loop 1604 to 0.47 miles north of Loop 1604.	0.010 miles NE	Not Available	A site assessment was completed in 1999 in association with an EAP; however, no actions or recommendations were provided.
5	**Ram Store 24 Tetco Store 310** **Cowboy Cleaners 6** 27755 US 281 N San Antonio, TX 78260	0.010 miles W	Gasoline – 1 active and 3 removed underground storage tanks Dry Cleaning Chemicals	The Ram Store reported an underground petroleum storage tank leak in 1999 that resulted in groundwater impacts to water supply wells within ¼ mile. Corrective action was taken and the case was closed. The Ram Store also received three minor citations from TCEQ in 2007 for violation of water quality regulations. The Tetco Store 310, a gas station, is listed as having removed 3 underground petroleum tanks from the ground in 2008. And, Cowboy Cleaners 6 is a registered dry cleaning facility with TCEQ.
6	**The Iron Skillet** **Carryon** 26715 US 281 N San Antonio, TX 78260	0.010 miles S	Gasoline – 5 active underground storage tanks Diesel - 1 inactive above ground storage tank	Carryon contains 4 active underground petroleum storage tanks which are legally authorized. The Iron Skillet owns 1 legally authorized above ground petroleum storage tank which is not active and 1 active underground storage tank that was reported to have leaked (no date provided) but did not result in groundwater impacts. In 2007 The Iron Skillet received two moderate citations from TCEQ for violations of waste storage regulations. In addition, The Iron Skillet was involved in litigation involving compliance with EPA regulations; however, the details of this case are not disclosed.

Table 3-54: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
7	**Dailey Car Wash** **Jabez Territory Supplies** **Mark William Dailey** 25661 US 281 N San Antonio , TX 78258	0.010 miles SE	Car Wash Chemicals Landscaping Supplies	Dailey Car Wash and Jabez Territory Supplies are listed on the Federal Registry System and therefore subject to environmental regulations. Mark William Dailey, a landscape irrigation system installation business, was given three moderate citations in 2008-09 for violations associated with business practices.
8	**Parrish & Co.** 26995 US 281 N San Antonio , TX 78260	0.010 miles NW	Not Available	Parrish & Co. is listed on the Federal Registry System and therefore subject to environmental regulation. In 2006, this establishment was reported to have spilled an undisclosed material/amount into the Cibolo Creek. After inspection by the Bexar County Fire Marshall's Office the case was closed.
9	**Stonegate Substation (VO)** 25529 US 281 N San Antonio, TX 78258	0.010 miles N	Sulfuric Acid	Stonegate Substation is an electric bulk power transmission and control facility that stores sulfuric acid in its control house. The facility has passed all validation checks.
10	**Ferrell Gas** 26585 US 281 N San Antonio, TX 78260	0.010 miles SE	Liquefied Petroleum Gas	Ferrell Gas is reported to have liquefied petroleum gas on the property. This facility has passed all validation checks.
11	**Winchester Hills** US 281 and Marshall Road. San Antonio, TX 78259	0.010 miles SE	Not Available	Winchester Hills is a residential neighborhood managed by a homeowner's association that is listed on the Federal Registry System and therefore subject to environmental regulations.
12	**US 281 Southbound Frontage Road** From Henderson Pass Road. to Loop 1604	0.020 miles S	Not Available	A site assessment was completed in association with an EAP (no date provided) and no actions or recommendations were provided.
13	**Ancira Enterprises** **Ancira Chrysler** 24000 US 281 N San Antonio, TX 78528	0.020 miles SE	Gasoline – 1 active above ground storage tank	Ancira is reported to have gasoline on the property which is stored in an above ground storage tank. This facility has passed all validation checks.
14	**Speedy Stop 31** 22255 US 281 N San Antonio, TX 78258	0.020 miles W	Gasoline – 2 removed underground storage tanks	Speedy Stop had 2 gasoline underground storage tanks on property which were removed in 2005.
15	**David Arkerman (Chevron)** 24341 US 281 N San Antonio, TX 78260	0.020 miles NW	Gasoline – 1 removed underground storage tank	The Chevron station had 1 gasoline underground storage tank on property which was removed in 1987.
16	**Weekley 281 Venture** 26443 US 281 N San Antonio, TX 78260	0.020 miles W	Not Available	Weekley 281 Venture is listed on the Facility Registry System and is therefore subject to environmental regulation.

Table 3-54: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
17	**Five Star Cleaners** 20821 US 281 N San Antonio, TX 78258	0.020 miles S	Dry Cleaning Chemicals	Five Star Cleaners is a registered dry cleaning facility with TCEQ.
18	**Residential Property** 27890 US 281 N San Antonio, TX 78260	0.030 miles SE	BTEX, MTBE	Hazardous and regulated materials have been identified on this residential property that may impact groundwater but which has been traced to a source outside the property. As such, the property owner is not held liable for the contamination.
19	**Bigs 205** 23650 US 281 N San Antonio, TX 78258	0.040 miles SE	Gasoline – 2 active underground storage tanks	Bigs is reported to have 2 legally authorized active underground storage tanks for gasoline.
20	**Speedy Stop 48** 26950 US 281 N San Antonio, TX 78260	0.040 miles SE	Gasoline/Diesel – 3 active underground storage tanks	Speedy Stop is reported to have 3 legally authorized active underground storage tanks, 2 store gasoline and 1 stores diesel.
21	**San Antonio Water System – Oliver Ranch** 26293 US 281 N San Antonio, TX 78258	0.080 miles W	Chlorine	San Antonio Water System stores liquid chlorine on its property. This facility has passed all validation checks.
22	**Five Star Cleaners** 20770 US 281 N, Ste. 107 San Antonio, TX 78258	0.120 miles SE	Dry Cleaning Chemicals	Five Star Cleaners is a registered dry cleaning facility with TCEQ.
23	**Martin Marietta Materials – San Pedro Plant** 19265 US 281 N San Antonio, TX 78258	0.120 miles W	Diesel – 1 active above ground storage tank	Martin Marietta Materials is reported to have 1 legally authorized active above ground storage tank for diesel.
24	**Estates Utility Stonegate** 2363 Estate Gate Dr. San Antonio, TX 78260	0.120 miles W	Chlorine	Estates Utility Stonegate is reported to store chlorine on its property. This facility has passed all validation checks.
25	**Hill Country Dry Cleaners** 18160 US 281 N, Ste. 601 San Antonio, TX 78232	0.120 miles SE	Dry Cleaning Chemicals	Hill Country Dry Cleaners is a registered dry cleaning facility with TCEQ.
26	**Henshaw Brothers Grocery** 26098 US 281 N San Antonio, TX 78258	0.130 miles E	Gasoline – 3 removed underground storage tank	Henshaw Brothers Grocery had 3 gasoline underground storage tanks on property, one of which was reported to have leaked in 1994. The leak was reported to have impacts to the Edwards Aquifer recharge or transition zones. All 3 tanks were removed later that year. Final concurrence was issued and the case is closed.

Table 3-54: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
27	**Wal-Mart Supercenter 1198** 1515 N Loop 1604 E San Antonio, TX 78258	0.160 miles W	Not Available	Wal-Mart has 1 legally authorized active underground storage tank with the capacity of under 1 gallon that stores an undisclosed material.
28	**Contractors Yard** 26254 US 281 N San Antonio, TX 78216	0.170 miles E	Gasoline/Diesel – 4 inactive above ground storage tanks	Contractors Yards has 3 diesel and 1 gasoline storage tank on property which are currently out of use.
29	**San Antonio Water System – Encino Park #2** 19754 US 281 N San Antonio, TX 78259	0.170 miles SE	Chlorine	San Antonio Water System stores liquid chlorine on its property. This facility has passed all validation checks.
30	**Cowboy Cleaners** 28120 US 281 N San Antonio, TX 78260	0.170 miles NE	Dry Cleaning Chemicals	Cowboy Cleaners is a registered dry cleaning facility with TCEQ.
31	**The Home Depot #6550** 20740 US 281 N San Antonio, TX 78259	0.190 miles SE	Sulfuric Acid, NOs, Aerosols, Gasoline, Mercury, Peroxide, Oxidizers, Compressed Oxygen and Gas, Fertilizer & Pesticides, Paints & Stains, Propane, Bleach, Fluorescent Light Bulbs, Lead Acid Batteries, and Others	Home Depot has been classified as a small quantity generator, non-industrial hazardous waste site. This facility stores Sulfuric Acid for which a validation check has been completed. This facility has been reported to have had a leaking petroleum tank (no date or details provided) which impacted groundwater but had no apparent impacts to receptors.
32	**D&D Machinery Sales** 2420 WR Larson Rd San Antonio, TX 78261	0.220 miles SE	None	D&D Machinery Sales was registered as a small quantity generator of hazardous waste; however, this registration was deactivated as no waste was produced over three consecutive years.
33	**Pilgrim Cleaners 346** 2339 E. Evans Rd., Ste. 112 San Antonio, TX 78259	0.250 miles SE	Dry Cleaning Chemicals	Pilgrim Cleaners is a registered dry cleaning facility with TCEQ.
34	**MCI – SWCOTX** 20855 Stone Oak Pkwy. San Antonio, TX 78258	0.320 miles W	Sulfuric Acid	MCI stores sulfuric acid on its property. This facility has passed all validation checks.

Table 3-54: Confirmed Hazardous and Regulated Materials Sites

Site ID	Facility Name/Address	Distance from US 281	Hazardous and Regulated Material	Summary of Database Search
35	**Costco #693** 1201 N Loop 1604 E. San Antonio, TX 78232	0.430 miles W	Sulfuric Acid, Lead Acid Batteries	Costco stores sulfuric acid and lead acid batteries on its property. This facility has passed all validation checks.

Source: GeoSeach Radius Report, May 2010.

Petroleum Storage Tanks Sites and Leaking Storage Tanks

Based on a detailed review, there are 11 sites within the hazardous and regulated materials study area that are reported to have or have had petroleum storage tanks on their property. Of the 11, 7 of the sites actively use the tanks to store gasoline and diesel fuel. Eight of the eleven sites reported storing petroleum in underground tanks of which four sites have removed some or all of the tanks from the ground. And, four sites have reported leaking tanks, three of which remain actively in use. As there have been four incidents of leaking petroleum tank within the study area, there is some potential for risk of encountering hazardous and regulated materials along the US 281 project corridor. The Iron Skillet, at 26715 US 281 N, was reported to have leaked gasoline (no date reported); however, no impacts to groundwater or receptors were documented. Final concurrence was issued for The Iron Skillet leak, the case was closed and the tank is still actively in use. The Ram Store 24, at 27755 US 281 N, was reported to have leaked gasoline in 1999 that resulted in ground water impacts and impacts to water supply wells within ¼ mile. Final concurrence was issued for The Ram Store leak, the case was closed, and the tank is still in active use. Henshaw Brothers Grocery, at 26098 US 281 N, was reported to have leaked gasoline in 1994 resulting in impact to the Edwards Aquifer recharge or transition zones. Final concurrence was issued for this leak, the case was closed and the tank was removed from the ground. And, Home Depot, 20740 US 281 N, was reported to have leaked petroleum (no date provided) which resulted in ground water impacts but no apparent threat to receptors. Final concurrence has been issued for the Home Depot leak, the case was closed and the tank remains in active use.

Other Hazardous and Regulated Materials

In addition to sites indentified above as storing or having had stored petroleum on their property, 15 sites are reported to store other hazardous and regulated materials in the hazardous and regulated materials study area. Six of these sites are dry cleaning establishments which are currently registered and in compliance with TCEQ regulations. Other regulated materials that exist within the study area include stored chlorine, sulfuric acid, and propane gas; all sites that store these hazardous and regulated materials are in compliance with the Tier II Chemical Reporting Program and have passed all validation checks. The potential risk associated with these sites is low as the database search revealed no reported leaks or violations.

Oil and Gas Well Sites

The RRC website identified no natural gas wells or pipelines within the US 281 project corridor. Based on the review of available information associated with oil and gas wells

and pipelines, the potential for impacts resulting from the Proposed Build Alternatives is low.

3.19.3 Environmental Consequences

No Build Alternative

This desktop level of review reveals that the 35 sites indentified within the hazardous and regulated materials study area are currently in compliance with environmental regulations and that past violations have been remedied and all cases are closed. As such, it is unlikely that the No-Build Alternative, which does not involve construction or acquisition of ROW, would result in the disturbance of hazardous and regulated materials. Therefore there likely would be no effect under the No-Build Alternative.

Proposed Build Alternatives

The location of each site identified in the database search was compared with the footprints of the Proposed Build Alternatives, which includes the proposed roadway and the proposed ROW, to determine if hazardous and regulated material sites could be impacted. The Proposed Build Alternatives were then compared to each other based on whether their proposed footprints could affect any portion of the properties identified above. As shown in **Table 3-55,** each Proposed Build Alternative has the potential to impact eight properties that currently have or have had in the past, hazardous and regulated materials on site.

Table 3-55: Properties Impacted by Alternatives and Hazardous and Regulated Material Sites

Alternative	Number of Properties Identified with Hazardous and Regulated Materials that could be Impacted by the US 281 Corridor Project	
No-Build Alternative	0	None
Expressway Alternative	8	2 - leaking petroleum storage tanks (cases closed) 1 - hazardous materials spill (case closed) 1 - property with known hazardous material contamination 4 - properties that are regulated for hazardous and regulated materials
Elevated Expressway Alternative	8	1 - leaking petroleum storage tank (case closed) 1 - hazardous materials spill (case closed) 1 - property with known hazardous material contamination 5 - properties that are regulated for hazardous and regulated materials

Source: US 281 EIS Team, GeoSearch, May 2010.

As shown, the Proposed Build Alternatives are generally comparable with the exception that the Expressway Alternative has the potential to impact two properties that have had leaking petroleum storage tanks on site, as compared to one property for the Elevated Expressway Alternative. If a Proposed Build Alternative is identified, it is recommended that subsurface investigations be considered within the vicinity of leaking petroleum storage tanks sites to determine if hazardous materials from any of these facilities have adversely affected the subsurface conditions of the areas within the footprint of each of the Proposed Build Alternatives.

In addition, a more detailed assessment is recommended if a Proposed Build Alternative is chosen to determine the extent of impacts that could occur as a result of construction.

Below are some considerations associated with the implementation of a Proposed Build Alternative:

- Any bridge or existing roadway pavement demolition could disturb potentially contaminated soils and would require the relocation of existing extensive utilities traversing the US 281 project corridor
- The proposed US 281 Corridor Project may involve excavation at locations where there are existing pipelines, utilities, ROW easements, and/or existing or abandoned railroad crossings, tracks, and ancillary equipment (such as crossties, switches, rail, trim, fasteners) which may require further assessment to evaluate potential releases
- Evidence of water wells were identified within the ½ mile around the US 281 project corridor based on aerial photography (See **Section 3.9** for detailed discussion). Prior to any planned construction, a more detailed search may be required to supplement this database
- No evidence of oil and gas well activities located within the boundaries of the proposed project area was determined based on aerial photography and a database search; however, additional assessment may be required for confirmation of these findings

Any unanticipated hazardous materials and/or petroleum contamination encountered during construction would be handled according to applicable state and federal regulations and TxDOT Standard Specifications and Guidelines for handling emergency discovery of hazardous materials.

If any structures are disturbed during construction activities, an Asbestos Survey would be completed to comply with EPA regulations (40 CFR 61, Subpart M - *National Emissions Standard for Hazardous Air Pollutants*) and the *Texas Asbestos Health Protection Rules* (25 TAC 295.31 - .71). These regulations require that, prior to any construction, renovation, or demolition, the area where work is to be performed shall be inspected by a properly trained and licensed individual for the presence of asbestos-containing materials that may be disturbed during the work.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. The ROW requirements for the non-toll, toll and managed lane options for each alternative are the same, therefore the impacts to hazardous/regulated materials would not change based on funding options.

3.19.4 Conclusion and Proposed Mitigation Measures

This database search should be considered as an initial screening assessment to indicate areas of potential concern for further study or precautionary actions. These limitations should be recognized when consideration is given to the Proposed Build Alternatives. A Hazardous Materials Assessment will be completed utilizing the same methodology as the Draft EIS for the Preferred Alternative and documented in the Final EIS.

Any unanticipated hazardous materials and/or petroleum contamination encountered during construction would be handled according to applicable federal and state regulation per TxDOT Standard Specifications.

The contractor would take appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area. The use of construction equipment within sensitive areas would be minimized or eliminated entirely. All construction materials used for this project would be removed as soon as work schedules permit.

3.20 VISUAL AND AESTHETIC QUALITIES

3.20.1 Methodology

This evaluation utilizes the guidance developed by FHWA for the assessment of visual impacts: Esthetics and Visual Quality Guidance Information (1986), Environmental Impact Statement Visual Impact Discussion (undated), and Visual Impact Assessment for Highway Projects (1981).

There are two groups that could potential be visually and aesthetically impacted by the US 281 Corridor Project: (1) individuals with a view from the road (roadways users), and (2) individuals with a view of the road (roadway viewers). This visual experience of the aesthetic quality of an area depends upon land, waterbody, vegetation and human development patterns.

Evaluating Visual and Aesthetic Change - Roadway Viewers

The existing US 281 project corridor generally follows the contours of the land with many cuts into the landscape. The roadway is visible from many adjacent properties that have an unencumbered view (not blocked by vegetation, terrain and/or other structures or buildings). Both of the Proposed Build Alternatives contemplate improvements that would elevate segments of the roadway higher than the existing US 281 roadway. This change would mean that existing roadway viewers could have a more prominent view of the roadway and/or there could be new roadway viewers.

GIS modeling was used to estimate the number of existing and future roadway viewers. A baseline condition was established using the contours of the landscape and the elevation of the existing US 281 roadway. An elevation point was placed every 500 feet along the roadway and a viewshed was mapped in order to estimate where roadway viewers are located. The visual changes were then modeled based on the proposed elevation of the roadway and structure, as contemplated for the Proposed Build Alternatives (see **Appendix K1**). An elevation point was mapped along the roadway every 500 feet and at the locations of other proposed elevation changes, such as at overpasses, on and off ramps, and at US 281/Loop 1604 interchange direct connectors for both of the Proposed Build Alternatives.

A roadway viewer was counted if a land parcel was within the mapped viewshed. It is assumed that a roadway viewer is located six feet above the ground (such as from a first floor window) and that there are no encumbered views. This is likely to overestimate the number of roadway viewers as there are likely many views of US 281, particularly in residential neighborhoods, that are blocked by vegetation, homes or other structures.

Roadway Viewer Response

According to FHWA guidance, a change in viewer exposure is typically assessed by measuring the number of viewers exposed to the change and the position of the viewer. The position of the viewer is described in the guidance as three distinct viewing distances, foreground (0 to 0.25 miles from the roadway), middleground (0.25 to 3 miles from the roadway) and background (greater than 3 miles from the roadway). Roadway viewers located in the foreground are anticipated to have direct exposure to the change and are analyzed here; effects to middleground and background viewers are described in **Chapter 4 – Indirect Effects**.

Southern US 281 Corridor

Photo: US 281 EIS Team, 2011

Visual sensitivity is a relative measure of the degree of concern that a roadway viewer may have in response to the change. Viewer sensitivity is determined by evaluating the type of land use and viewing duration. Different viewer types have different sensitivities. Residential land uses are typically the most sensitive to change because a view of a roadway is generally perceived as negative and residential land uses are occupied day and night. Commercial uses however, are primarily occupied only during working hours and increased visibility of a business is generally perceived as positive.

Evaluating Visual and Aesthetic Change - Roadway Users

Roadway users have a temporary and changing view of the surrounding landscape and land uses as they travel through the US 281 project corridor, as such, they generally have less exposure and sensitivity to the visual and aesthetic conditions compared to roadway viewers. The viewshed models used for roadway viewers were also used to estimate the area likely to be visible from the roadway.

3.20.2 Affected Environment

The US 281 project corridor is located within the Edwards Plateau ecological region of Texas, which is characterized by steep hillsides, pastoral fields and oak and juniper parks and forests. Much of the natural landscape around the US 281 project corridor has been altered by commercial and residential development, especially the southern portion. The southern portion of the US 281 project corridor consists of creates a viewshed mainly composed of large retail shopping centers, multi-family and single-family residences.

Traveling north from Loop 1604, the roadway user will see the large limestone wall that delineates several acres of a quarry located on the west side of the US 281 project corridor. There are open expanses of cleared lands, devoid of vegetation, which appear to be prepared for development. The tallest structures seen by the roadway user are several water towers, power lines and cell phone towers on both sides of the roadway. As the roadway user passes The Village at Stone Oak, a large retail shopping center in the northeast quadrant of the US 281 and Stone Oak Parkway intersection, the viewshed becomes less dominated by development and includes areas with large tracts of native trees and shrubs interspersed with small businesses (adjacent to the US 281 project corridor) and single-family residences (set back from the US 281 project corridor).

Roadway viewers have a viewshed similar to the roadway user in that it is mainly composed of parking lots, driveways and the current US 281 facility. The roadway viewer sees the highway against a backdrop of homes and businesses. There are currently no sidewalks except for a few signalized cross walks at intersections where the US 281 Super Street was constructed. In the northern portion of the corridor, past Stone Oak Parkway, the viewer will see the highway amongst more natural topography with denser areas of native vegetation.

There are several residential neighborhoods and apartment complexes as well as large lot residential properties located in proximity to the existing US 281 project corridor. Some of the residents in these areas are existing roadway viewers and some could become new roadway viewers as a result of the Proposed Build Alternatives. From south to north, the residential neighborhoods include:

- Redland Ridge neighborhood
- The Ravina Apartments
- Encino Park neighborhood
- Big Springs neighborhood
- Villages at Encino Park neighborhood
- Stone Oak neighborhood
- The View at Encino Commons (Apartments)
- Cavalo Creek Estates neighborhood
- Oakridge Heights neighborhood
- Encino Ridge neighborhood
- Evans Ranch neighborhood
- Winchester Hills neighborhood
- The Oaklands neighborhood
- Mountain Lodge neighborhood
- Sendero Ranch neighborhood
- Summerglen neighborhood
- Lookout Canyon neighborhood
- Belterra neighborhood
- Tuscan Oaks neighborhood
- The Estates of Stonegate neighborhood
- Trinity Oaks neighborhood
- Large lot residential properties north of Bulverde Road

Northern US 281 Corridor

Photo: Google, 2012

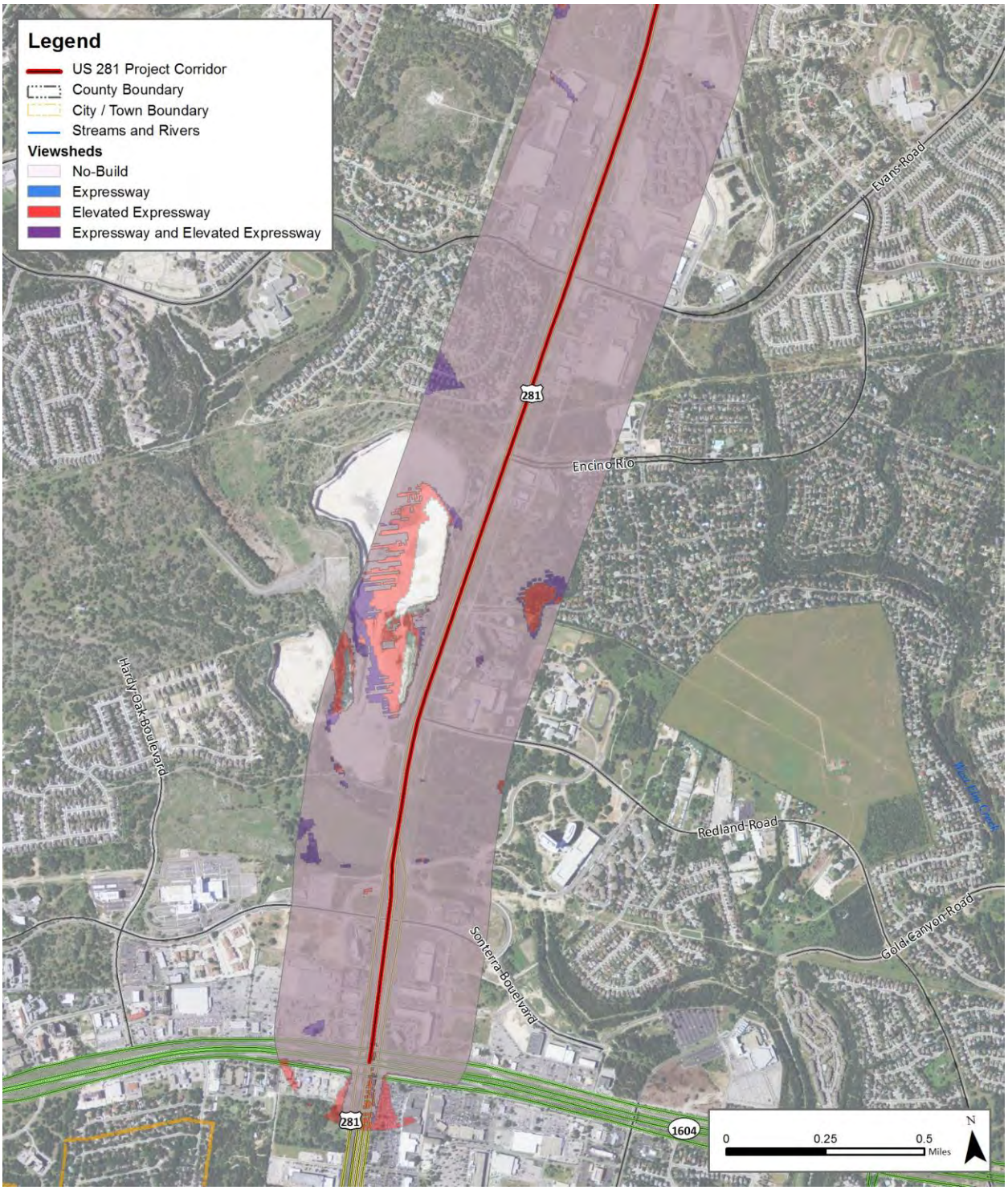
3.20.3 Environmental Consequences

No-Build Alternative

US 281 is currently visible to most of the properties located in the foreground viewshed of the US 281 project corridor (**Figure 3-31a** through **Figure 3-31c**). Approximately 795 residential properties within the existing foreground viewshed.

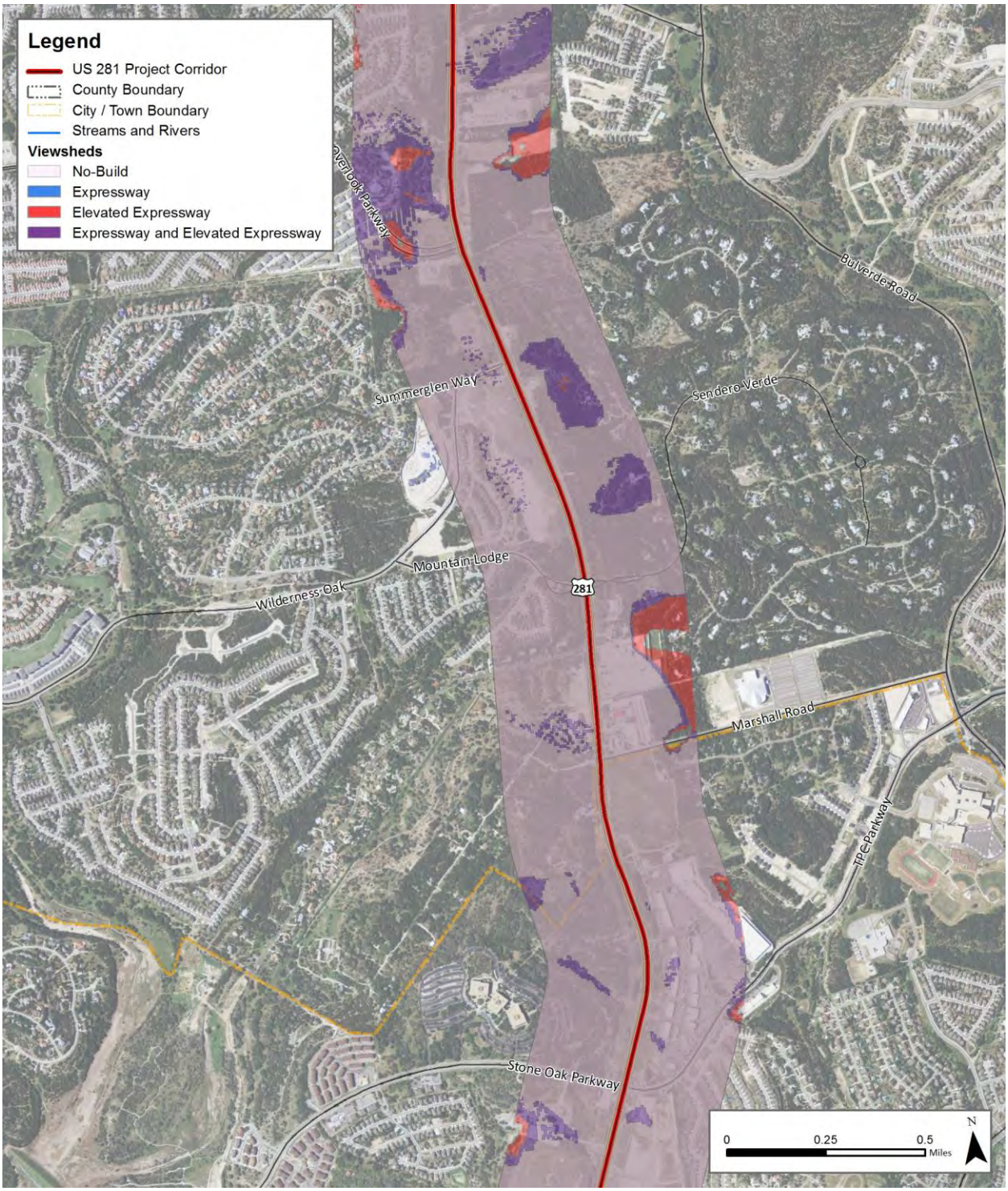
The No-Build Alternative does not propose changes to the US 281 project corridor so would not increase or decrease the exposure for either roadway viewer or roadway user. As such, the No Build Alternative would have no direct effect on the visual and aesthetic quality of the project corridor.

Figure 3-31a: Foreground viewshed



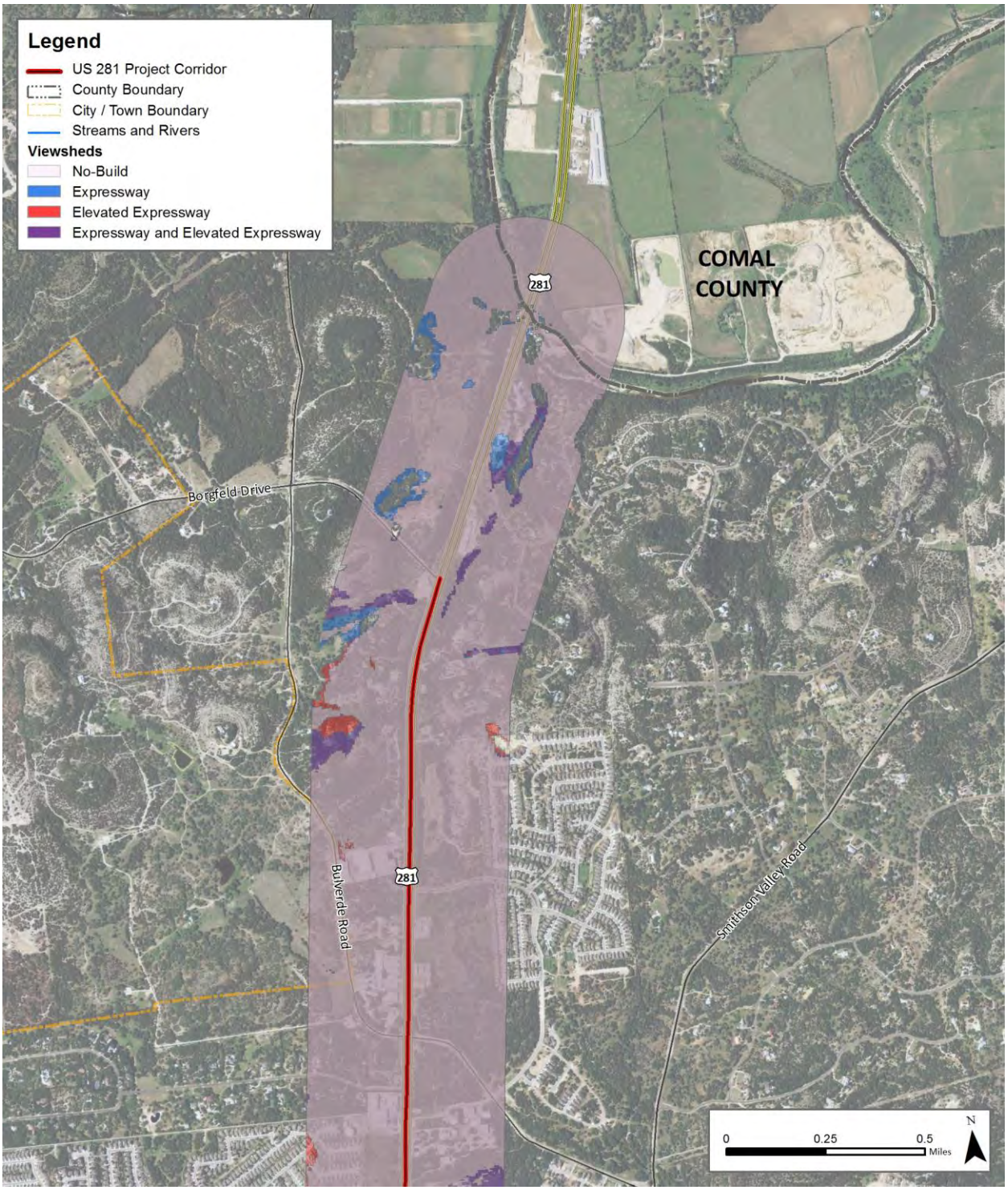
Source: US 281 EIS Team, 2012

Figure 3-31b: Foreground viewshed



Source: US 281 EIS Team, 2012

Figure 3-31c: Foreground viewshed



Source: US 281 EIS Team, 2012

Expressway Alternative

The Expressway Alternative could impact the visual and aesthetic quality of the US 281 project corridor for the roadway user and roadway viewer. On an individual scale, visual impacts would occur where the visual resources have a marked change from previous conditions. Marked changes would occur where the cleared open space adjacent to the existing right-of-way would be converted into frontage roads and landscaping; and where the roadway would be vertically elevated approximately 25 to 35 feet at proposed overpasses (Redland Road, Encino Rio, Evans Road, Stone Oak Parkway, Marshall Road, Wilderness Oak, Overlook Parkway, Bulverde Road and Borgfeld Drive) and at the US 281/Loop 1604 interchange direct connectors. **Figure 3-32** provides a conceptual illustration of the Expressway Alternative at Evans Road.

Figure 3-32: Conceptual Illustration of the Expressway Alternative at Evans Road

Source: US 281 EIS Team, 2010

The elevated overpasses and the US 281/Loop 1604 interchange direct connectors would increase the size of the foreground viewshed over the existing condition thereby increasing the number of residential properties with potential views of US 281 (**Figure 3-31a** through **Figure 3-31c**).

There would be approximately 805 residential properties within the foreground viewshed of the Expressway Alternative, an increase of approximately 10 residential properties over the No Build Alternative. These residential roadway viewers may

respond negatively resulting from a more prominent or new view of the structure itself or the lighting, and because this change would be permanent and on-going. The change in viewshed for the roadway user as a result of the Expressway Alternative may be perceived as positive where the elevated overpasses would offer a new, more expansive view of the surrounding landscape and land uses. These beneficial effects are expected to be negligible because traffic speeds on the corridor are anticipated to increase (see **Section 3.6**) and the exposure time to these new views would be fleeting.

Elevated Expressway Alternative

The proposed elevated structure would traverse the length of the US 281 project corridor at a typical height of 25 feet to 35 feet and could rise to approximately 60 feet where on and off ramps are located. **Figure 3-33** provides a conceptual illustration of the Elevated Expressway Alternative at Evans Road.

Figure 3-33: Conceptual Illustration of the Elevated Expressway Alternative at Evans Road

Source: US 281 EIS Team, 2010

The elevated structure, on and off ramps, and elevated US 281/Loop 1604 interchange direct connectors of the Elevated Expressway Alternative would create a larger foreground viewshed than the Alternative, as shown in **Figure 3-31a** through **Figure 3-31c**.

Approximately 815 residential properties would be within the foreground viewshed of the Elevated Expressway Alternative; this is 20 more than the No Build Alternative and

10 more than the Expressway Alterative. As with the Expressway Alternative it is likely that roadway viewers that have a more prominent or new view of the US 281 project corridor would respond more negatively; particularly residential viewers who are more sensitive to change. The roadway users would have an elevated and more expansive view of the surrounding landscape for a longer period of time, as compared to the Expressway Alternative. The increased exposure for the roadway users would likely be beneficial.

Funding Options

As described in **Chapter 2 - Alternatives Considered**, the Expressway Alternative and the Elevated Expressway Alternative are being considered for non-toll, toll and managed lane funding options. Visual impacts of tolling would be negligible as tolling equipment would be limited to only a few locations and consist of only minor amount of additional signage and lighting.

3.20.4 Conclusion and Proposed Mitigation Measures

The US 281 project corridor from Loop 1604 to Borgfeld Drive, provides a view of commercial and residential development. The northern portion of the corridor is less dominated by development and includes areas with large tracts of native trees and shrubs interspersed with small businesses (adjacent to US 281) and single-family residences (set back from the US 281). Both roadway users and roadway viewers would be impacted by either of the Proposed Build Alternatives. The Elevated Expressway Alternative has the highest potential to negatively impact residential roadway viewers and positively impact for roadway users. **Table 3-56** compares the estimated number of residential roadway users that could be affected by each alternative.

Table 3-56: Residential Properties within the Foreground Viewshed

Alternative	Number of Residential Properties
No-Build Alternative	795
Expressway Alternative	805
Elevated Expressway Alternative	815

Source: US 281 EIS Team, 2012

Negative impacts on roadway viewers may be mitigated, where practicable, by landscaping and aesthetic treatments. All lighting for the Proposed Build Alternatives will be acceptable fixtures that meet or exceed the COSA City Code – Section 35-339.04 and Bexar County Commissioners Court Regulation No. 12.501.072208 for "full cutoff" criteria (no light output emitted above 90 degrees at any lateral angle around the fixture). Context Sensitive Solutions (CSS) will be considered for the Preferred Alternative in the Final EIS. CSS is a collaborative, interdisciplinary approach that leads to preserving and enhancing scenic, aesthetic, historic, community, and environmental resources, while improving or maintaining safety, mobility, and infrastructure conditions (AASHTO/FHWA 2007).

3.21 ENERGY REQUIREMENTS

3.21.1 Methodology

The anticipated impacts related to energy consumption were assessed qualitatively based on the forecasted future traffic operations (see **Section 3.6.3**), construction activities, and the likely requirements for on-going maintenance.

3.21.2 Affected Environment

The US 281 project corridor has experienced significant growth over the past decade and today is largely developed, with single- and multi- family subdivisions, and commercial and retail businesses line the US 281 project corridor on both sides. The current vehicle fuel consumption is a function of the operational characteristics of the US 281 project corridor. A 2009 study conducted by TxDOT reported that US 281 from Loop 1604 to the Comal County line is the thirty-eighth (out of 100) most congested roadway segment in Texas. According to the study the US 281 corridor experienced over 149,000 annual hours of delay per mile in 2009 and incurred a cost of $25.67 million in lost time and wasted fuel as a result of congestion (TxDOT 2010a). Today, 75 percent of the US 281 corridor is operating at a level of service (LOS) E or F (LOS A being the best traffic condition and F being the worst - see **Section 3.6.3** for more details).

Energy consumption associated with maintenance activities currently includes energy used to patch and re-surface the roadway and other activities that provide a safe surface for transportation.

3.21.3 Environmental Consequences

No Build Alternative

By 2035, the average number of vehicles traveling on the US 281 project corridor is anticipated to grow and congestion is expected to worsen if no improvements are made. By 2035, 100 percent of the US 281 project corridor will be operating at a LOS E or F. It is expected that some traffic, that would otherwise use the US 281 project corridor, will use parallel corridors instead, (such as Bulverde Road and Blanco Road) as a result of diminished operational conditions on the US 281 project corridor. Vehicular fuel consumption would continue to increase under the No-Build Alternative as traffic congestion increases.

By 2035 it is likely that the useful life of the existing roadway will expire. As the infrastructure ages and deteriorates, it is expected that the need for on-going maintenance will increase, thus increasing maintenance energy consumption.

Proposed Build Alternatives

Both Proposed Build Alternatives would improve the LOS on the US 281 project corridor. In 2035, between 20 and 25 percent of the corridor would operate at a LOS of E or F. The improved operations of the roadway would reduce the annual hours of delay experienced by US 281 project corridor motorists as well as the amount of wasted fuel resulting from congestion.

The fuel consumption for long-term maintenance is expected to be greater for the Proposed Build Alternatives when compared to the No Build Alternative because there would be a greater area of roadway surface to maintain. However, the Proposed Build Alternatives would also extend the useful life of the US 281 project corridor, so major maintenance repairs are expected to occur less frequently.

Construction of either of the Proposed Build Alternative would require the short-term consumption of energy including the fuel used by construction vehicles and the energy required to produce construction materials. Some construction activities associated with the Proposed Build Alternatives are likely to be intensive (e.g., earthwork, paving) and would expend energy.

3.21.4 Conclusion and Proposed Mitigation Measures

The No Build Alternative would not consume short-term energy resources associated with construction but would likely require more energy as a result of congestion and the fuel consumption of roadway users, and for on-going maintenance when compared to the Proposed Build Alternatives. The Proposed Build Alternative would require short-term, and potentially intensive use of energy resources during construction however, the improvements are likely to reduce long-term consumption of energy.

Several mitigation strategies have been contemplated that could reduce the amount of energy consumed during construction activities:

- Maximum the use of on-site and/or local materials to reduce haulage of materials
- Use repetitive design dimensions to allow for the re-use of forms
- Turn off construction equipment when they are not in use
- Locate construction staging areas and access road to reduce the distances traveled
- Plan construction phasing and detour routes such that they minimize congestion for motorists.

3.22 RELATIONSHIP OF LOCAL SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

An industrial society is highly dependent on transportation. Urbanized development is an integral part of the existing environment. The US 281 Corridor Project would be vital to a much larger transportation system serving the San Antonio area. The proposed project would provide a faster, safer, and more efficient transportation system. It would become a vital component of the overall transportation network in Bexar and Comal counties.

Highways and their construction are classified as long-term productive facilities. The goal in highway construction is to create a facility that fulfills the need for transportation service, is compatible with today's land use, and enhances future development. The long-term objective is to provide the most beneficial means of serving those wishing to use the system with the least amount of money expended for continued maintenance and enhancement. The present land use would possibly experience some degree of change, as these changes would be regulated and controlled to a large degree by the various governmental agencies (local and state) that are responsible for planning and

zoning. The facility would enhance accessibility to adjacent sites increasing their value and/or potential for development.

There would be some degree of adverse impacts during construction resulting from the additional noise, dust, and to some extent, mud which is inherent to highway construction despite stringent control measures for temporary erosion and dust prevention. Potential short-term loss of productivity would occur during construction due to congestion delay and temporary access closure. Potential short-term benefits to the local economy are in employment opportunities and increased business with local merchants by the contractor's work force. These benefits would be minor.

3.23 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The implementation of either of the Proposed Build Alternatives involves the commitment of natural, physical, human and fiscal resources. Land utilized in the construction of a roadway is considered an irreversible commitment during the period that the land is used as a transportation facility; however, if a greater need arises for the use of the land, or if the roadway facility is no longer needed, the land can be converted to another use. Presently, there are no reasons to consider that such a conversion would ever be necessary or desirable. Considerable amounts of labor, construction material and fuel would be expended as a result of the construction of the US 281 Corridor Project. Additionally, substantial amounts of labor and natural resources would be required in the fabrication and the preparation of the construction materials. Although these materials are generally irretrievable, they are not considered to be in short supply and the use of these materials would not result in an adverse effect upon the continued availability of these resource materials. Any construction would also require a substantial expenditure of local, state, and federal funds, which are not retrievable. All projects that are proposed for federal and/or state funds were initiated in a manner consistent with federal guidelines in Section 450 of Title 23 CFR and Section 613.200, Subpart B, of Title 49 CFR. Energy, environment, air quality, cost, and mobility considerations are addressed in the fiscal programming of the US 281 Corridor Project. The commitment of these resources is based on the concept that residents in the immediate area, region and state would benefit by the improved quality of the transportation system. These benefits would include, but not be limited to, improved accessibility and safety, savings of time, and a greater availability of quality services. These benefits are anticipated to outweigh the commitment of resources for the construction of the proposed project.

There would be irretrievable and irreversible commitments of land, material and capital use in the construction of either of the Proposed Build Alternatives. The No-Build Alternative would involve no irreversible or irretrievable commitment of human and/or natural resources.

3.24 CONSTRUCTION

Potential impacts that may occur during the construction of the facility and associated mitigation measures are summarized below.

Impacts to existing utilities (water, sewer, electric, natural gas, communication) may be associated with construction of either of the Proposed Build Alternatives. The contractor would contact the appropriate local owner/operators to locate all utility lines within the existing and proposed ROW of the Preferred Alternative and construction staging areas, and coordinate a work schedule that would avoid and minimize any disruption of the utility service(s) during the construction of the facility.

Maintenance of the current flow of traffic on the existing and associated roadway network would be planned and scheduled to minimize adverse impacts to the traveling public. Traffic control during project construction would be in accordance with Part VI (*Traffic Controls for Streets and Highway Construction and Maintenance Operations*) of the *Texas Manual on Uniform Traffic Control Devices* (TMUCD). In the short-term, there may be an increase in traffic congestion and potential changes in traffic patterns and routes in the vicinity of the project during construction, which could possibly cause temporary delays for emergency responders. All emergency service providers (police protection, fire protection, emergency medical service providers and others) would be notified prior to roadway construction and access issues during construction. With this information, emergency responders can plan and utilize detours in advance of emergency situations.

There would be some short-term noise impacts resulting from the construction of the project. It is anticipated that if one of the Proposed Build Alternatives is indentified as the Preferred Alternative that the areas adjacent to the ROW would experience elevated noise levels during construction of the facility. To minimize construction noise, provisions would be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of the muffler systems of the construction equipment. Due to the relatively short-term exposure periods imposed on any one receiver, extended disruption of normal activities would not be considered likely. Every reasonable effort would be made to minimize construction noise.

There may be short-term localized effects to air quality (increase in dust) in the immediate area(s) adjacent to the project during the construction. There may be a temporary degradation of air quality through dust and exhaust gases associated with the construction equipment. Measures to control dust would be considered and incorporated into the final project design and construction specifications.

The Alamo RMA would require its contractors to take appropriate measures to prevent, minimize, and control accidental spills that may occur during the roadway construction. All construction equipment and materials would be removed as soon as the schedule permits in the construction sequence.

The potential would be present for construction impacts to existing hazardous waste sites, if applicable as well as unreported sites that may be discovered during excavation and/or grading activities. Further investigation would assist in identifying existing sites that could be affected due to their proximity to the Preferred Alternative. If an unreported or unknown site were discovered during construction activities, TxDOT,

Alamo RMA, and TCEQ regulatory procedures would be followed to eliminate or minimize any adverse environmental consequences.

3.25 SOCIAL, ECONOMIC AND ENVIRONMENTAL CONSEQUENCES SUMMARY

A summary of the environmental impacts by section for the proposed alternatives is presented in tabular form in **Table 3-57.** This table provides a concise overview of the difference in cost, impacts, and benefits of the alternatives.

Table 3-57: Summary of Direct Impacts by Alternative

	Alternative and Funding Option						
	Metric or Unit	Expressway Alternative			Elevated Expressway Alternative		
		Non-Toll	Toll	Managed	Non-Toll	Toll	Managed
Length	Miles	7.3			7.3		
Construction Cost (millions)	2010/2011 Dollars (Millions)	376.9	389.8	389.8	581.6	589.9	589.9
ROW costs (millions)	2010 Dollars (Millions)	30.7			23.9		
Engineering/ Professional Services Estimate	2010/2011 Dollars (Millions)	26.4	27.5	27.5	40.7	41.4	41.4
Total (millions)	2010/2011 Dollars (Millions)	434.0	448.0	448.0	646.2	655.2	655.2
Land Use (see Table 3-2)							
Residential (single/multi-family	Acres	5.0			1.6		
Commercial (mixed, office, retail	Acres	26.8			26.1		
Educational	Acres	0.0			0.0		
Government/ Institution	Acres	0.0			0.0		
Parks	Acres	0.0			0.0		
Section 4(f)/6(f) Resources	Acres	0.0			0.0		
Mining	Acres	0.0			0.0		
Place of Worship	Acres	0.3			0.0		
Forest	Acres	18.3			20.3		
Range Land	Acres	69.5			41.7		
Open Space	Acres	2.1			6.4		

Table 3-57: Summary of Direct Impacts by Alternative

	Alternative and Funding Option						
	Metric or Unit	Expressway Alternative			Elevated Expressway Alternative		
		Non-Toll	Toll	Managed	Non-Toll	Toll	Managed
Industrial	Acres	0.1			0.3		
Transportation/ Utilities	Acres	6.4			2.7		
Total	Acres	128.5			99.1		
Farmlands							
Project Area	Acres	0.0			0.0		
Displacements (see Table 3-20)							
Single-Family	# of potential	1			0		
Commercial	# of potential	26			28		
Utilities	# of potential	1			0		
ROW Impacts (see Table 3-22)							
Additional ROW Required	Acres	128.5			99.1		
Potential Loss in Tax Revenue (see Table 3-30)							
City of San Antonio	Annual Property Taxes	$29,249			$22,034		
Bexar County	Annual Property Taxes	$135,469			$105,180		
North East ISD	Annual Property Taxes	$135,489			$48,884		
Comal County ISD	Annual Property Taxes	$233,945			$171,158		
Pedestrian and Bike Facilities							
Planned		Yes			Yes		

Table 3-57: Summary of Direct Impacts by Alternative

		Alternative and Funding Option					
	Metric or Unit	Expressway Alternative			Elevated Expressway Alternative		
		Non-Toll	Toll	Managed	Non-Toll	Toll	Managed
Air Quality							
CO Emission Concentrations (see Table 3-34)							
Stone Oak Parkway							
Year 2015	One-Hour CO (ppm)	2.8			2.2		
	One-Hour % NAAQS	8%			6%		
	Eight-Hour CO (ppm)	1.8			1.4		
	Eight-Hour % NAAQS	20%			16%		
Year 2035	One-Hour CO (ppm)	2.8			2.3		
	One-Hour % NAAQS	8%			7%		
	Eight-Hour CO (ppm)	1.8			1.5		
	Eight-Hour % NAAQS	20%			17%		
Bulverde Road							
Year 2015	One-Hour CO (ppm)	2.0			2.2		
	One-Hour % NAAQS	6%			6%		
	Eight-Hour CO (ppm)	1.3			1.4		
	Eight-Hour % NAAQS	14%			16%		
Year 2035	One-Hour CO (ppm)	2.5			2.8		
	One-Hour % NAAQS	7%			8%		
	Eight-Hour CO (ppm)	1.6			1.8		
	Eight-Hour % NAAQS	18%			20%		
Preliminary Traffic Noise Impacts (see Table 3-39)							
Sensitive Receptors	Total number of potentially impacted receivers	71	71	71	107	108	107
Impacts to Floodplains (see Table 3-42)							
Increased Impermeable Surface Area	Acres	86			83		

Table 3-57: Summary of Direct Impacts by Alternative

	Alternative and Funding Option						
	Metric or Unit	Expressway Alternative			Elevated Expressway Alternative		
		Non-Toll	Toll	Managed	Non-Toll	Toll	Managed
Stream Crossings	#	12			12		
Permanent Impacts to Stream Crossings	#	9			6		
Vegetation Type (see Table 3-45)							
Wooded	Acres within ROW	98			80		
Unmaintained (non-wooded)	Acres within ROW	118			111		
Developed (including maintained non-wooded vegetation)	Acres within ROW	169			170		
Wildlife (see Table 3-46)							
Wooded Habitat	Acres	98			80		
Bexar County Karst Zones (see Table 3-48)							
Zone 1	Acreage of footprint	242			238		
Zone 2	Acreage of footprint	165			149		
Zone 3	Acreage of footprint	102			92		
Zone 4	Acreage of footprint	0			0		
Zone 5	Acreage of footprint	3			3		
Bexar County Karst Features (see Table 3-48)							
Zone 1	# of Features	36			36		
Zone 2	# of Features	9			8		
Zone 3	# of Features	10			10		
Zone 4	# of Features	0			0		
Zone 5	# of Features	0			0		
Golden-cheeked Warbler (see Table 3-49)							
Habitat	Acres	65			56		

Table 3-57: Summary of Direct Impacts by Alternative

	Alternative and Funding Option						
	Metric or Unit	Expressway Alternative			Elevated Expressway Alternative		
		Non-Toll	Toll	Managed	Non-Toll	Toll	Managed
Cultural Resources							
Historic	**Potential Non-archeological Historic Resources**	0			0		
Archeological	**Archeological Sites Recommended for Further Work**	1			1		
Parkland and Recreational Areas							
Parklands	# /Acres	0.0 /0			0.0 /0		
Recreational Areas	# /Acres	0.0 /0			0.0 /0		
Potential Hazardous/Regulated Materials (see Table 3-55)							
Hazardous Materials Spill	#	1			1		
Leaking Petroleum Storage Tanks (case closed)	#	2			1		
Properties with Known Hazardous Material Contamination	#	1			1		
Properties that are Regulated for Hazardous and Regulated Materials	#	4			5		
Visual							
Viewshed	Greater impact to roadway user or viewer?	viewer			Viewer		
Residential Properties within the Foreground Viewshed	#	805			815		

1 Source: US 281 EIS Team, July 2011.

Table 3-58: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
Land Use	No mitigation measures are proposed; the US 281 Corridor Project is consistent with existing local and regional plans.
Farmlands	No mitigation measures are proposed; however, if changes are made to the alignment of the Preferred Alternative in the Final EIS analysis, additional coordination with NRCS will occur, which will include a discussion of mitigation measures.
Environmental Justice (EJ)	Mitigation measures may include: • Continue to seek meaningful involvement of low-income and minority communities in the project development. • Publish Spanish language versions of the Public Hearing notice in a locally-circulated Spanish language newspaper and include it with notice to affected property owners. • If the Preferred Alternative includes either the Toll or Managed Lane option, produce bilingual tolling/managed lanes informational materials for the website and general distribution.
Displacements	Displaced businesses and residences are eligible for assistance per the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970, as amended by the Uniform Relocation Act Amendments of 1987. Assistance may include identification of replacement properties that are: • Comparable in size, amenities, and neighborhood type • Within the financial means of all displaced persons • Similarly accessible to public services and employment
Right-of-Way (ROW) Impacts	Acquisition of proposed ROW will be conducted in compliance with TxDOT's *Right of Way Manual Volume 2 – Right of Way Acquisition*, as revised August 2011.
Potential Loss in Tax Revenue	The US 281 Corridor Project has the potential to remove taxable property from the tax rolls of the local taxing jurisdiction and therefore result in a loss of tax revenues. The property value of land adjacent to the US 281 Corridor Project has the potential to increase as a result of improved safety, mobility, functionality, and quality of life within the corridor, thereby allowing taxing jurisdictions to increase tax revenues. These potential increases in property value would partially off-set the loss in tax revenue that would result from the conversion of land and improvements to the transportation ROW.
Pedestrian and Bicycle Facilities	Pedestrian and Bicycle Facilities should be designed in compliance with the Americans with Disabilities Act. Pedestrian and Bicycle Facilities could include: • Sidewalks • Bicycle/Pedestrian Trails and/or Paths • Dedicated/Partially-dedicated/Shared Bike Lanes • Crosswalks • Bike Racks • Sidewalk Furniture • Safety Lighting
Air Quality	• The US 281 Corridor Project is subject to a regional air quality analysis • Contractor could schedule construction activities to minimize disruptions to traffic, especially during peak travel periods to minimize emissions • Contractor should comply with federal, state, and local regulations concerning the

Table 3-58: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
	generation of dust from construction activities which may include: o Cover or treat disturbed areas with dust suppressors o Use tarpaulins on loaded trucks o Water dust generating surfaces
Traffic Noise	Noise abatement measures could include: • Traffic management strategies • Buffer zones • Noise barriers such as walls or earthen berms Noise associated with construction could be reduced by: • Implementing work-hour controls • Ensure proper maintenance of muffler systems of construction equipment
Water Quality	• Coordination with TCEQ would be pursued to maintain compliance with: o Section 404 of the CWA o Section 401 water quality certification o Edwards Aquifer Protection Program o Texas Pollutant Discharge Elimination System permitting requirements o Notice of Intent General permitting requirements • A Storm Water Pollution Prevention Plan could be implemented including strategies such as: o Silt fences o Inlet protection barriers o Hay bales o Seeding or re-vegetating excavated soils • Low Impact Development strategies could be implemented including: o Bioretention o Permeable friction course o Biological media filter vault o Storm water filter cartridge o Hydrodynamic storm water separator wet vault Groundwater quality mitigation strategies could be implemented including: • Define extent of existing contamination plumes • Predict groundwater flow paths • Build and maintain monitoring networks • Treat contaminated water • Use filter strips, sand filters, extended detention ponds, bioswales, and/or rain gardens
Floodplains	Strategies to minimize impacts to floodplains include: • Provide flood water storage adjacent to the roadway via detention facilities • Design drainage structures to accommodate anticipated high flows to reduce upstream and downstream adverse impacts • Design detention facilities and drainage structures that manage stormwater while enhancing water quality

Table 3-58: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
Wetlands and Other Waters of the US	Strategies to minimize impacts to wetlands and other waters of the US could include: • Implement erosion and sediment control measures during and after construction • Minimize de-vegetation • Decrease the amount of fill placement • Use bridge crossings instead of filled embankments • Use retention basins and re-vegetated swales Alleviate flow alterations caused by structures

Vegetation	Non-regulatory compensatory mitigation is not proposed; however, several strategies have been contemplated to reduce adverse impacts to vegetation including:
	• Preserve trees that neither compromise safety nor interfere with construction activities
	• Re-vegetate disturbed areas with trees and groundcover
	• Use beneficial landscape practices which include:
	  o Use of regionally native plants
	  o Use construction practices that minimize adverse impacts to the natural habitat
	  o Reduce use of fertilizers and pesticides
	  o Design landscaping to be water efficient and to reduce runoff
	Prevent introduction of invasive species

Wildlife	To avoid adverse impacts to migratory birds, the contractor could implement measures to prevent migratory birds from building nests in the construction area between March and August and/or could remove any old migratory bird nest between September and January. To avoid adverse impacts to aquatic wildlife, the contractor would minimize the area to be disturbed, replant the areas cleared, and/or optimize stream diversion to include low flow augmentation of intermittent streams.
Threatened & Endangered Species *Karst Species*	If potential karst features or caves are revealed during construction activities, work would be ceased within 344 feet of the feature, the feature would be covered and a Section 10(A)(1)(a) permitted karst biologist would inspect the site as soon as possible to evaluate potential species habitat.
Threatened & Endangered Species *Golden-cheeked warbler*	Strategies to minimize impacts to the GCWA during construction include: • Limit vegetation removed in wooded areas during nesting and breeding season (March to September) • Limit removal of vegetation to that necessary for construction the US 281 Corridor Project • Locate construction staging areas away from known or potential GCWA habitat • Re-seed disturbed area with native vegetation after construction
Cultural Resources	Additional field surveys for historic and archeological resources will be conducted for the Preferred Alternative and documented in the Final EIS. Section 106 consultation will be coordinated per the requirements of the NHPA. The results of the cultural resources surveys and Section 106 coordination will be shared with the public and available for comment between the Draft EIS Public Hearing and the circulation of the Final EIS. If unanticipated archeological resources are encountered during construction, work would cease and post-review discovery procedures would be initiated by a certified archeologist.

Table 3-58: Summary of Potential Mitigation and Monitoring Options

Resource	Potential Mitigation and Monitoring Options
Parklands & Recreational Areas	No mitigation measures are proposed.
Potentially Hazardous & Regulated Materials	A Phase I Environmental Assessment in compliance with ASTM Standard E 1507-05 could be conducted during the acquisition of ROW to determine appropriate mitigation requirements. Other mitigation measures may include: • Take appropriate measures to prevent, minimize, and control the spill of hazardous materials in the construction staging area • Minimize or eliminate use of construction equipment within sensitive areas • Remove all construction materials used as soon as work schedules permit • Develop soil and/or groundwater management plans to respond to the discovery of contamination during construction
Visual & Aesthetic Qualities	Context-Sensitive Solutions (CSS) will be explored which could include: • Aesthetic treatments to structural components (retaining walls, bridges, signage, storm water management features, safety features, pedestrian and bicycle amenities) • Architectural details (landscaping and revegetation, lighting design/energy usage, colors, finishes)

Source: US 281 EIS Team, July 2011.

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