

**CATEGORICAL EXCLUSION FOR
PROPOSED US 281 NORTH AT LOOP 1604
INTERCHANGE IMPROVEMENTS**

BEXAR COUNTY, TEXAS

**FEDERAL HIGHWAY ADMINISTRATION
AND
ALAMO REGIONAL MOBILITY AUTHORITY**

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1.0 INTRODUCTION

The project proposed in this categorical exclusion (CE) would serve to improve the existing interchange of United States Highway (US) 281 North and Loop 1604 in northern San Antonio, Bexar County, Texas. The proposed improvements would involve adding two levels (Levels 4 and 5) to the existing three-level interchange. Levels 4 and 5 would provide direct connectors between the two roadways. Non-through traffic lanes would be added to the mainlanes of both US 281 North and Loop 1604 to accommodate the merge and diverge lanes associated with the direct connectors. Additional non-capacity resulting enhancements are also proposed to improve safety and mobility within the project area. These enhancements include auxiliary lanes, ramp modifications, lighting improvements, sidewalks, and pedestrian bridges. The proposed project would not result in additional roadway capacity. The proposed non-toll project is being developed by the Alamo Regional Mobility Authority (Alamo RMA), in cooperation with the Texas Department of Transportation (TxDOT).

On US 281 North, the limits of the proposed interchange improvements extend from Bitters Road to Loop 1604. The limits on Loop 1604 extend from Bitters Road to Redland¹ Road. **Figure 1** shows the project in relation to Bexar County. **Figure 2(A-B)** shows the *Castle Hills, Longhorn, and Bulverde United States Geological Survey (USGS) 7.5 minute topographic maps of the project area.*

The need to improve and add capacity to US 281 North and Loop 1604 has been recognized for many years. Environmental analyses for these needed improvements are underway. Recently, Alamo RMA announced plans to prepare environmental impact statements for improvements to US 281 North (from Loop 1604 to Borgfeld Road) and Loop 1604 (from Farm to Market (FM) 1957 to Interstate Highway 35). The proposed upgrading/capacity improvements to US 281 North and Loop 1604 would be separate and distinct actions from each other and from the US 281 North/Loop 1604 interchange project addressed in this CE.

Although the US 281 North/Loop 1604 interchange improvements (categorized as operational) would not result in any additional capacity on either US 281 North or Loop 1604, the interchange design would operate efficiently even if none of the proposed additional capacity improvements to US 281 North and Loop 1604 are ever implemented.

¹ Bexar County first spelled Redland Road as “Red Land”. The City of San Antonio and the San Antonio-Bexar County Metropolitan Organization however, use the official spelling “Redland” and include this version in the Metropolitan Transportation Plan. This document uses the “Redland” spelling for consistency and reference to the San Antonio-Bexar County Metropolitan Transportation Plan.

The proposed operation improvements to the interchange could be designed to accommodate the possible future capacity improvements to those roadways.

The proposed project is included in and consistent with the financially constrained San Antonio – Bexar County Metropolitan Planning Organization’s (MPO) *2035 Metropolitan Transportation Plan* (2035 MTP), and the MPO’s 2008-2011 Transportation Improvement Program (TIP). The total estimated cost of the project is \$145,207,355, according to the 2008-2011 Transportation Improvement Program (TIP) amendment approved in January 2010. The estimated year of completion is 2013. The improvements would be funded through a combination of American Recovery and Reinvestment Act of 2009 (“Economic Stimulus Program”) and Proposition 14 funds.

Appendix A provides photographs of the project area.

2.0 DESCRIPTION OF THE EXISTING FACILITY

On US 281 North, the project limits begin at Bitters Road and end at Loop 1604. Within the project limits, US 281 North is typically a six-lane access controlled, divided roadway with continuous frontage roads. The US 281 mainlanes consist of three 11-foot lanes with 10-foot inside and 10-foot outside shoulders in each direction. Auxiliary lanes are present where necessary to accommodate traffic merging or diverging between ramps. The frontage roads consist of three 11-foot lanes in each direction with a 4-foot inside shoulder and an outside curb. The existing US 281 North right-of-way is 300-400 feet wide (usual). Within the project limits, US 281 North currently carries 123,000 vehicles per day (VPD) and has a posted speed limit of 65 miles per hour (mph).

On Loop 1604, the project limits begin at Bitters Road and end at Redland Road. Within the project limits, Loop 1604 is typically a four-lane access controlled, divided roadway with continuous frontage roads. The Loop 1604 mainlanes consist of two 12-foot lanes with 4-foot inside and 10-foot outside shoulders in each direction. Auxiliary lanes are present where necessary to accommodate traffic merging or diverging between ramps. The frontage roads consist of two 12-foot lanes in each direction with 4-foot inside and 8-foot outside shoulders. The existing Loop 1604 right-of-way is 350-400 feet wide (usual). The existing traffic volume on Loop 1604 is 122,000 VPD and the main lane speed limit is 70 mph.

Existing typical sections for US 281 North and Loop 1604 are shown in **Figure 3A**.

The existing interchange of US 281 North and Loop 1604 is classified as a three-level diamond. Currently, the mainlanes of US 281 North are depressed through the interchange (first level) with the frontage roads of US 281 North and Loop 1604 being at-

grade (second level). The mainlanes of Loop 1604 (third level) go over US 281 North and the frontage roads. Under existing conditions, all traffic flow between US 281 North and Loop 1604 must pass through signalized, at-grade intersections; there are no direct connectors between US 281 and Loop 1604.

3.0 NEED AND PURPOSE

Currently, approximately 245,000 vehicles per day travel through the US 281 North/Loop 1604 interchange. By 2035, this number is expected to exceed 490,000 – a projected increase of 100 percent.

The existing interchange consists of three levels with US 281 North mainlanes at the bottom level, frontage road intersections at the second level, and Loop 1604 mainlanes at the third level. All vehicles traveling from US 281 North to Loop 1604 and vice versa must exit to the frontage roads and travel through signalized intersections. Both Loop 1604 and US 281 North are high volume freeways. Movements between these freeways have increased substantially over the last 10 years causing delays at the frontage road signals. The congestion caused by the movement of traffic between these facilities has caused functional and operational problems at this intersection.

Congestion occurs throughout all hours of operation, though it is substantially worse during peak periods (particularly in the mornings). During the afternoon peak period, there is a queue of approximately 1,000 vehicles per hour (vph) making the left turn from northbound US 281 to westbound Loop 1604. In the morning peak period, the heaviest delay occurs along eastbound Loop 1604 where traffic counts indicate approximately 1,200 vph making a right turn onto southbound US 281 North.

One measure of a roadway's traffic handling capability is the Level of Service (LOS) rating. LOS ratings range from A (free flowing traffic) to F (traffic demand exceeds capacity). Under existing conditions, the interchange operates at a LOS F. LOS F is reflective of a congested environment with traffic stacking, delays, and the inability to move about efficiently or rapidly. The existing LOS F conditions clearly demonstrate the need for improvements to the US 281 North/Loop 1604 interchange.

The existing interchange operates at LOS F for several hours during the AM and PM peak periods. The need for the proposed US 281/Loop 1604 interchange improvements is evidenced by the fact that demand currently exceeds capacity for several hours during the AM and PM peak periods (volumes ranging from 10,600 to 20,900 VPD). Future projections (2035 volumes ranging from 35,100 to 44,300 VPD) will further stress the system and adversely affect LOS.

The number of traffic collisions is another indication of conditions at the interchange. According to the San Antonio Police Department, 132 collisions were reported at the US 281 North/Loop 1604 interchange in 2008 - more than any other interchange in the City of San Antonio, and 32 more than the next most collision-prone interchange (IH 10/Loop 1604).

The purpose of the proposed project is to enhance mobility and safety, improve operational efficiency and reduce delays within the project area.

4.0 DESCRIPTION OF THE PROPOSED ACTION

The proposed project would consist of constructing four direct connectors and associated roadway improvements including auxiliary lanes and ramp modification at the US 281 North/Loop 1604 interchange in San Antonio, Bexar County, Texas. The proposed project would also include additional safety and mobility enhancements not necessitated by the direct connectors. The proposed safety and mobility enhancements would include lighting improvements, sidewalks and pedestrians bridges. The limits of the proposed project extend from approximately Bitters Road to Redland Road on Loop 1604 (a distance of approximately six miles) and Bitters Road to Loop 1604 on US 281 North (a distance of approximately three miles). An aerial layout showing the proposed project plan view is presented in **Figure 4 (A-F)**. The proposed project would be constructed within existing state-owned right-of-way; no additional right-of-way would be acquired.

Below are the specific design characteristics of the proposed operational improvements².

Proposed Direct Connectors

The northbound US 281 North to westbound Loop 1604 direct connector is proposed to exit US 281 North near Donella and cross over the interchange at the fourth level. It would tie to westbound Loop 1604 near Stone Oak Parkway. On westbound Loop 1604 an auxiliary lane would be added to accept the direct connection traffic and is proposed to terminate at a new Blanco Road exit ramp. An exit ramp from this direct connection to the westbound frontage road east of Stone Oak Parkway is also proposed. Other ramping changes are associated with the addition of this direct connector (see “Proposed Ramping Changes” below).

² The project description, as reflected in the December 2009 Draft CE, did not accurately reflect the schematic. Although there were no changes in the schematic design, more detailed descriptions of the proposed improvements were added in this document for clarification and minor corrections to the project description have been made. The description reflected in this (final) version of the CE accurately reflects the final schematic as presented at the January 11, 2010 public meeting.

The northbound US 281 North to eastbound Loop 1604 direct connector is proposed to split from the northbound to westbound direct connector and tie to eastbound Loop 1604 near the Gold Canyon underpass. An auxiliary lane would be added to eastbound Loop 1604 until just east of Redland Road overpass and then taper into the existing Loop 1604 lanes.

The eastbound Loop 1604 to southbound US 281 North direct connector exits Loop 1604 east of Stone Oak Parkway and ties into the US 281 North southbound mainlanes near Donella. An auxiliary lane is proposed to be added to the southbound US 281 North mainlanes to accept direct connector traffic. The auxiliary lane would terminate at the existing Brook Hollow exit. To aid in lane balance and operations, an auxiliary lane is proposed to be added on the eastbound Loop 1604 mainlanes between the Stone Oak Parkway exit ramp and the proposed direct connector. Ramping changes are required to accommodate this proposed direct connector (see “Proposed Ramping Changes” below).

The westbound Loop 1604 to southbound US 281 North direct connector is proposed to exit near Gold Canyon and cross over the interchange at the fifth level tying to the eastbound to southbound direct connector south of Loop 1604. To improve operations, an auxiliary lane would be constructed between the existing Redland Road entrance ramp and this direct connector.

Proposed Ramping Changes

On northbound US 281 North the existing exit ramp to Henderson Pass and the Loop 1604 frontage road would be removed to provide room for the direct connector. Traffic wanting to access the frontage roads in this area would utilize the existing Donella exit ramp approximately 1,700 feet to the south.

On southbound US 281 North the existing entrance ramp just south of Henderson Pass would be removed to provide room for the direct connector. Traffic wanting to access the mainlanes from the frontage roads in this area would utilize the existing Donella entrance ramp approximately 1,700 feet to the south.

On eastbound Loop 1604, the exit ramp east of the Stone Oak Parkway overpass which provides access to US 281 North would be relocated approximately 3,000 feet to the west to provide room for the direct connector.

On eastbound Loop 1604, a new exit ramp to Redland Road is proposed. An auxiliary lane is proposed between the existing Gold Canyon Road entrance ramp and this new exit ramp.

On westbound Loop 1604, the existing exit ramp to Gold Canyon Road is proposed to be removed. Traffic would access Gold Canyon Road via the existing Redland Road exit.

On westbound Loop 1604, the existing ramps between Stone Oak Parkway and Blanco Road are proposed to be reversed. The exit ramp to Blanco Road would be shifted east approximately 2,500 feet, and the entrance ramp from Stone Oak Parkway would shift west approximately 2,500 feet.

Proposed Auxiliary Lanes

To improve traffic operations, auxiliary lanes are proposed to be added between existing ramps at the following locations:

On Loop 1604 westbound mainlanes, between the existing entrance ramp from Blanco Road and the existing Bitters Road exit ramp;

On US 281 North southbound mainlanes between the existing entrance ramp from Thousand Oaks Boulevard and the existing Bitters Road exit ramp;

On US 281 North northbound mainlanes, between the existing entrance ramp from Bitters Road and the existing Brook Hollow exit ramp.

On US 281 North northbound mainlanes, between the existing entrance ramp from Thousand Oaks Boulevard and the existing Donella exit ramp.

Auxiliary lanes would be added to the frontage roads between the following exit ramps and the cross street intersection: westbound Loop 1604 exit to Bitters Road and eastbound Loop 1604 exit to Blanco Road. These frontage road locations will be re-surfaced, full width, from the ramp gore to the intersection.

Other Proposed Operational and Safety Improvements

At Bitters Road, Huebner Road, Gold Canyon Road and Redland Road, the existing cross street structures would be widened and new turn around structures (two at each location) would be constructed. Sidewalks would be constructed on the cross street structures.

The Henderson Pass structure (which is currently closed to traffic) would be partially removed; approximately 15-feet of the structure width would be retained to support utilities.

Safety illumination would be installed at all Loop 1604 mainlanes and frontage road entrance and exit ramps. Continuous illumination would be installed on all the direct

connector structures. In addition, continuous illumination would be installed in the median of Loop 1604 from Bitters Road to Redland Road.

The US 281 North mainlanes and frontage roads would be re-surfaced between Bitters Road and Loop 1604. The Loop 1604 mainlanes would be re-surfaced from Blanco Road to Redland Road and the frontage roads would be re-surfaced from Stone Oak Parkway to Gold Canyon Road.

Five-foot wide sidewalks are proposed along the US 281 North northbound and southbound frontage roads between Bitters Road and Loop 1604. Five-foot wide sidewalks are also proposed along the Loop 1604 eastbound and westbound frontage roads between Stone Oak Parkway to Gold Canyon Road.

Two 12-foot wide pedestrian bridges would also be constructed at the US 281 North/Loop 1604 interchange. These structures would cross over the US 281 North mainlanes and would parallel the Loop 1604 frontage roads.

5.0 ALTERNATIVES ANALYSIS

A build and a no build alternative were considered for the US 281 North/Loop 1604 interchange.

No Build Alternative

The No Build Alternative would leave the US 281 North/Loop 1604 interchange in its current condition, and no funds or energy would be expended for planning or construction. The allocated funds for this project could therefore be used for other projects. The No Build Alternative would not improve safety and mobility at the interchange. Under the No Build Alternative, the safety and mobility benefits associated with the direct connectors and other proposed improvements would not be realized. As traffic volumes continue to increase, safety and mobility would continue to deteriorate. The No Build Alternative does not satisfy the purpose and need for the proposed project and is not consistent with the regional transportation plan. The No Build Alternative fails to satisfy the need and purpose; therefore, the No Build Alternative is not the preferred alternative.

Build Alternative

Enhanced mobility and increased safety would be accomplished at the US 281 North/Loop 1604 interchange through the construction of direct connectors and proposed roadway enhancements (collectively, the Build Alternative). With the existing

interchange, all vehicles traveling between the Loop 1604 and US 281 North expressways must exit to the frontage roads and travel through signalized intersections, resulting in congestion, delays, and operational inefficiencies. The proposed direct connectors and the proposed roadway enhancements would provide substantially improved traffic flow through the US 281 North/Loop 1604 interchange; upon completion, LOS at the interchange would improve to C. The Build Alternative satisfies the project's purpose of enhancing mobility and safety, improving operational efficiency and reducing delays within the project area. For this reason, the Build Alternative is the preferred alternative.

6.0 EXISTING ENVIRONMENT

6.1 Water Resources

6.1.1 Waters of the U.S./Wetlands

Jurisdictional waters of the US include all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including their tributaries and adjacent wetlands (USACE). This includes intermittently or perennially flowing streams exhibiting an ordinary high water mark, their adjacent wetlands, and other water bodies exhibiting a "significant nexus" with these waters that is, exerting a significant effect on the chemical, physical, and biological integrity of those waters (Rapanos, et al).

Based on the information available from aerial photographs and topographic maps, and field investigations, there are 13 jurisdictional creeks within the project limits, as shown on the USGS Longhorn and Bulverde topographic map (**Figure 2 A-B**). Four streams crossing US 281 North and nine streams crossing Loop 1604 had an indication of a high water mark and, as such, were determined to be jurisdictional waters of the US. The jurisdictional waterways crossing US 281 North are a tributary to Salado Creek and three unnamed tributaries to Lorence Creek. The jurisdictional waterways crossing Loop 1604 are Panther Springs Creek and three unnamed tributaries, West Elm Creek and one tributary, Mud Creek, and two unnamed tributaries to Lorence Creek.

According to the National Wetland Inventory maps, no wetlands are known to occur within the project limits. Subsequent field investigations of potential wetlands were based on the US Army Corps of Engineers (USACE) wetland delineation manual (TR Y-87-01) for identification of wetlands. These methods require the presence of wetland vegetation, hydric soils, and hydrologic parameters to designate wetland areas. No potential wetlands were identified in the project area.

In addition, the project area does not contain any navigable waters and Section 9 (US Coast Guard) and Section 10 (USACE) coordination is not required.

6.1.2 Edwards Aquifer

The proposed project lies entirely within the boundaries of the San Antonio Segment of the Edwards Aquifer. The San Antonio Segment of the Edwards Aquifer is designated as a sole source aquifer. It provides the sole source of drinking water for nearly 2 million central Texans.

The Edwards Aquifer consists generally of three zones: the recharge zone, the transition zone, and the contributing zone. The recharge zone is comprised of outcrops of highly faulted and fractured limestone allowing precipitation runoff to easily flow into the aquifer. The transition zone is comprised of outcropping confining units of the Edwards Aquifer. Fractures and openings in the confining units allow recharge to the Edwards Aquifer. The contributing zone is the drainage area (also called catchment area) that "catches" water from rainfall and run off into streams or infiltrates into the water table aquifer then flows over relatively impermeable limestone until it reaches the recharge zone. The project is located primarily over the Edwards Aquifer recharge zone; the southern 1.1 mile of the project along US 281 is located over the Edwards Aquifer transition zone (**Figure 2 A-B**).

The Texas Commission on Environmental Quality (TCEQ) regulates activities having the potential for polluting the Edwards Aquifer and hydrologically connected surface water in order to protect existing and potential uses of groundwater and maintain Texas Surface Water Quality Standards. Construction activities within the Edwards Aquifer are subject to Edwards Aquifer rules (30 TAC 213). The Edwards Aquifer rules apply to all regulated developments within the recharge zone and to certain activities within the transition zone and to discharges ten miles upstream of the recharge zone within the aquifer's contributory watersheds.

6.1.3 Threatened and Impaired Waters

Salado Creek (Segment 1910) is listed as an impaired water body, according to the TCEQ's 2008 Clean Water Act Section 303 (d) list. However, the project does not require coordination with the TCEQ regarding Section 303(d) because the project area is more than five miles upstream from the impaired stream segment. Appropriate Best Management Practices (BMPs) would be in place at stream crossings during construction to protect water quality.

6.1.4 Floodplains

According to the flood insurance rate maps (FIRM panels 48029C0140E, 48029C0276E, 48029C0277E, 48029C0278E and 48029C0279E) for Bexar County, Texas, the proposed project is crossed by the 100-year flood hazard zone at eight of the stream crossing locations (**Figure 2 A-B**). Flood hazard zones occur along Loop 1604 at Panther Springs Creek, three Panther Creek tributaries and one Salado Creek tributary. Flood hazard zones occur along US 281 North at three Salado Creek tributaries. The entirety of the project is located in Bexar County, which is a regular participant in the National Flood Insurance Program.

6.2 Vegetation

The project is located within the Edwards Plateau ecoregion, Balcones Canyonlands subregion, and lies within the Live Oak-Mesquite-Ashe Juniper Parks, Live Oak-Ashe Juniper Woods, and Live Oak-Ashe Juniper Parks Vegetation Types as described by the Texas Parks and Wildlife Department (TPWD) in “The Vegetation Types of Texas”.

Past development within and adjacent to the project area has modified the land such that little native vegetation remains within the right-of-way. Within the project limits, the right-of-way is regularly mowed and maintained. Other than small landscaped trees, no other trees occurred within the right-of-way. Dominant tree species observed outside the right-of-way include live oak, mesquite, mountain laurel (*Sophora secundiflora*), cedar elm, Ashe juniper and huisache (*Acacia farnesiana*). Although some areas along the right-of-way contain vegetation somewhat typical of the vegetation types discussed above, the majority of land along the entire length of the project limits has been converted to public roadways or commercial businesses with both native and non-native landscaped plants. The entire project limits are essentially devoid of any overstory canopy. There was no riparian habitat observed at any of the creek crossings within the project limits.

6.2.1 Special Habitat Features

The streams crossing the proposed project, potential karst features, and swallow nesting areas under bridges are defined as Special Habitat Features according to the MOA/MOU between TxDOT and TPWD.

As a function of time and state of flow the streams in the proposed project area are categorized as ephemeral, where the streams flow in direct response to precipitation and whose bed is at all times above the water table. None of the streams crossing the proposed project have regularly flowing water or offer riparian habitat.

The proposed project area is also home to several cliff swallow and barn swallow nesting areas under bridges. These species nest under bridges throughout the project area. These species are unlikely to face direct impacts as a result of the proposed project because existing bridge structures are to remain intact. Furthermore, the project will directly benefit these species by adding habitat via the construction of additional bridge structures. In the event that migratory birds are encountered on-site during project construction, every effort will be made to avoid adverse impacts to protected birds, active nests, eggs, and/or young.

The project area is underlain by karstic limestone bedrock, with numerous subterranean voids including solution cavities, closed depressions, caves, and sinkholes. As presented in a Biological Assessment prepared by TxDOT (**Appendix B**, *Biological Assessment of Effects on Threatened and Endangered Species, Interchange of Loop 1604 and U.S. Highway 281, Bexar County, Texas, December 2009*), 28 features were previously surveyed along Loop 1604 in 2005 and found not to contain endangered or listed karst invertebrate species or habitat. In 2009 an additional survey was performed. Four of the original 28 features could not be located. Eight additional karst features were found. All 32 features (24 identified in 2005 and 8 identified in 2009) were evaluated for excavation; 13 of those features were subsequently excavated. Of the 13 excavated features, it was determined that nine were potential habitat for endangered karst species. Presence/absence surveys were undertaken for the nine features in accordance with United States Fish and Wildlife Service (USFWS) protocols. No listed karst invertebrates were discovered during the presence/absence surveys. Non-listed karst invertebrates were discovered in four of the nine features. Although no listed karst invertebrate species were identified during presence/absence surveys, potential project-related effects to unknown endangered karst species populations are possible. In summary, it has been determined that the action may affect, but is not likely to adversely affect, two federally-listed endangered karst invertebrate species. These karst species are included on the List of Endangered and Threatened Wildlife for Bexar County (50 CFR §17.11).

No other unusual vegetation features or special habitat features exist within the project area.

6.3 Wildlife

Wildlife commonly found in the project area is typical of the Edwards Plateau ecoregion and would likely include major wildlife species found in Bexar County. Within the proposed project limits, wildlife is expected to be typical of urban and suburban areas. During site visits typical urban wildlife species were observed including: cliff swallows

(*Petrochelidon pyrrhonota*), barn swallows (*Hirundo rustica*), and mourning doves (*Zenaida macroura*).

6.4 Threatened and Endangered Species

The USFWS and TPWD lists of threatened and endangered species for Bexar County were evaluated on January 28, 2010, and compared to the previous list for Bexar County. The review revealed that 11 species had been added to the list since the draft CE was prepared: two amphibians (San Marcos salamander, Texas Blind salamander), one crustacean (Peck's cave amphipod), two fish (fountain darter, San Marcos gambusia), two insects (Comal Springs dryopid beetle, Comal Springs riffle beetle), three mollusks (rock pocketbook, Texas fatmucket, Texas pimpleback), and one plant (Texas wild-rice). Of the 11, two mollusks (Texas fatmucket, Texas pimpleback) are newly-listed species (State-threatened) and one mollusk (rock pocketbook) has been newly added to Bexar County list as a rare species. The other eight species represent additions to the Bexar County list, but are not newly-listed threatened/endangered or rare species (**Table 1**). A review of TPWD's Natural Diversity Database was conducted on April 15, 2009, to identify historically documented observations (elements of occurrence) of threatened and endangered species within and near the proposed project area. Elements of occurrence records for the *Castle Hills*, *Longhorn*, and *Bulverde* USGS 7.5 minute topographical quadrangle maps were reviewed.

The results of the NDD review reveal that two endangered species, the golden-cheeked warbler (*Dendroica chrysipara*) and the Comal blind salamander (*Eurycea tridentifera*), have been identified within 2-miles of the proposed project, however no threatened or endangered species have been identified within the direct confines of the project construction limits. It should be noted that the NDD is simply a historical record of species occurrence. The NDD is not designed for, or capable of, tracking species movement into or out of a specific area; it merely shows that said species occupied a specific location in the past.

Table 1: Threatened and Endangered Species in Bexar County

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Amphibians				
Cascade Caverns salamander (<i>Eurycea latitans complex</i>) Status: - / T	Endemic; subaquatic; springs and caves in Medina River, Guadalupe River, and Cibolo Creek watersheds within Edwards Aquifer area.	No	No habitat for the Cascade Caverns salamander occurs within the project area.	The project would have no impact on this species.
Comal blind salamander (<i>Eurycea tridentifera</i>) Status: - / T	Endemic; semi-troglobitic; found in springs and waters of caves.	No	No habitat for the Comal blind salamander occurs within the project area.	The project would have no impact on this species.
San Marcos Salamander (<i>Eurycea nana</i>) Status: LE / -	Known to occur from the San Marcos Springs at the bottom of Spring Lake and an adjacent downstream portion of the upper San Marcos River; known to inhabit areas with a gravelly substrate characterized by dense mats of algae and aquatic moss.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
Texas blind salamander (<i>Typhlomolge rathbuni</i>) Status: LE / -	Occurs along a six mile stretch of the San Marcos Spring Fault in the vicinity of the city of San Marcos; known only within the caverns and springs associated with the San Marcos Spring Fault located in the Guadalupe River Basin.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
Texas salamander (<i>Eurycea neotenes</i>) Status: -/-	Endemic; troglobitic; found in springs seeps, cave streams and creek headwaters. Often hides under rocks and leaves in water; restricted to Helotes and Leon Creek drainages	No	No habitat for the Texas salamander occurs within the project area.	The project would have no impact on this species.
Arachnids				
Braken Bat Cave meshweaver (<i>Cicurina venii</i>) Status: LE / -	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	Due to lack of reported occurrence in the project area, it has been determined that the proposed project would have no effect on this species. The proposed project would not destroy or adversely modify designated critical habitat for this species.	The project would have no effect on this species.
Cokendolpher cave harvestman (<i>Texella cokendolpheri</i>) Status: LE / -	Small, eyeless harvestman; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	Due to lack of reported occurrence in the project area, it has been determined that the proposed project would have no effect on this species. The proposed project would not destroy or adversely modify designated critical habitat for this species.	The project would have no effect on this species.
Government Canyon Bat Cave meshweaver (<i>Cicurina vespera</i>) Status: LE / -	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	Due to lack of reported occurrence in the project area, it has been determined that the proposed project would have no effect on this species.	The project would have no effect on this species.

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Government Canyon Bat Cave spider (<i>Neoleptoneta microps</i>) Status: LE / -	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	Due to lack of reported occurrence in the project area, it has been determined that the proposed project would have no effect on this species.	The project would have no effect on this species.
Madla Cave meshweaver (<i>Cicurina madla</i>) Status: LE / -	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	Due to lack of reported occurrence in the project area, it has been determined that the proposed project would have no effect on this species. The proposed project would not destroy or adversely modify designated critical habitat for this species.	The project would have no effect on this species.
Robber Baron Cave meshweaver (<i>Cicurina baronia</i>) Status: LE / -	Small, eyeless, or essentially eyeless spider; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	Due to lack of reported occurrence in the project area, it has been determined that the proposed project would have no effect on this species. The proposed project would not destroy or adversely modify designated critical habitat for this species.	The project would have no effect on this species.
Birds				
American peregrine falcon (<i>Falco peregrinus anatum</i>) Status: DL / T	Year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.	No	Fall and spring migration includes assembling on the Texas coast to rest and replenish fat stores; migration over project area would be incidental.	The project would have no impact on this species.
Black-capped vireo (<i>Vireo atricapillus</i>) Status: LE / E	Migratory songbird that nests in Texas late March through September; habitat is highly variable – all types exhibit a distinctive patchy, two-layered aspect that includes a deciduous, broad-leaved shrub and tree layer with open, grassy spaces; foliage reaching to ground level; upper canopy cover within vireo habitat is relatively open.	No	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no effect on this species.
Golden-cheeked warbler (<i>Dendroica chrysoparia</i>) Status: LE / E	Migratory songbird that nests in Texas early March through early August; prefers tall, dense, mature stands of Ashe juniper at least 20 years old and 15 feet tall for bark shedding to construct nests, stands usually mixed with oak, Texas ash, cedar elm, or hackberry trees; preferred habitat found in moist drainage bottoms along steep-sided canyons and hillsides, sometimes found in dry uplands.	No	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no effect on this species.

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Whooping crane (<i>Grus americana</i>) Status: LE / E	Typically stop to rest and feed in open bottomlands of large rivers, marshes, and agricultural areas; in Texas, whooping cranes feed on blue crab, clams, frogs, minnows, rodents, small birds, and berries. As of December, 2006, there were 237 whooping cranes in the wild that migrate and winter in Texas ³ .	No	Migration through the project area may occur, but any use would be considered incidental.	The project would have no effect on this species.
Zone-tailed hawk (<i>Buteo albonotatus</i>) Status: - / T	In Texas, the zone-tailed hawk nests from late March to mid-May. The zone-tailed hawk nesting habitat consists of large riparian trees, such as cottonwood and willow, often close to steep slopes or cliffs. The zoned-tailed hawk feeds on small vertebrates such as birds, lizards, rodents, frogs, and snakes. Threats to the zone-tailed hawk include the loss of riparian habitat throughout its nesting range.	No	The occurrence of zone-tailed hawks in Bexar County is rare. Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Interior Least Tern (<i>Sterna antillarum athalassos</i>) Status: LE / E	Subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony.	No	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no effect on this species.
Mountain Plover (<i>Charadrius montanus</i>) Status: -/-	Nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding; shortgrass plains and bare, dirt fields; primarily insectivorous.	No	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Peregrine Falcon (<i>Falco peregrinus</i>) Status: DL / T	Both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.	No	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Western Burrowing Owl (<i>Athene cunicularis hypugaea</i>) Status: -/-	Open grassland, especially prairie, plains and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roots in abandoned burrows.	No	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
White-faced Ibis (<i>Plegadis chihi</i>) Status: - / 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	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Wood Stork (<i>Mycteria americana</i>) Status: - / 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 in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960.	No	Appropriate nesting habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Crustaceans				
A cave obligate crustacean (<i>Monodella texana</i>) Status: -/-	Subaquatic; subterranean obligate; underground freshwater aquifers.	No	No habitat for the cave obligate crustacean occurs within the project area.	The project would have no impact on this species.
Peck's cave amphipod (<i>Stygobromus pecki</i>) Status: LE / -	Crustacean that occupies subterranean habitats of the Edwards Aquifer near several spring openings in Comal County.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
Fish				
Fountain Darter (<i>Etheostoma fonticola</i>) Status: LE / -	A fish that is known only from the San Marcos and Comal Rivers within the Guadalupe River Basin; prefers areas where there are springs with a dense bed of aquatic plants growing close to bottom of the canal.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
Guadalupe bass (<i>Micropterus treculii</i>) Status: -/-	Endemic to perennial streams of the Edward's Plateau region; introduced to the Nueces River system.	No	No habitat for the Guadalupe bass occurs within the project area.	The project would have no impact on this species.
San Marcos gambusia (<i>Gambusia georgei</i>) Status: LE / -	Last collected in the wild in 1982 from the San Marcos River; TPWD listed the fish as "extirpated" in the last revision of the Annotated County Lists of Rare Species.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
Toothless blindcat (<i>Trogloglanis pattersoni</i>) Status: - / T	Troglobitic, blind catfish endemic to the San Antonio Pool of the Edward's Aquifer.	No	No habitat for the toothless blindcat occurs within the project area.	The project would have no impact on this species.
Widemouth blindcat (<i>Satan eurystomus</i>) Status: - / T	Troglobitic, blind catfish endemic to the San Antonio Pool of the Edward's Aquifer.	No	No habitat for the widemouth blindcat occurs within the project area.	The project would have no impact on this species.

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Insects				
A ground beetle (<i>Rhadine exilis</i>) Status: LE / -	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	A determination is made that the proposed project may affect, but is not likely to adversely affect <i>R. exilis</i> based on the known proximity of these species to the proposed project and on the scope of the proposed project. The proposed project would not destroy or adversely modify designated critical habitat for this species.	The project may affect, but is not likely to adversely affect, this species.
A ground beetle (<i>Rhadine infernalis</i>) Status: LE / -	Small, essentially eyeless ground beetle; karst features in north and northwest Bexar County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	A determination is made that the proposed project may affect, but is not likely to adversely affect <i>R. infernalis</i> based on the known proximity of these species to the proposed project and on the scope of the proposed project. The proposed project would not destroy or adversely modify designated critical habitat for this species.	The project may affect, but is not likely to adversely affect, this species.
Comal Springs dryopid beetle (<i>Stygoparnus comalensis</i>) Status: LE / -	Known to occur at Comal Springs in Comal County and at Fern Bank Springs in Hays County; most dryopid larvae are vermiform and live in soil or decaying wood; however, Comal Springs dryopid beetle is the only known subterranean species in family Dryopidae and larval are presumed to inhabit the air-filled voids within the aquifer.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
Comal Springs Riffle Beetle (<i>Heterelmis comalensis</i>) Status: LE / -	Known only from San Marcos Springs in Hays County and from Comal Springs in Comal County; the beetle is aquatic and has been collected from riffles in spring runs with gravel substrate and water depth of typically one to four inches.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
Helotes mold beetle (<i>Batrisodes venyivi</i>) Status: LE / -	Small, eyeless mold beetle; karst features in northwestern Bexar County and northeastern Medina County. Obligate karst species that require a habitat consisting of underground, honeycomb limestone that maintains high humidity and stable temperatures and a surface environment that is conducive to the supplementation of nutrients to these underground areas.	Yes	Due to lack of reported occurrence in the project area, it has been determined that the proposed project would have no effect on this species. The proposed project would not destroy or adversely modify designated critical habitat for this species.	The project would have no effect on this species.
Manfreda giant-skipper (<i>Stallingsia maculosus</i>) Status: -/-	Most skippers are small and stout-bodied. At rest most skippers hold front and hind wings at different angles. Skipper larvae are smooth with the head and neck constricted; larvae usually feed inside a leaf shelter and pupate in a cocoon made of leaves fastened together with silk.	No	No habitat for the Manfreda giant-skipper occurs within the project area.	The project would have no impact on this species.

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Rawson's metalmark (<i>Calephelis rawsoni</i>) Status: -/-	Moist areas in shaded limestone outcrops in central Texas, desert scrub, or oak woodland in foothills or along rivers elsewhere; larval hosts are <i>Eupatorium havanense</i> , <i>E. greggi</i> .	No	No habitat for the Rawson's metalmark occurs within the project area.	The project would have no impact on this species.
Mammals				
Black Bear (<i>Ursus americanus</i>) Status: T,SA;NL/T	Bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear, treat all Texas black bears as federal and state listed Threatened.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no effect on this species.
Cave myotis bat (<i>Myotis velifer</i>) Status: -/-	Colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow nests. Roosts in clusters of up to thousands of individuals. Hibernates in limestone caves of Edwards Plateau during winter.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Ghost-faced bat (<i>Mormoops megalophylla</i>) Status -/-	Colonially roosts in caves, crevices, abandoned mines and buildings. Breeds late winter-early spring.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Gray wolf (<i>Canis lupus</i>) Status: LE/E	Extirpated; formerly known throughout the western two-thirds of the state in forests, brushlands or grasslands.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no effect on this species.
Plains spotted skunk (<i>Spilogale putorius interrupta</i>) Status: -/-	Open fields, prairies, croplands, fence rows, farm yards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Red Wolf (<i>Canis rufus</i>) Status: LE/E	Extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no effect on this species.
Mollusks				
Creepers (squawfoot) (<i>Strophitus undulatus</i>) Status: -/-	Small to large streams, prefers gravel or gravel and mud in flowing water. Found in the Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
False spike mussel (<i>Quincuncian mitchelli</i>) Status: -/T	Substrates of cobble and mud, with water lilies present. Historically found in the Rio Grande, Brazos, Colorado and Guadalupe (historic) River basins.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Golden orb (<i>Quadrula aurea</i>) Status: -/T	Sand and gravel in some locations and mud at others. Found in the Guadalupe, San Antonio, and Nueces River basins.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Mimic cavesnail (<i>Phreatodrobia imitata</i>) Status: -/-	Subaquatic; only known from two wells penetrating the Edwards Aquifer.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Pistolgrip (<i>Tritogonia verrucosa</i>) Status: -/-	Stable substrate rock, hard mud, silt and soft bottoms, often buried deeply. East and Central Texas and found in Red through San Antonio River basins.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Rock pocketbook (<i>Arcidens confragosus</i>) Status: -/-	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	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Texas fatmucket (<i>Lampsilis bracteata</i>) Status: -/T	Streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and coarse gravel or sand in moderately flowing water; Colorado and Guadalupe River basins	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Texas pimpleback (<i>Quadrula petrina</i>) Status: -/T	Mud, gravel and sand substrates, generally in areas with slow flow rates; Historically known from the Colorado and Guadalupe river basins	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Reptiles				
Texas horned lizard (<i>Phrynosoma cornutum</i>) Status: - / T	Prefers open habitats in arid and semi-arid regions with sparse ground cover including bunchgrass and cactus growing on sandy/rocky soil types; Harvester ants make up a substantial portion of the Texas horned lizard diet; historic range included almost the entire State – currently, its presence has declined in central Texas.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Indigo Snake (<i>Drymarchon corais</i>) Status: - / 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 microhabitats, such as rodent burrows, for shelter.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Spot-tailed earless lizard (<i>Holbrookia lacerata</i>) Status: -/-	Central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas. Eggs laid underground.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Texas Tortoise (<i>Gopherus berlandieri</i>) Status: - / 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; longevity greater than 50 years; active March-November; breeds April-November.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Timber/Canebrake rattlesnake (<i>Crotalus horridus</i>) Status: - / 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.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Plants				

Species Status: USFWS/TPWD	Species/Habitat Description	Habitat Present	Pertinent Information	Project Impact/Effect
Big red sage (<i>Salvia pentstemonoides</i>) Status: -/-	Texas endemic and flowers from June through October. Found in moist to seasonally wet, steep limestone outcrops on seeps within canyons or along creek banks.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Bracted twistflower (<i>Streptanthus bracteatus</i>) Status: -/-	Endemic and flowers from April through May. Found in shallow clay soils over limestone, mostly on rocky slopes.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Correll's false dragon-head (<i>Physostegia correllii</i>) Status: -/-	Flowers from May through September. Found in wet, silty clay loams on streambanks, in creek beds, irrigations channels, and roadside drainage ditches.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Elmendorf's onion (<i>Allium elmendorfii</i>) Status: -/-	Texas endemic and flowers from March through May. Found in grassland openings in oak woodlands on deep loose well drained sands.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Hill Country wild-mercury (<i>Argythamnia aphyroides</i>) Status: -/-	Texas endemic and flowers from April through May with fruit persisting until midsummer. Found mostly in bluestem-grama grasslands associated with plateau live oak woodlands on shallow to deep clays over limestone on rolling uplands.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Parks' jointweed (<i>Polygonella parksii</i>) Status: -/-	Texas endemic and flowers from June through late October or September through October. Mostly found on deep, loose whitish sand blowouts in Post Oak Savanna landscapes.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Sandhill woollywhite (<i>Hymenopappus carizoanus</i>) Status: -/-	Texas endemic and flowers from April through June. Found in disturbed or open areas in grasslands and post oak woodlands on deep sands.	No	Appropriate habitat does not exist within or adjacent to the project area.	The project would have no impact on this species.
Texas wild-rice (<i>Zizania texana</i>) Status: LE / -	A perennial, emergent, aquatic grass known only from Spring Lake and its outflow, the San Marcos River, and downstream to its confluence with the Blanco River in Hays County, Texas; prefers shallow, clear, clean, flowering water with constant temperatures; grow in the swiftest currents in the middle of the river.	No	There is no suitable habitat within or adjacent to the ROW.	The project would have no effect on this species.
* U. S. Fish and Wildlife Service (C = candidate, E = endangered, T = threatened, DL = delisted, PDL = proposed delisting) ** Texas Parks and Wildlife Department (E = endangered and T = threatened)				

6.5 Migratory Birds

The terms of the Migratory Bird Treaty Act (MBTA) of 1918 apply to the proposed 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.

In the event that migratory birds are encountered on-site during project construction, every effort will be made to avoid adverse impacts to protected birds, active nests, eggs,

and/or young. The contractor would be prepared to prevent migratory birds from building nests between February 15 and October 1.

6.6 Prime Farmlands

The Farmland Protection Policy Act (FPPA, 7 USC 4201-4209; and its regulations, 7 CFR Part 658) require federal agencies, such as FHWA, to coordinate with the Natural Resources Conservation Service (NRCS) if their activities may irreversibly convert farmland (directly or indirectly) to nonagricultural use. For purposes of the FPPA, farmland includes prime farmland, unique farmland, and farmland of statewide or local importance.

The proposed project would be constructed within existing right-of-way and would be located within an urban setting; therefore, the project is exempt from the FPPA. No coordination with the NRCS would be required.

6.7 Social and Economic Conditions

This section describes socio-economic conditions for the project area.

Land Use

The proposed improvements are located in northern San Antonio, Bexar County, Texas. According to estimates from the City of San Antonio, approximately 56 percent of the land immediately adjacent to the project is identified as commercial property. Residential uses comprise approximately 8 percent of land use immediately adjacent to the project. Approximately 22 percent of the land immediately adjacent to the project is identified as vacant. Commercial civic and utility uses comprise much of the remaining land immediately adjacent to the project. Existing land uses in the project area are shown in **Figure 5**.

Demographics

Census 2000 data at the census block group (BG) and block level were used for project level analyses. A BG is a subset of a census tract (CT) that closely represents the actual community composition. The proposed project is located adjacent to the CT, BGs and associated census blocks listed in **Table 2** and shown on **Figure 6**.

According to the US Census Bureau, the population of Bexar County was 1,392,931 and the population of the City of San Antonio was 1,144,646 in 2000. The total population of the blocks within the study area was 12,892.

Table 2: Project Area Census Tracts, Block Groups, and Blocks

Census Tract	Block Group	Block(s)	
1211.08	4	4004	4013
		4012	
1211.16	1	1000	1006
1211.16	2	2011	
1211.17	1	1000	
1211.17	2	2002	2004
		2003	
1211.18	1	1001	1007
		1002	1012
		1003	1013
		1004	1014
		1005	
		1006	
1219.02	1	1031	
1914.06	1	1000	1025
1914.07	1	1000	
1917.00	1	1001	1009
		1002	1018
		1003	1034
1917.00	2	2000	2022
		2016	2030
		2018	2032
		2021	
1917.00	4	4000	4001
1918.02	1	1034	1043
		1041	
		1042	
1918.03	3	3000	3004

Source: Census 2000

Limited English Proficiency (LEP)

Executive Order (EO) 13166, “Improving Access to Services for Persons with Limited English Proficiency (LEP),” was signed by President Clinton on August 11, 2000. This EO calls for all federal agencies to examine the services they provide and identify any need for services to those with limited English proficiency, and develop and implement a system to provide those services so that LEP persons can have meaningful access to them. In compliance with this EO, this project was assessed to determine if a LEP population is located within the project area.

Within Bexar County, approximately 15 percent of the population five years of age and over speaks English less than “very well.” According to the 2000 Census, the total population of people five years of age and over within the BGs adjacent to the project, is approximately 29,094 persons. Of the project area BG population, 948 people (3 percent) speak English less than “very well. Specific LEP languages and respective percentages represented in the LEP study area are the following: Spanish (1.2 percent) and Asian and Pacific Islander (0.2 percent). Throughout the proposed project limits, the street and business signs are in English and do not display notices in additional languages such as Spanish. There are no indications that a LEP community exists within the limits of the proposed project. However, every effort will be made to provide project and meeting materials and information in both English and Spanish.

6.7.1 Community Profile

Minority Population

As shown in **Table 3** and based upon information from the US Census Bureau, *Census 2000* data, the minority population in Bexar County was 897,656 (approximately 64 percent of total county population). The minority population in the City of San Antonio was 780,684 (approximately 68 percent of total city population). The total population of census blocks in the project study area is 12,892. The percent minority population within the blocks in the project study area ranged from 0 percent to 55 percent which is lower than the percentage of minority residents in Bexar County (64 percent) and the City of San Antonio (68 percent). One census block (CT 1917.00, BG 2, Block 2018) had a minority population greater than 50 percent, with a total population of 11 and a minority population of 6, or 55 percent. The population of this block represents approximately 0.1 percent of the study area population.

Table 3: Minority Population 2000 Census			
Area / CT, BG, Block	Population	Minority Population	Percent Minority
Bexar County	1,392,931	897,656	64%
San Antonio	1,144,646	780,684	68%
CT 1211.08, BG4			
Block 4012	271	47	17%
Block 4004	109	7	6%
Block 4013	0	0	N/A
CT 1211.16, BG1			
Block 1000	804	151	19%
Block 1006	516	109	21%
CT 1211.16, BG2			
Block 2011	114	15	13%
CT 1211.17, BG1			
Block 1000	1137	39	3%
CT 1211.17, BG2			
Block 2002	49	2	4%
Block 2003	0	0	
Block 2004	309	45	15%
CT 1211.18, BG1			
Block 1001	0	0	N/A
Block 1002	317	105	33%
Block 1003	136	59	43%
Block 1004	99	19	19%
Block 1005	34	5	15%
Block 1006	56	17	30%
Block 1007	430	55	13%
Block 1012	165	39	24%
Block 1013	192	44	23%
Block 1014	0	0	N/A
CT 1219.02, BG1			
Block 1031	19	0	0%
CT 1914.06, BG1			
Block 1000	1433	130	9%
Block 1025	950	99	10%
CT 1914.07, BG1			
Block 1000	160	20	13%
CT 1917, BG 1			
Block 1001	4	0	0%
Block 1002	133	38	29%
Block 1003	0	0	N/A

Table 3: Minority Population 2000 Census			
Area / CT, BG, Block	Population	Minority Population	Percent Minority
Block 1009	198	16	8%
Block 1018	57	5	9%
Block 1034	209	8	4%
CT 1917, BG 2			
Block 2000	49	6	12%
Block 2016	106	8	8%
Block 2018*	11	6	55%
Block 2021	0	0	N/A
Block 2022	13	0	0%
Block 2030	0	0	N/A
Block 2032	0	0	N/A
CT 1917, BG 4			
Block 4000	0	0	N/A
Block 4001	986	132	13%
CT 1918.02, BG1			
Block 1034	542	27	5%
Block 1041	0	0	N/A
Block 1042	0	0	N/A
Block 1043	0	0	N/A
CT 1918.03, BG3			
Block 3000	714	101	14%
Block 3004	678	49	7%

*Environmental Justice Population

Source: US Census Bureau. Census 2000, Summary File 3, Table P7 and Summary File 1, Table P7

Household Income

Median household income in 1999 for Bexar County was \$43,724 according to *Census 2000* data. Median household income in 1999 for the City of San Antonio was \$41,331 according to *Census 2000* data. Median incomes for the BGs in the project area ranged from \$45,227 to \$130,288 in 1999. **Table 4** shows a breakdown by BG for the project area. According to the data, the median income in the project area BGs is greater than the median household income of either the City of San Antonio or Bexar County as a whole.

Table 4: Median Household Income and Poverty Status: 1999

Area / CT, BG	Population	Median Household Income	Persons Below Poverty Level	
			Number	Percent
Bexar County	1,359,271	\$43,724	215,736	16%
City of San Antonio	1,122,736	\$41,331	193,731	17%
CT 1211.08, BG4	1,109	\$65,750	28	2.5%
CT 1211.16, BG1	1,285	\$45,227	67	5%
CT 1211.16, BG2	616	\$53,654	42	7%
CT 1211.17, BG1	1,653	\$70,188	119	7%
CT 1211.17, BG2	1,032	\$84,777	30	3%
CT 1211.18, BG1	1,734	\$91,457	14	0.8%
CT 1219.02, BG1	3,422	\$80,935	47	1%
CT 1914.06, BG1	6,364	\$110,963	162	2.5%
CT 1914.07, BG1	2,129	\$130,288	41	2%
CT 1917, BG 1	1,950	\$80,320	63	3%
CT 1917, BG 2	900	\$94,839	16	2%
CT 1917, BG 4	4,306	\$85,550	67	1.5%
CT 1918.02, BG1	4,192	\$104,137	23	0.5%
CT 1918.03, BG3	2,149	\$125,432	18	0.8%
PROJECT AREA TOTAL	32,841		737	2.2%

Source: US Census Bureau. Census 2000, Summary File 3, Table P77 & Table P87.
 (Note: This data not available at the "Block" level)

The US Department of Health and Human Services poverty guideline for a family of four is \$22,050 in 2009. Low-income persons constitute approximately 2.2 percent of the project area. As shown in **Table 4**, the percent of persons living below the poverty level in the individual BGs that comprise the project area ranged from 0.5 percent to 7 percent. Overall, the percentage of the population below the poverty level in the project area (2.2 percent) is below the percentage of persons living below poverty in Bexar County (16 percent), and lower than those living in the City of San Antonio (17 percent).

6.7.2 Environmental Justice (EJ)

EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires each Federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority populations and low-income populations." FHWA has identified three fundamental principles of environmental justice:

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

In compliance with this EO, this project was assessed in order to determine whether or not the proposed activities would have a disproportionate impact on low-income or minority populations. Disproportionately high and adverse human health or environmental effects are defined by FHWA as adverse effects that are predominately borne by a minority population and/or a low income population or will be suffered by the minority population and/or low income population and are appreciably more severe or greater in magnitude than the adverse effects that will be suffered by the non-minority and/or non low-income population.

Minority Population

One census block (CT 1917.00, BG 2, Block 2018) adjacent to the project area has a minority population greater than 50 percent – the threshold for identifying environmental justice populations. The total population within CT 1917.00, BG 2, Block 2018 is 11 and the minority population is 6, or 55 percent. The population of this block, which is considered an Environmental Justice population, represents 0.1 percent of the study area population. No other project area census blocks exceeded 50 percent minority population.

Low Income

For purposes of Environmental Justice analysis, low-income populations are defined as any readily identifiable group of persons whose median family income is at or below the US Department of Health and Human Services poverty level (\$22,050 in 2009) and who live in a geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers) who would be similarly affected by a proposed program, policy, or activity. With regard to income, none of the BGs in the project area are considered Environmental Justice populations.

6.8 Air Analysis

The purpose of the proposed project is to improve operational efficiency and reduce delays at the US 281 North and Loop 1604 interchange by constructing direct connectors between the two roadways. This project (CSJs: 0253-04-139, 141) is exactly included in and consistent with the financially constrained San Antonio – Bexar County MPO’s 2035 MTP and the 2008-2011 TIP. Copies of the pages are included in **Appendix C**. This project is located in Bexar County which is in an area designated by the US Environmental Protection Agency (EPA) as attainment of all National Ambient Air Quality Standards (NAAQS); therefore, the transportation conformity rule does not apply.

The San Antonio area (Bexar, Comal, Guadalupe and Wilson Counties) entered into an Early-Action Compact agreement with the EPA in 2004. As part of the agreement, proactive efforts were implemented to improve air quality, and the San Antonio area was designated as a deferred nonattainment area for ozone based on the 1997 ozone NAAQS of 0.080 ppm. The EPA designated the San Antonio area attainment on April 2, 2008. In addition, the five counties along the Austin-San Antonio corridor implemented the “Big Push” initiative in an attempt to further improve air quality in this region. The "Big Push" encourages additional voluntary measures to reduce emissions in this corridor.

In March 2008 the EPA revised the NAAQS for ozone to 0.075 parts per million (ppm). Non-attainment area designations in accordance with the revised 2008 ozone standard were expected to occur in March 2010 and in a March 12, 2009 letter from Governor Perry to EPA, Bexar County was recommend to be designated as nonattainment for ozone. The EPA was scheduled to make final designations in March, 2010. However, on September 16, 2009, the EPA announced that it was reconsidering the 2008 revision to the ozone standard. Reconsideration of the ozone standard is expected to be complete by August 2010. Non-attainment area designations under the 2010 ozone standard are expected to occur in August 2011. It is anticipated that areas designated non-attainment under the revised 2010 ozone standard will have to demonstrate Transportation Conformity by August 2012 (i.e., one year after the effective date of the non-attainment designations).

6.8.1 Mobile Source Air Toxics

In addition to the criteria air pollutants covered under the NAAQS, the EPA also monitors air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). Mobile source air toxics

(MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and emitted to the air when fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

Because the projected average daily traffic (ADT) for the individual direct connectors does not exceed 140,000 vpd, a quantitative analysis of MSAT is not required. Although a qualitative assessment cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions, if any, from various alternatives. The qualitative assessment found in **Appendix D** is derived from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives* (Claggett and Miller, 2006).

There may be localized areas where ambient concentrations of MSATs are slightly higher in any build scenario than in the no build scenario. Dispersion studies have shown that the “roadway” air toxics start to drop off at about 100 meters (328 feet). By 500 meters (1,640 feet), most studies have found it very difficult to distinguish the roadway from background toxic concentrations in any given area. Therefore, the study area for sensitive receptors includes the areas 500 meters from the project area. Sensitive receptors include those facilities most likely to contain large concentrations of the more sensitive population (hospitals, schools, licensed daycare facilities, and elder care facilities). The Department of Family and Protective Services childcare licensing website was searched to identify childcare facilities within 100 and 500 meters of the project area. A field survey was conducted to verify these facilities and identify other potential sensitive receptors located within 500 meters of the project area. Nine sensitive receptors were found within 500 meters of the project area (**Figure 7**). As shown in **Table 5**, three of these sensitive receptors are within 328 feet (100 meters) and six are between 328 feet (100 meters) and 1,640 feet (500 meters) from the road.

Table 5: Sensitive Receptors

Facility Name	Address	Located within 328 feet (100m) of the right-of-way	Located within 1,640 feet (500m) of the right-of-way
St. Thomas Episcopal Church and School	1416 N SL-1604 E San Antonio, TX 78232	X	
Northern Hills Church and School	3703 N Loop 1604 E San Antonio, TX 78247		X
Community Bible Church and Pre-School	2477 North Loop 1604 E San Antonio, TX 78232		X
Concordia Lutheran Church and Pre- School	16801 Huebner Rd San Antonio, TX 78258		X
Harvest Fellowship Church and Pre-School	1270 N Loop 1604 E San Antonio, TX 78232	X	
Abiding Presence Lutheran Church and Pre-School	14700 San Pedro Ave San Antonio, TX 78232	X	
Parkhills Baptist Church and School	17747 San Pedro Ave San Antonio, TX 78232		X
Christian Family Church and School	3607 N Loop 1604 E, San Antonio, TX 78232		X
Coker Elementary School	302 Heimer Road, San Antonio TX 78232		X

6.9 Noise Analysis

The analysis of noise levels within the study area was accomplished in accordance with TxDOT’s (FHWA approved) *Guidelines for Analysis and Abatement of Highway Traffic Noise*. A total of seven noise receivers were analyzed as representatives of other receivers in the project area (**Figure 8**). A summary of the analysis is presented in **Section 7.9**.

6.10 Historic Resources

A review of the National Register of Historic Places (NRHP), the list of State Archeological Landmarks, and the list of Recorded Texas Historical Marker indicates that no properties within the project area are listed in the NRHP. No other historically significant properties have been previously documented within the Area of Potential Effects (APE). Through consultation with the State Historic Preservation Officer

(SHPO) the APE has been defined as 150-feet beyond the existing or proposed right-of-way. Cultural resource survey efforts included three separate reconnaissance surveys which resulted in the identification of nine historic-age properties (built prior to 1965) located within this project's APE. There are no Official Texas Historical Markers located within the project's APE.

Pursuant to the First Amended Statewide Programmatic Agreement for Cultural Resources (PA-TU), reviews of the NRHP eligibility documentation and evaluations made in previous surveys were conducted for this project by a TxDOT pre-certified architectural historian and by TxDOT Historical Studies Branch staff. Determinations for this project were based primarily on the most recent findings reported in the *Historic Resources Survey Loop 1604, Bexar and Guadalupe Counties, Texas* (HNTB Project 39055, prepared by HNTB Corporation, April 2007). Of the 159 historic-age resources (built prior to 1965) identified in the report within a study area of 150-feet beyond the right-of-way of the larger project, only ten lie within the current project's APE. Consultation between TxDOT Environmental Affairs Divisions and the SHPO resulted in concurrence on April 27, 2007, that these nine historic-age resources were not eligible for listing in the NRHP.

Pursuant to Stipulation VI, "Undertakings with the Potential to Cause Effects," of the PA-TU among the FHWA, the SHPO, the Advisory Council on Historic Preservation, and the TxDOT and Memorandum of Understanding, TxDOT historians therefore determined that no historic properties are present in the proposed project's APE and that individual project coordination with SHPO is not required.

6.11 Archeology

A TxDOT archeologist evaluated the potential for the proposed undertaking to affect archeological history properties (36 CFR 800.16(1)) or State Archeological Landmarks (13 TAC 26.12) in the APE. The following documentation presents TxDOT's findings and explains the basis for those findings.

The extent of modern development in northern Bexar County 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 study area 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 current project area. These investigations were concluded with the identification of numerous newly recorded archeological sites. 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, with 28 prehistoric sites, 8 historic sites, and 3 sites with both components. PAI archeologists also revisited and reassessed 26 previously recorded sites.

A large aerial survey in the vicinity of the study area 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 resulted in a number of small prehistoric lithic scatters, 41BX90, 41BX91, 41BX99, 41BX121, 41BX749 and 41BX758 recorded near US 281 (McGraw et. al 1977).

The study area has been surveyed by previous projects throughout the history of the construction of both US 281 and Loop 1604. The first archeological survey along US 281 was initiated in December, 1984, and resulted in a report of negative findings. The project area was revisited in September, 1987, with similar results. Intersection improvements along a portion of US 281 resulted in a recommendation of no survey warranted in December, 1995. 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 41BX90 was found to extend within the area of potential effects. Due to the lack of chronologically diagnostic material and the extent of modern disturbances, the SHPO concurred on May 19, 2000, that the portion of the site within the right-of-way was not eligible for listing in the NRHP.

In the following year, the proposed widening of the southbound parallel partial access controlled lanes from Loop 1604 to Henderson Pass as part of a maintenance project was preceded by a recommendation of no historic properties affected with a concurrence from the SHPO on April 23, 2001. By 2002, two additional segments were 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 SWCA Environmental Consultants under THC Antiquities permit No. 2651, received the same a month earlier on February 12, 2002. The US 281/Stone Oak Parkway project also included a new control section job number

(CSJ: 0253-04-114) that combined a new north terminus at Marshall Road with the Stone Oak interchange project for combined limits from Loop 1604 to Marshall Road.

TxDOT conducted a reevaluation of a segment of US 281 previously assessed in May, 2000 (CSJ: 0253-04-089) in early January, 2005. This included a small northward extension of the APE approximately 0.25 mile further northward. TxDOT recommended that no archeological properties were 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). The proposed project was only partially surveyed due to rights-of-entries issues and one ineligible undiagnostic upland lithic scatter was identified. A reevaluation of US 281 at Borgfeld Drive (CSJ: 0253-04-093 and -112) was conducted in November, 2005, resulting in no change from the original archeological findings of no effect and THC consultation in March, 2002.

Multiple Section 106 consultations for the US 281 and Loop 1604 corridors, including the interchange project area, have been conducted over the last several decades. The archeological investigations consisted of background literature and records review, and pedestrian surveys. To date, none of the archeological surveys conducted within the APE of the proposed interchange have identified any archeological properties which would be eligible for listing in the NRHP or warrant designation as a State Archeological Landmark. Most of the APE has been previously disturbed by highway construction, installation of utilities or other development activities; thus, the area is not likely to contain intact cultural sites.

Two previously recorded prehistoric archeological sites (41BX22 and 41BX65) lie within the current APE and site 41BX777 lies adjacent to the northern terminus. Site 41BX22 near the Salado Creek and 411BX65 along Panther Springs Creek were recently evaluated by UTSA in 2008. Due to the extensive disturbance and modern impacts, neither site was recommended as eligible for listing on the National Register. The third previously recorded site, 41BX777, lies near the northern terminus of the project area along US 281. Recorded as a prehistoric scatter of lithic debris, the area was not recommended for further work. The Texas SHPO has previously concurred that all three previously recorded sites within the current APE were not eligible for listing on the National Register and no further work was warranted.

In summary, multiple archeological surveys to date within and adjacent to the area of potential effects have not identified any archeological property eligible for listing on the National Register of Historic Places nor that warrants designation as a State Archeological Landmark. Based on the extent and negative results of previous surveys, the extensive surface and subsurface disturbances both within and adjacent to the ROW, and the limited scope of proposed work, there is little likelihood of significant or intact prehistoric or historical archeological sites within the APE nor is the setting is not favorable for their occurrence or preservation. As a result, it is recommended that no archeological historic properties (36 CFR Part 800.16(1) or State Archeological Landmarks (13 TAC 26.12) occur within the APE, none will be affected by the proposed undertaking, and that no additional archeological investigations are warranted. The proposed undertaking meets the criteria for a project with No Potential to Cause Effects on Historic Properties as defined in Appendix 3 of the PA-TU. The proposed project also meets the criteria for activities that do not require review under the Memorandum of Understanding (MOU) between TxDOT and the Texas Historical Commission. The project description conforms to items I, K, and L in Appendix 3 of the PA-TU and items I, K, and L in 43 TAC 2.24(e)(1) of the MOU.

TxDOT finds that the proposed undertaking would not affect archeological historic properties or State Archeological Landmarks, and that no additional work is required.

Section 106 review and consultation has been initiated in accordance with the PA-TU and the MOU between the THC and TxDOT. The THC concurred with the above recommendation of no effect to archeological resources on September 3, 2009. Federal tribal coordination has been initiated.

6.12 Parks and Public Land/Section 4(f)

Under Section 4(f) of the 1966 Transportation Act (23 CFR 774), projects which impact or use public parks, recreation areas, wildlife or waterfowl refuges and historic sites, must perform a 4(f) evaluation. No Section 4(f) properties have been identified in the project area.

6.13 Hazardous Materials Waste

A database search of EPA and TCEQ regulated facilities and regulatory compliance permitting was performed to identify the potential existence of hazardous materials or accidental releases within the project limits. The regulatory databases reviewed were prepared by GeoSearch, Inc. **Table 6** identifies the regulatory databases reviewed. In addition, a field reconnaissance of the project limits was conducted to confirm the

location of selected listed facilities, and to observe the general environmental conditions at these sites within the project limits. No observable physical evidence (e.g., discolored surfaces or soil, anomalous patches of dead flora) of potential contamination or a potentially hazardous materials release was encountered during field surveys.

Table 6: Hazardous Materials Regulatory Database Review for Project Area

Regulatory Database	Location
National Priorities List	www.epa.gov/superfund/sites/npl/npl.htm
Comprehensive Environmental Response Compensation and Liability Information System	www.epa.gov/enviro/html/cerclis/cerclis_query.html
Resource Conservation and Recovery Act Information System	www.epa.gov/enviro/html/rcris/rcris_query_java.html
National Response Center	www.nrc.uscg.mil/foia.html
TCEQ for Municipal Solid Waste Facilities	www.tceq.state.tx.us/permitting/waste_permits/msw_permits/msw.html
TCEQ Registered Petroleum Storage Tanks	www.tceq.state.tx.us/permitting/registration/pst/pst_query.html
TCEQ Leaking Petroleum Storage Tanks	www.tceq.state.tx.us/remediation/pst_rp/pstquery.html

Sites observed adjacent to the right-of-way included Resource Conservation and Recovery Act Information System sites, petroleum storage tank and leaking petroleum storage tank sites, Voluntary Cleanup Program sites, several closed and abandoned landfill sites and other commercial developments. No obvious environmental concerns were noted during the review of the regulatory data and the site reconnaissance.

A new search performed by GeoSearch, Inc. in April 2009 revealed no additional obvious environmental concerns.

7.0 DIRECT EFFECTS OF THE PROPOSED PROJECT

7.1 Water Resources

7.1.1 Waters of the U.S./Wetlands

Project-related work would only occur within the jurisdictional boundaries of two waters of the US (Panther Springs Creek and Mud Creek) – both of which are crossed by Loop 1604. All other crossings on Loop 1604 would be spanned by the roadway improvements. No work would occur in jurisdictional waters traversed by US 281 North.

Panther Springs Creek is spanned by two frontage road bridges and two mainlane bridges (STA 305+00). No wetlands were identified at this location. The existing westbound

Loop 1604 bridge over Panther Springs Creek would be widened from 30 to 40 feet. The existing eastbound Loop 1604 bridge over Panther Springs Creek would not be widened³. The impact to the channel would be only the addition of bridge columns within the channel bed. Work at this crossing would result in temporary (construction access) impacts of approximately 0.05 acres and a permanent impact of approximately 0.01 acres. No impacts to wetlands would occur.

Mud Creek is also spanned by two frontage road bridges and two mainlane bridges (STA 485+50). No wetlands were identified at this location. The existing eastbound Loop 1604 bridge over Mud Creek would be widened approximately 20 feet to the outside of the bridge³. The existing westbound Loop 1604 bridge over Mud Creek would be widened approximately 10 feet to the outside of the bridge³. The impact to the channel would be only the addition of bridge columns within the channel bed. Work at this crossing would result in temporary (construction access) impacts of approximately 0.05 acres and a permanent impact of approximately 0.01 acres. No impacts to wetlands would occur.

These two crossings can each be authorized under Section 404 of the Clean Water Act by nationwide permit 14 for linear transportation projects. Although impacts are less than one-tenth of an acre and no jurisdictional wetlands are present at these locations, pre-construction notification to the USACE is required at both locations under Nationwide Permit General Condition 17, because the stream crossings occur within the karst invertebrate consultation area (**Section 7.4**). No compensatory mitigation would be anticipated under General Condition 17.

7.1.2 Edwards Aquifer

The proposed improvements would add approximately 19.8 acres of impervious cover over the recharge zone of San Antonio Segment of the Edwards Aquifer. The recharge zone is the portion of the aquifer primarily where fractures and conduits are present allowing for surface water migration. The 19.8 acres represents approximately .003 percent of the 768,925 acre recharge zone of the San Antonio Segment of the Edwards Aquifer. This .003 percent increase in impervious cover is negligible when considering the size and extent of the recharge zone.

³ The project description, as reflected in the December 2009 Draft CE, did not accurately reflect the schematic. Although there were no changes in the schematic design, more detailed descriptions of the proposed improvements were added in this document for clarification and minor corrections to the project description have been made. The description reflected in this (final) version of the CE accurately reflects the final schematic as presented at the January 11, 2010 public meeting.

It should be noted that the draft CE, as made available for public review in December 2009, incorrectly estimated the amount of additional impervious cover to be approximately 10 acres (representing .001 percent of the recharge zone). This calculation did not account for impervious cover resulting from the addition of acceleration and deceleration lanes, turn-around lanes and auxiliary lanes. Both percentages (.001 and .003) represent negligible additions of impervious cover; thus, the calculation error does not alter of the findings of this document.

This construction project would not be characterized by significant changes to existing grades but rather construction of bridges above existing facilities. Most mainlanes and frontage roads would remain in their existing locations. Features such as auxiliary lanes, ramp adjustments, bridge abutments, and horizontal shifts of some frontage roads would require grading to match to existing facilities. Those changes would not entail major earthwork.

TCEQ regulations require the use of temporary and permanent BMPs for the treatment of stormwater runoff from areas of impervious cover. The regulations require the removal of 80 percent of total suspended solids (TSS) in stormwater runoff from the increase in impervious cover resulting from the project. A water pollution abatement plan would be prepared and approval acquired from TCEQ prior to construction, in accordance with the Edwards Aquifer Rules.

7.1.3 Stormwater

To meet the requirements of the TCEQ's Section 401 Water Quality Certification conditions for nationwide permits, BMPs would be included in the project to address water quality during and after construction. During construction, measures developed and implemented as part of the project's stormwater pollution prevention plan (SW3P) would reduce adverse effects to water quality. The project would use TCEQ-approved erosion (temporary vegetation) and sedimentation (silt fences and rock berms) controls during construction to minimize temporary impacts. The post construction total suspended solid control BMP for this project would be water quality filters.

Surface water runoff from the project area flows to Salado Creek via Elm Creek, Mud Creek, Panther Springs Creek and Lorence Creek, and then eventually to the San Antonio River. The project does not cross any public water supply reservoirs. Effects to water quality, if any, are expected to be temporary and minor. Pursuant to Section 402 of the Clean Water Act, the EPA regulates the discharge of stormwater from construction sites that disturb five or more acres. The TCEQ began administering this regulatory program on behalf of the EPA in 2003.

Pursuant to Section 402 of the Clean Water Act, potential stormwater discharge from the project area during construction must be authorized by TCEQ. As such, the proposed project would require a TCEQ Texas Pollution Discharge Elimination System (TPDES) Water Quality General Permit for Construction Activities (CGP). If a project would disturb one or more acres, the requirements of the CGP would apply. This project disturbs over five acres; therefore, a notice of intent must be filed with the TCEQ. The proposed project is also located within the boundaries of a regulated Municipal Separate Storm Sewer (MS4) System. The City of San Antonio, San Antonio Water Systems (SAWS, 2009), and TxDOT are co-permittees for the MS4 permit. The permit authorizes each of the MS4 operators (TxDOT and San Antonio) to discharge stormwater runoff from the MS4 to waters of the US. A Notice of Intent (NOI) will be required for TPDES compliance. The NOI will be posted alongside the SW3P at the construction site.

An SW3P would be included in the construction plans. The SW3P would include provisions for temporary erosion and sedimentation controls to be employed during construction. Where appropriate, these temporary erosion and sedimentation control structures would be in place prior to initiation of the work and maintained throughout the duration of the project.

The contractor would take appropriate measures to prevent, minimize and control the spill of hazardous materials in staging areas. All materials being removed and/or disposed of by the contractor would be done in accordance with state and federal laws and by approval of the project engineer.

See the draft environmental permits, issues and commitments sheet found in **Appendix G** for additional information pertaining to required permits.

7.1.4 Floodplains

The hydraulic design for the drainage structures associated with this project would be in accordance with current TxDOT and FHWA design policies and standards. The highway facility would permit the conveyance of a 100-year flood, inundation of the roadway being acceptable, without causing significant impacts to the roadway or floodplains upstream or downstream. The entirety of the project is located in Bexar County, which is a regular participant in the National Flood Insurance Program. The project would not increase the base flood elevation to a level that would violate applicable floodplain regulations or ordinances. Coordination with the local floodplain administrator is required.

7.2 Vegetation

Within the right-of-way, approximately three acres of mowed, maintained grasses and a 0.2-acre area of ornamental shrubs would require removal in conjunction with proposed improvements. No new right-of-way or easements would be required to accommodate the proposed project.

The TxDOT and TPWD Memorandum of Agreement (MOA) provide the criteria necessary for determining the appropriate mitigation of impacts to vegetation and wildlife. Mitigation of impacts, in order of importance, is accomplished by avoidance, minimization, or compensation of impacts on a resource. If needed, the planning and implementation of compensatory mitigation would occur at the discretion of TxDOT and would be coordinated with TPWD. In accordance with the MOA, between TxDOT and TPWD, habitats given consideration for non-regulatory mitigation during project planning include:

- habitat for federal candidate species (impacted by the project) 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 or not 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 that the TxDOT District chooses to consider.

The 13 waterways that cross the proposed project area may experience temporary water quality related impacts, however, best management practices including silt fencing, temporary vegetation, and mulch may be used to retain and reduce sediment laden runoff. Very little work will be done within these channels.

Numerous cliff swallow and barn swallow nesting areas are located under bridges in the proposed project area. These species are unlikely to face direct impacts as a result of the proposed project because existing bridge structures are to remain intact. Furthermore, the project will directly benefit these species by adding habitat via the construction of additional bridge structures.

According to the most recent karst survey and subsequent Biological Assessment (TxDOT 2009), 32 features (24 identified in 2005 and 8 identified in 2009) were evaluation for excavation; 13 of those features were subsequently excavated. Of the 13 excavated features, it was determined that nine were potential habitat for endangered karst species. However, presence/absence surveys conducted in these nine features were all negative for the presence of listed karst invertebrate species.

Compensatory mitigation is not proposed because mitigation activities would not assist in the prevention of the listing of a federal candidate species, existing vegetation is not a rare vegetation series, and is not representative of unique habitats such as a bottomland hardwood forest, caves, cliffs, bluffs, ponds, seeps, springs, or native prairies.

Efforts would be taken during construction to avoid and minimize the disturbance of vegetation and soils within the project area. Disturbed areas that are not paved would be re-vegetated in accordance with Executive Order 13112 on Invasive Species; the 1999 FHWA guidance on invasive species; the Executive Memorandum on Beneficial Landscaping; and guidelines published in TxDOT's Roadside Vegetation Management Manual.

7.3 Wildlife

No new right-of-way or easements would be acquired. Maintained vegetation within the existing right-of-way provides minimal habitat for wildlife. Impacts to this vegetation would be avoided and minimized as much as possible. As a result, the impact on any wildlife species potentially utilizing these areas would be minimal.

7.4 Threatened and Endangered Species

A total of 33 federal and/or state listed threatened or endangered species occur in Bexar County, Texas. Based on the lack of habitat for terrestrial wildlife or plant species, no impacts to endangered or threatened terrestrial or aquatic species are expected.

According to the most recent karst survey and subsequent Biological Assessment (**Appendix B**, TxDOT 2009), 32 features (24 identified in 2005 and 8 identified in 2009) were evaluated for excavation; 13 of those features were subsequently excavated. Excavation of these features revealed that nine were potential habitat for endangered karst species; however, no listed karst species were discovered during presence/absence surveys conducted in all nine features. Non-listed karst invertebrates were discovered in four of the nine sampled features. The Biological Assessment also reports that potential effects to unknown endangered karst species populations are possible. In summary, it has been determined that the action may affect, but is not likely to adversely affect, two

federally-listed endangered karst invertebrate species. These karst species are included on the List of Endangered and Threatened Wildlife for Bexar County (50 CFR §17.11).

The results of electrical resistivity geologic surveys conducted in conjunction with project development indicate that significant (relating to engineering concerns) karst features are present in the shallow subsurface along Loop 1604 west of the interchange. These karst features are potential habitat for the endangered karst species. The results of boring surveys also indicate that most of these karst features occur in the western half of the interchange. In the context of the range-wide status of the species, effects associated with the proposed action are unlikely to appreciably diminish the potential for species survival and recovery. Approximately 1,063 acres of critical habitat for these species has been designated in Bexar County. There are no direct effects to designated critical habitat. The nearest critical habitat is approximately 0.25 miles from the project area, and would not be affected by construction activities and the physical effects of the project. As reported in the Biological Assessment (**Appendix B**), there is some potential for direct effects to *R. infernalis* or *R. exilis*, and therefore the project may affect, but is not likely to adversely affect *R. infernalis* or *R. exilis*. This determination stems from consideration of the uncertainties that exist in assessing the potential effects to these particular species.

Because it has been determined that the proposed project may affect two protected karst species, informal consultation under the Endangered Species Act was conducted with the USFWS. Consultation was compliant with Section 7 of the Endangered Species Act. A letter of concurrence was issued by USFWS on January 25, 2010 which stated that based upon the Biological Assessment and information reviewed, USFWS concurs that the project may affect but is not likely to adversely affect *R. exilis* or *R. infernalis* known to occur in Bexar County, Texas. USFWS also concurred with the determination that the proposed project will not adversely modify designated critical habitat located near the proposed project area (**Appendix E**). In a letter dated February 23, 2010, TxDOT notified USFWS of the increase in impervious cover from the draft CE (**Section 7.1.2**). The notification letter included reference to discussion between FHWA and USFWS on February 19, 2010, in which the agencies determined that the increase in impervious cover would not alter the Section 7 effects determination made for *R. exilis* or *R. infernalis*.

7.5 Migratory Birds

The terms of the Migratory Bird Treaty Act (MBTA) of 1918 apply to the proposed project. The MBTA prohibits take of birds, young, eggs, or occupied nests in part or whole for all birds on the migratory bird list, except as authorized by permit. Swallows

were noted in the area and their nests are likely to be present under some existing bridge structures. These species are unlikely to face direct impacts as a result of the proposed project because existing bridge structures are to remain intact. Once complete, the addition of bridge structures would increase nesting opportunities for barn and cave swallows.

Other habitat for migratory birds may exist in the proposed project, however any streams, water bodies, woody vegetation, or other habitat impacted by the project serving as temporary or seasonal stop-over habitat for migratory birds are adjacent to similar features not impacted by the project that would serve the same function. At the landscape level, impacts to stop-over habitat from the project would be negligible. As a result, migration patterns would not be affected by the proposed project.

In the event that migratory birds are encountered on-site during project construction, every effort will be made to avoid adverse impacts to protected birds, active nests, eggs, and/or young. The contractor would be prepared to prevent migratory birds from building nests between February 15 and October 1.

7.6 Prime Farmlands

No Prime Farmlands would be utilized or impacted by the construction or implementation of the proposed project.

7.7 Social and Economic Impacts

The proposed improvements would require no new right-of-way or easements. No relocations of residences or businesses would result from the proposed project.

The proposed improvements to this interchange would not fragment neighborhoods within the project area, and travel patterns and accessibility are not anticipated to be adversely impacted by the proposed project. Consequently, the proposed interchange improvements would enhance accessibility to residences and businesses within the project area and enable residents to travel between neighborhoods more efficiently and safely. In addition, improvements would facilitate safer vehicular turning movements for drivers. Lastly, pedestrian access would be improved by the pedestrian features included in the project design (**Section 4.0**).

Environmental Justice (EJ) Community

One environmental justice population was found to be located within the project area (CT 1917.00, BG 2, Block 2018) comprising 0.1 percent of the total population in the project

area (**Table 3**). No additional right-of-way or easements are required for the proposed project, and no displacements would occur. The socioeconomic and community effects of the proposed project are anticipated to be positive and would result from the enhanced safety and mobility aspects of the proposed project. All users of the proposed interchange, including low income and minority users, would benefit from the improved mobility and enhanced safety resulting from the proposed project. For these reasons, the proposed interchange improvements would not have a disproportionate or adverse impact on environmental justice populations.

The proposed project has been developed in compliance with E.O. 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

7.8 Air Quality

The proposed direct connectors are intended to enhance traffic safety and improve traffic flow. The proposed action would not add capacity to the existing facility; thus, current and future emissions should continue to follow existing trends – unaffected by this project. Therefore, a Traffic Air Quality Analysis is not required. The improvements addressed in this CE would have beneficial impacts to the air quality within the proposed project area because the proposed project would help to reduce congestion; thereby, reducing emissions.

The predicted 2035 traffic volumes and direct connector movements for each individual direct connector are shown in **Table 7**.

Table 7: 2035 Direct Connector Traffic Volumes

DIRECT CONNECTOR MOVEMENT DIRECTION	TRAFFIC VOLUME (ADT)
Northbound US 281 North to Westbound Loop 1604	44,300
Eastbound Loop 1604 to Southbound US 281 North	36,800
Westbound Loop 1604 to Southbound US 281 North	36,300
Northbound US 281 North to Eastbound Loop 1604	35,100

Source: 2006 URS Traffic Study

Because none of the direct connectors would have an ADT exceeding 140,000, a quantitative analysis of MSAT is not required. Although a qualitative assessment cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing potential MSAT emissions. The qualitative assessment addressed in **Appendix D**.

Additionally, the EPA regulations for vehicle engines and fuels will cause overall MSATs to decline significantly over the next 20 years. Even after accounting for a projected 64 percent increase in vehicle miles traveled, FHWA predicts MSATs will decline in the range of 57 to 87 percent from a baseline year of 2000 to 2020 based on the current vehicle and fuel regulations in effect. These reductions will reduce the background level of MSATs, as well as the possibility of even minor MSAT emission increases, from this project.

MSAT effects at the levels likely to be encountered along a roadway are mostly long term health effects. These long term effects are characterized by long term cancer risk factors. Dispersion modeling of MSAT concentrations has shown that concentrations begin to decrease at about 100 meters and generally are not distinguishable from background concentrations beyond 500 meters. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupported assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Vehicle technology and fuels are becoming cleaner and emitting ever lower levels of MSATs. Vehicle miles traveled (VMT) is increasing; however, models indicate that overall tailpipe emissions will continue to decrease over the next 20 years. This trend is expected to continue leading to further improvements in air quality over time. 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.

MSAT emissions for the Build Alternative could be offset due to increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). On a regional basis, EPA's vehicle and fuel regulations coupled with fleet turnover would cause region-wide MSAT levels to be significantly lower than today in almost all cases. The complete qualitative MSAT analysis can be found in **Appendix D**.

7.9 Noise Analysis

This analysis was prepared in accordance with TxDOT's (FHWA approved) *Guidelines for Analysis and Abatement of Highway Traffic Noise* and serves to assess potential traffic noise impacts that would result from the proposed improvements. 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." 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 sound level heard over a period of time and is expressed as "Leq."

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.

The FHWA has established the following 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 would occur. These criteria are shown in **Table 8**.

Table 8: FHWA Noise Abatement Criteria

Activity Category	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)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries and hospitals.
C	72 (exterior)	Developed lands, properties or activities not included in categories A or B above.
D	--	Undeveloped lands.
E	52 (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals and auditoriums.

NOTE: primary consideration is given to exterior areas (Category A, B or C) where frequent human activity occurs. However, interior areas (Category E) 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.

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) The FHWA traffic noise modeling software was used to calculate existing and predicted traffic noise levels. 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.

Existing and predicted traffic noise levels were modeled at receiver locations (**Table 9** and **Figure 8**) that represent the land use activity areas adjacent to the proposed project

that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

Table 9: Traffic Noise Levels (Leq [dBA])

Receiver	NAC Category	NAC Level	Existing	Predicted 2035	Change (+/-)	Noise Impact
R1-Harvest Fellowship Church	E	52	45	46	+1	No
R2-Harvest Fellowship Church Playground	B	67	64	66	+2	Yes
R3-Residence	B	67	64	69	+5	Yes
R4-Residence	B	67	69	74	+5	Yes
R5-Residence	B	67	67	70	+3	Yes
R6-Abiding Presence Lutheran Day School Playground	B	67	68	70	+2	Yes
R6-Abiding Presence Lutheran Church	E	52	42	45	+3	No

As indicated in **Table 9**, the proposed project would result in a traffic noise impacts at five of the seven receiver locations. Accordingly, the following noise abatement measures were considered: traffic management, alteration of horizontal and/or vertical alignments, and acquisition of undeveloped property to act as a buffer zone and the construction of noise barriers.

Before any abatement measure can be proposed for incorporation into the project, it must be both feasible and reasonable. In order to be "feasible," the abatement measure must be able to reduce the noise level at an impacted receiver by at least five dBA; 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.

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. Other measures such as time or use restrictions for certain vehicles are not allowed on state highways.

Alteration of horizontal and/or vertical alignments: any alteration of the existing alignment would displace existing businesses and residences, require additional right-of-way and not be cost effective/reasonable.

Buffer zone: the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.

Noise barriers: this is the most commonly used noise abatement measure. Noise barriers were evaluated with the following results:

R2 and R6: Noise barriers that would achieve the minimum feasible reduction of 5 dBA at these receivers would exceed the reasonable, cost-effectiveness criterion of \$25,000.

R3, R4, and R5: For these receivers, noise barriers would achieve the minimum feasible reduction of 5 dBA, and would not exceed the reasonable, cost-effectiveness criterion of \$25,000. Noise barriers are considered both feasible and reasonable for these receivers.

Table 10 shows the proposed noise barriers and barrier costs. Any subsequent project design changes may require a reevaluation of this proposal. The final decision to construct the proposed noise barriers would be made upon completion of the project design, utility evaluation and the polling of adjacent property owners. See **Figure 8** for locations of the proposed barriers.

Table 10: Noise Barrier Proposal (Preliminary)

Barrier (s)	Impacted Representative Receivers	Total # of Benefited Receivers	Length (feet)	Height (feet)	Total Cost	Cost Per Benefited Receiver
1 - East of Krugerrand Drive	R3	14	1,561	12	\$337,176	\$24,084
2 – North of Diamond Hills Drive	R4	5	489	12	\$105,624	\$21,125
3 – West of Redland Road	R5	7	604	8	\$86,976	\$12,425

Some areas adjacent to the project are currently Category D, undeveloped land. Although no new development is currently planned, designed or programmed in these areas, land use zoning databases indicate residential zoning in the undeveloped area located north of Loop 1604 and west of Redland Road. There is no NAC for undeveloped land; therefore,

the project will not result in any noise impacts. However, to avoid noise impacts that may result from future development of properties adjacent to the project in this area, local officials responsible for land use control programs should ensure, to the maximum extent possible, that in this area, no new activities are planned or constructed along or within the following predicted (2035) noise impact contour as shown in **Table 11**.

Table 11: Noise Impact Contour

Project Area	Location	Land Use	Distance from ROW (feet)
West of Redland Road	North of Loop 1604	66 dBA (Residential)	350

Noise associated with the construction of the project is difficult to predict. Heavy machinery, the 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 is expected to be exposed to construction noise for a long 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.

A copy of this traffic noise analysis 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 this document (Date of Public Knowledge), FHWA, TxDOT and Alamo RMA are no longer responsible for providing noise abatement for new development adjacent to the project.

7.10 Historic Resources

Pursuant to Stipulation VI, "Undertaking with the Potential to Cause Effects," of the PA-TU authorized among the FHWA, the SHPO, the Advisory Council on Historic Preservation, and, TxDOT, TxDOT historians determined that no historic properties are present in the proposed project's APE and that individual project coordination with SHPO is not required.

Supporting historic documentation can be found in **Appendix F**.

7.11 Archeology

No new right-of-way or easements would be required for this project. As indicated in **Section 6.11**, the proposed project would not impact known archeological resources. In the event that unanticipated archeological deposits are encountered during construction, work in the immediate area will cease, and TxDOT archeological staff will be contacted to initiate post-review discovery procedures under the provisions of the PA-TU (2005) and MOU between TxDOT and the Texas Historical Commission.

7.12 Parks and Public Land / Section 4(f)

The proposed project would not require the use of nor impair the purposes of any publicly-owned park, recreational area or wildlife refuge. Further, no historic properties are found in the project area. For these reasons, a Section 4(f) evaluation would not be required.

7.13 Hazardous Materials

Based on project research of available data regarding land use in the area and the distance of these facilities from the right-of-way, encounters with hazardous materials are not expected. Any discovery of unanticipated hazardous materials and/or petroleum contamination during project construction would be handled according to applicable federal, state and local regulations per TxDOT Standard Specifications.

8.0 INDIRECT AND CUMULATIVE IMPACTS

The existing interchange of US 281 North and Loop 1604 is located in northern San Antonio, Bexar County, Texas. Bexar County and San Antonio are rapidly expanding. The US Census Bureau's population estimate for Bexar County grew 35 percent from 1990 to 2007. Similarly, census data reveals San Antonio grew 42 percent from 1990 to 2007 (US Census). These estimates are in line with MPO population maps, which indicate current population densities of 200 to 5000 persons per square mile on land adjacent to the project, within project limits, except on the northern side of Loop 1604 at the extreme eastern project terminus; where population density is close to zero (Map D, San Antonio-Bexar County MPO).

The following sections describe the analysis of potential indirect and cumulative impacts from the US 281 North/Loop 1604 project. Resources such a decennial census data, San Antonio-Bexar County MPO projections, as well as land use, zoning, water quality ordinances, aerial imagery, and other geographic information system (GIS) databases from San Antonio and Alamo Area Council of Governments allowed for the use of

graphic assessments to develop the findings discussed in the following sections. Given the unpredictable nature of indirect and cumulative impacts, it must be stated that analysis relied on a combination of qualitative assumptions and quantitative assessment. Various qualitative assumptions used during the analysis included anticipated development trends and associated travel demands.

8.1 Indirect Impacts Analysis

Indirect effects, as defined by CEQ regulations, are “caused by the proposed action and occur later in time or farther removed in distance, but are still reasonably foreseeable” (40 CFR 1508.8). Indirect effects can be linked to direct effects in a causal chain (NCHRP 2002). The chain can be extended as indirect effects produce further consequences. Examples of direct and indirect effects of several types of transportation projects are summarized in **Table 12**.

Table 12: Examples of Indirect Effects

Project Action	Direct Effect	Indirect Effect
Bypass Highway	Improved Access	Farmland converted to residential use. New residences produce new labor force attracting new businesses.
New Light Rail	Improved Access	New businesses open producing jobs/taxes. Traditional businesses/residents priced out.
New Highway	Improved Access	Development alters character of historic area. Visitors increase to historic area.

Source: NCHRP Report 466, *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* (2002).

Probability also helps distinguish indirect effects from direct effects: direct effects are often inevitable while indirect effects are merely probable. The purpose of this section is to assess the indirect effects related to the proposed improvements presented in this CE.

As illustrated in **Table 13**, the indirect effects analysis for the proposed project generally follows a seven-step process (TxDOT, 2009):

Table 13: Seven-Step Approach to Estimating Indirect Effects

<p>Step 1 – Scoping: The basic approach, effort required, and geographical boundaries of the study are determined.</p>
<p>Step 2 – Identify the Study Area’s Direction and Trends: Information regarding the study area is compiled with the goal of defining the context for assessment.</p>
<p>Step 3 – Inventory the Study Area’s Notable Features: Additional data on environmental features are gathered and synthesized with a goal of identifying specific environmental issues by which to assess the project.</p>
<p>Step 4 – Identify Impact-Causing Activities of Proposed Action and Alternatives: Fully describe the component activities of each project alternative</p>
<p>Step 5 – Identify Potentially Significant Indirect Effects for Analysis: Indirect effects associated with project activities and alternatives are cataloged, and potentially significant effects meriting further analysis are identified.</p>
<p>Step 6 – Analyze Indirect Effects and Evaluate Analysis Results: Qualitative and quantitative techniques are employed to estimate the magnitude of the potentially significant effects identified in Step 5 and describe future conditions with and without the proposed transportation improvement. The uncertainty of the results of the indirect effects analysis is evaluated for its ramification on the overall assessment.</p>
<p>Step 7 – Assess Consequences and Develop Mitigation (when appropriate): The consequences of indirect effects are evaluated in the context of the full range of project effects. Strategies to avoid or lessen any effects found to be unacceptable are developed. Effects are reevaluated in the context of those mitigation strategies.</p>

A GIS-based approach was used to identify and quantify potential indirect effects of the proposed project on the study area’s notable features.

Step 1: Scoping

The proposed project would construct direct connectors from westbound and eastbound Loop 1604 to southbound US 281 North and from northbound US 281 North to eastbound and westbound Loop 1604. Improvement would include associated US 281 North and Loop 1604 merge and diverge lanes as well as various exit ramps, entrance ramps, and overpass improvements along US 281 North and Loop 1604 within the project limits.

As described in **Section 3.0**, traffic congestion is a major concern in the area. According to the San Antonio-Bexar County MPO, Loop 1604 and US 281 North in the vicinity of the interchange are classified as congested roadways, according to both objective measurement and public perception (San Antonio-Bexar MPO). In addition to safety and mobility enhancements, the proposed action would construct four direct connectors between US 281 North and Loop 1604, to and from US 281 south of Loop 1604. The director connectors would allow movement between the two roadways without the

constrictions associated with traffic signals; thus, reducing congestion by improving traffic flow through the interchange.

The geographical boundaries of the study area for indirect effects would include the area in which the proposed improvements could potentially influence local traffic patterns or land development. Between two roadways providing access to a common destination, motorists will generally utilize the closer roadway. Therefore, this „commuteshed“ between adjacent roadways represents the limit of influence of a roadway, or the limit of the study area. Areas outside the study area are better served by the adjacent roadways. South of Loop 1604, the indirect effects study area is generally bounded by the commuteshed between US 281 North/Loop 1604 and Wurzbach Parkway/NW Loop 410/Blanco Road/W. Bitters Road. North of Loop 1604, the indirect effects study area is generally bounded by the commuteshed between Loop 1604 and Huebner Road/Stone Oak Parkway/E. Evans Road. The western boundary is Salado Creek and the eastern boundary is Judson Road (**Figure 9**). The study area is located entirely within Bexar County. It encompasses approximately 19,832 acres and includes a portion of north-central San Antonio, the entirety of the City of Hollywood Park, and almost all of the City of Hill Country Village. Of the 19,832 acres located within the study area, approximately 13,878 acres are currently developed (70.0%) and commercial development is forthcoming on additional approximately 516 acres (2.6%), according to data collected from the City of San Antonio. Approximately 2,470 acres (12.5%) is roadway right-of-way (arterials, farm-to-market roads, ranch-to-market roads, US highways, state highways, loops, and interstate highways). Approximately 404 acres (2.0%) is dedicated greenspace – parks and preserves. Of the remaining undeveloped lands (approximately 2,564 acres, or 12.9%), approximately 465 acres is within floodplain where land would be developed minimally, if at all, in accord with local development codes, leaving approximately 2,099 acres (10.6%) of potentially developable land in the study area, almost all of which is zoned for residential and commercial development (**Table 14**). See **Figure 9** for a layout of these areas.

Table 14: Land Use in the Indirect Effects Study Area

Land Use	Acreage	Percent of Study Area
Developed	13,878	70.0
Under Development	516	2.6
Right-of-Way	2,470	12.5
Undeveloped*	2,564	12.9
Park/Greenspace	404	2.0
TOTAL	19,832	100.0

*approximately 2,099 acres of this would be considered developable
 (not in floodplain)

The time frame for data utilized in this analysis is 1974 to 2035, the horizon year for the San Antonio-Bexar County MPO’s mobility 2035 Metropolitan Transportation Plan. The analysis incorporates analysis of aerial photography from 1974 to 2005, and San Antonio development data from 1980 to 2005.

Step 2: Identify the Study Areas’ Directions and Goals

Indirect effects are commonly related to changes in land use. When a transportation project is constructed, an indirect effect may occur when land in the project area develops. For example, if a bypass or a relief route is constructed around a town, development may occur in the bypass area in the form of restaurants, gas stations and other commercial establishments. Land development in turn results in the transformation of primarily agricultural uses within the study area to residential and commercial land uses. Increased development can alter the landscape, increase impervious cover, modify species composition of any remaining habitats, and introduce fertilizers and anthropogenic chemicals into the biotic system.

A comparison of historic aerial photography including USGS imagery from 1974 and 1988, Texas Natural Resources Information System (TNRIS) imagery from 1996 and 2000, and 2005 imagery from the City of San Antonio (Planning and Development Services), indicates that development was intense during the 1970s and 1980s. Land use within most of the study area in 1974 is interpreted as woodland, ranch land, and other undeveloped uses, with most development occurring in the south-central portion of the study area adjacent to US 281 North and the south side of Loop 1604. Little development occurred north of Loop 1604. Developed land increased from approximately 5,231 acres (26.3%) in 1974 to approximately 9,010 acres (45.4%) in 1988. As shown in **Table 14**, developed land now totals approximately 13,878 acres

(70.0%). The San Antonio Planning and Development Services Department Future Land Use Plan map shows projected future land use planning is in progress in the southern portion of the study area; however, specific future land uses have not been designated within the indirect effects study area.

The study area is within the city limits of San Antonio, and also encompasses all of the City of Hollywood Park and all except the southwest corner of the City of Hill Country Village. Growth in the area has been extensive and ongoing. This growth has been accompanied by land development serving the growing population. Commercial growth is encouraged in this area, evidenced by its location in San Antonio's 6-year term Tax Abatement area, where property tax break incentives are offered for business ventures investing \$5 million and creating a minimum of 50 full-time jobs (San Antonio Department of Economic Development, 2009).

Current land use maps from the City of San Antonio indicate a preponderance of residential development south of Loop 1604 with a concentration of commercial and retail development focused along US 281 North and Loop 1604. A larger proportion of commercial and retail development occurs north of Loop 1604, interspersed with residential and vacant land. The cities of Hollywood Park and Hill Country Village, located in the southwest portion of the study area, are both highly developed and constrained by growth by the City of San Antonio, which surrounds them.

In March 2009, the MPO's Transportation Policy Board adopted a combined Transit Oriented Development/Infill Development scenario centering around compact and mixed use development, connectivity, accessibility and walkability. Infill development concentrates growth inside of Loop 1604, while Transit Oriented Development focuses on growth occurring along major transit corridors. This growth scenario is reflected in the recently adopted 2035 MTP.

A stated goal of the 2035 MTP is to "encourage the cost effective expansion of the regional transportation system to meet the growing mobility needs while ensuring air quality; enhancing the safety of the traveling public; fostering appropriate land use patterns; advancing alternative modes of transportation; and, increasing accessibility for the traditionally underserved segments of the community." The San Antonio Unified Development Code (UDC 2009) also reflects current local development trends. The UDC states that zoning is a key tool for regulating building mass, population density and land usage. The study area contains extensive residential and commercial development, and most vacant, developable land is zoned for these uses. Land use and zoning plans indicate that residential and commercial development are the main drivers of land development in the study area, and although the 2035 MTP reflects a more constrained

development scenario, the potential for continued development in the study area will continue as long as vacant, developable parcels are available.

The study area contains approximately 11,911 acres of Edwards Aquifer recharge zone and 6,877 acres overlying the Edwards Aquifer transition zone⁴. Development in the recharge zone is subject to TCEQ Edwards Aquifer Rules which require non-degradation of water within the aquifer. In addition, the SAWS program requirements include submission of Water Pollution Abatement Plans and Aquifer Protection Plans for development in the Edwards Aquifer recharge zone, through the UDC. SAWS has also implemented a program for inspection of stormwater systems over the recharge zone every five years to repair any defects that could potentially leach stormwater into the aquifer.

Recharge features also often provide habitat for cave invertebrates, some species of which are endemic to central Texas (**Section 6.4**). The key habitat characteristics for karst invertebrates are stable temperature and humidity, adequate subsurface drainage, and a healthy surface community.

Accompanying past development is increased impervious cover, with associated loss of karst habitat and associated aquifer recharge features. Veni estimated that about 26 percent of known karst caves in Bexar County had been destroyed through filling, capping, or covering with roads or buildings and blasting by construction and quarrying operations (Veni, 1991). Additional loss has undoubtedly occurred in conjunction with development that has occurred since 1991.

The study area overlies approximately 960⁵ acres of Karst Zone 1, areas with known endangered karst cave species occurrence, and approximately 10,701 acres of Karst Zone 2, areas with high probability of endangered karst cave species occurrence. Additionally, Bexar County Karst Invertebrate Critical Habitat Unit 19 occurs in the study area. This is an approximately 12.2-acre area located 1,200 feet north of Loop 1604 approximately 1.5 miles west of the US 281 North/Loop 1604 interchange, within an area of existing commercial and residential development. In addition to designated critical habitat areas, the Bexar County Karst Invertebrate Draft Recovery Plan (USFWS 2008) also includes karst faunal areas (KFAs) as a crucial factor for recovery of endangered karst invertebrates. KFAs are multiple areas with caves containing known populations, protected in perpetuity,

⁴ Corrections have been made since the December 2009 Draft CE was made available for public review. Previously, Indirect Effects study area acreage not in any Aquifer zone was inadvertently included in Recharge and Transition zones acreage calculation.

⁵ A correction has been made since the December 2009 Draft CE was made available for public review. Previously, Indirect Effects study area acreage not in Karst Zone 1 was inadvertently included in the Karst Zone 1 acreage calculation.

each of sufficient size to buffer against detrimental external environmental effects, such as would occur in developing areas like the study area.

In a 2009 amendment to Chapter 35 of the UDC (UDC 2009), the UDC requires a habitat compliance form for development of parcels larger than two acres located in karst zones 1 or 2 or in an area identified as potential habitat as outlined in draft 2008 Recovery Plan for Bexar County Karst Invertebrates (USFWS March 2008). It stipulates that a property owner shall either indicate obtainment of a Section 10(a) permit, Section 7 biological opinion, participation in a Regional Habitat Conservation Plan or indication of submittal of an endangered species survey to the U.S. Fish & Wildlife Service. The amendment recognizes that many species occur partially, extensively or exclusively on private lands, and reiterates the City of San Antonio Master Plan's Natural Resources Goal to "preserve the unique, rare and significant features of San Antonio's natural environment" and to "Encourage the development of Habitat Conservation Plans for areas of the Edwards Aquifer Drainage and Recharge Zones associated with rare, unique or sensitive biota".

Step 3: Inventory of Study Area's Notable Features

Based on previous environmental studies performed in the project area, and in consideration of issues of local importance, notable features identified within the study area include endangered karst species and surface water quality associated with Edwards Aquifer recharge. No impaired stream segments occur within five miles downstream of the project area, according to the TCEQ's 2008 Clean Water Act Section 303 (d) list.

As stated in **Section 6.6**, the proposed action would not add capacity to the existing facility and current and future emissions should continue to follow existing trends not being affected by this project. Therefore, air quality is not carried forward as an impacted notable feature.

The indirect effects study area includes approximately 960 acres of karst zone 1 (areas with known endangered karst species occurrence), 10,701 acres of karst zone 2 (areas with high probability of endangered karst species occurrence), and 12 acres area of endangered cave species critical habitat. The study area also includes approximately 11,911 acres of Edwards Aquifer recharge zone and 6,877 acres of Edwards Aquifer transition zone, and approximately 36 miles of stream segments.

The indirect effects study area was evaluated for the presence of endangered species. The TPWD Texas Natural Diversity Database was reviewed on April 17, 2009, for an overview of areas with potential for endangered karst species occurrence. According to the Biological Assessment prepared by TxDOT for this project (**Appendix B**), the closest record was that of Government Canyon Bat Cave meshweaver (*Cicurina vespera*) more

than 2.0 miles north of Loop 1604. As stated previously, the proposed action may affect, but is not likely to adversely affect, two karst invertebrate species (endangered species). These are *Rhadine exilis* and *R. infernalis*, beetles with no common name. As reported in the Biological Assessment, the project will have no effect on any other federally listed species occurring in Bexar County, including seven other karst invertebrate species.

Step 4: Identify Impact-Causing Activities of Proposed Improvements

Impact-causing activities are described by type.

Modification of regime effects - Approximately three acres of mowed, maintained grasses and a 0.2-acre area of ornamental shrubs will be removed permanently, with another 2 acres that will be temporarily disturbed during construction. The estimated length of temporary disturbance is six months. Drainage will not be modified; the current drainage system will be utilized, and the existing open-ditch and storm sewer system outfall locations would not change.

Thirteen crossings of US jurisdictional waters occur within the project limits. Minimal disturbance will occur below the OHWM at two of these crossings, covered under NWP 14 (**Section 7.1.1**).

The proposed project would add approximately 19.8 acres of pavement, primarily bridge structure. The proposed widening of the eastbound Loop 1604 to southbound US 281 North direct connector would represent approximately 0.4 acres of this, also primarily bridge structure. These improvements would result in additional stormwater run-off and impervious cover over the Edwards Aquifer recharge zone.

Land Transformation and Construction – The proposed project would include the following:

- Four new US 281-Loop 1604 direct connectors, mostly on structure:
 - Northbound US 281 North to westbound Loop 1604.
 - Northbound US 281 North to eastbound Loop 1604.
 - Eastbound Loop 1604 to southbound US 281 North.
 - Westbound Loop 1604 to southbound US 281 North.
- Auxiliary lanes
 - On Loop 1604 westbound mainlanes, between the existing entrance ramp from Blanco Road and the existing Bitters Road exit ramp.

- On US 281 North southbound mainlanes between the existing entrance ramp from Thousand Oaks Boulevard and the existing Bitters Road exit ramp.
- On US 281 North northbound mainlanes, between the existing entrance ramp from Bitters Road and the existing Brook Hollow exit ramp modification.
- On US 281 North northbound mainlanes, between the existing entrance ramp from Thousand Oaks Boulevard and the existing Donella exit ramp.
- The frontage roads between the following exit ramps and the cross street intersection: westbound Loop 1604 exit to Bitters Road and eastbound Loop 1604 exit to Blanco Road.
- Ramping Changes
 - On northbound US 281 North the existing exit ramp to Henderson Pass and the Loop 1604 frontage road would be removed to provide room for the direct connector.
 - On southbound US 281 North the existing entrance ramp just south of Henderson Pass would be removed to provide room for the direct connector.
 - On eastbound Loop 1604, the exit ramp east of the Stone Oak Parkway overpass which provides access to US 281 North would be relocated approximately 3,000 feet to the west to provide room for the direct connector.
 - On eastbound Loop 1604, a new exit ramp to Redland Road is proposed. An auxiliary lane is proposed between the existing Gold Canyon Road entrance ramp and this new exit ramp.
 - On westbound Loop 1604, the existing exit ramp to Gold Canyon Road is proposed to be removed.
 - On westbound Loop 1604, the existing ramps between Stone Oak Parkway and Blanco Road are proposed to be reversed.
- Safety illumination would be installed at all Loop 1604 mainlanes and frontage road entrance and exit ramps. Continuous illumination would be installed on all

- the direct connector structures. In addition, continuous illumination would be installed in the median of Loop 1604 from Bitters Road to Redland Road.
- Five-foot wide sidewalks along the US 281 North northbound and southbound frontage roads between Bitters Road and Loop 1604. Five-foot wide sidewalks are also proposed along the Loop 1604 eastbound and westbound frontage roads between Stone Oak Parkway to Gold Canyon Road.
 - Two 12-foot wide pedestrian bridges would also be constructed at the US 281 North/Loop 1604 interchange. These structures would cross over the US 281 North mainlanes and would parallel Loop 1604 frontage roads.
 - At Bitters Road, Huebner Road, Gold Canyon Road and Redland Road, the existing cross street structures would be widened and new turn around structures (two at each location) would be constructed. Sidewalks would be constructed on the cross street structures.

Resource Extraction – No excavation would be required excepting that required for installation of piers for elevated structures and for road base installation for auxiliary lanes.

Processing – Storage of materials would occur off-site. It is anticipated, based on usual practices that the contractor, if selected, would negotiate to use a portion of the parking lot at one of the large shopping centers which are not completely occupied at this time for the contractor's field office and storage site. If the contractor chooses to use undeveloped land or another site for material storage, impacts to natural resources may increase.

Land Alteration – Land alteration as a result of this project would largely be limited to the increase in paved area. Vegetated areas in the ROW would be revegetated.

Resource Renewal – Disturbed areas of vegetation would be reestablished following construction.

Changes in Traffic – The proposed project is expected to reduce traffic congestion. The proposed improvements would improve the reliability of travel times through the project limits by allowing traffic utilizing the direct connectors to bypass congestion at the existing signalized intersection. The addition of turnarounds would improve accessibility to some businesses.

Changes in Pedestrian Traffic – The proposed addition of sidewalks and pedestrian crossings is expected to lead to an increase in pedestrian traffic along the corridor.

Waste Emplacement and Treatment – Soil excavated from the project area would likely be stockpiled for use on this or other projects or sold for other uses, depending upon the results of soil testing. The contractor, if selected, may choose to provide portable sanitary facilities for employees at the field office. No other sanitary waste discharge is anticipated. Pavement removed from the existing roadway would be recycled for use as riprap material, in accordance with local policy. Packing materials would be disposed of in the landfill by a certified contractor.

Chemical Treatment –None of the slopes which would be revegetated are steeper than 3:1 in grade; therefore, no chemical binders would be needed. Periodic applications of herbicide may occur during the maintenance phase of the project.

Access Alteration –

- On westbound Loop 1604 at the entry of the proposed direct connector, a new exit ramp to the westbound frontage road east of Stone Oak Parkway drive is proposed.
- On northbound US 281 North, the existing exit ramp to Henderson Pass and the Loop 1604 frontage road would be removed to provide room for the direct connector. Traffic wanting to access the frontage roads in this area would utilize the existing Donella exit ramp approximately 1,700 feet to the south.
- On southbound US 281 North the existing entrance ramp just south of Henderson Pass would be removed to provide room for the direct connector. Traffic wanting to access the mainlanes from the frontage roads in this area would utilize the existing Donella entrance ramp approximately 1,700 feet to the south.
- On eastbound Loop 1604, a new exit ramp to Redland Road is proposed.
- On westbound Loop 1604, the existing exit ramp to Gold Canyon Road is proposed to be removed. Traffic would access Gold Canyon Road via the existing Redland Road exit, located approximately one mile to the east.
- On westbound Loop 1604, the existing ramps between Stone Oak Parkway and Blanco Road are proposed to be reversed. The exit ramp to Blanco Road would be shifted east approximately 2,500 feet, and the entrance ramp from Stone Oak Parkway would shift west approximately 2,500 feet.

- At Bitters Road, Huebner Road, Gold Canyon Road and Redland Road, new turn around structures (two at each location) would be constructed.

Step 5: Identify Potentially Substantial Indirect Effects

Potential indirect effects to notable features were identified and assessed for the potential to be substantial. Impact-causing activities can include 1) encroachment-alteration effects – those that affect the functions of the natural environment due to project features; 2) access-alteration effects – those that result from traffic pattern or access changes attributable to the design of the project influencing the location of residential and commercial growth; and 3) induced growth effects – those attributable to induced growth rather than project features (NCHRP).

Encroachment-Alteration Effects

Endangered Karst Species

Potential encroachment-alteration effects to endangered karst species include impacts related to reduction of cave habitat and/or cave cricket foraging habitat through construction activity and diminishment of the quality of these habitats from infiltration of stormwater containing contaminants. The nearest area of critical habitat is approximately 0.25-mile from the right-of-way. As reported in the Biological Assessment (**Appendix B**), the project would not destroy or adversely modify any designated critical habitat unit. The Biological Assessment also reports that potential effects to unknown endangered karst species populations are possible, but discountable, and therefore the project may affect, but is not likely to adversely affect endangered karst species. Therefore, encroachment-alteration effects to endangered karst species from the proposed project would not be considered substantial.

Edwards Aquifer Recharge Features and Surface Water Quality

Potential encroachment-alteration effects to surface water quality and associated Edwards Aquifer recharge includes stormwater runoff from the project roadway potentially entering surface waters and subsequently into recharge features. A water pollution abatement plan would be prepared for the proposed project; therefore, engineered features for water quality improvement would be in place to offset any potential increase in roadway total suspended solids in runoff from added impervious cover. No impacts to surface water quality adversely affecting Edwards Aquifer recharge would be anticipated from roadway runoff.

Furthermore, land disturbing activities associated with project construction would require coordination with the TCEQ. A water pollution abatement plan in compliance with the Edwards Aquifer Rules, would be submitted to TCEQ for review and approval prior to initiation of construction. In addition, the project construction plans would include an SW3P in compliance with TPDES requirements. These documents specify the BMPs incorporated into the project to prevent erosion and sedimentation during construction, as well as post-construction total suspended solid controls.

Thirteen crossings of waters of the US occur within the project limits, all within the recharge zone. Work would occur at two crossings, Panther Springs Creek and Mud Creek, crossed by Loop 1604. The impact at both crossings would be the addition of bridge columns within the channel beds. Permanent fill below the ordinary high water mark at each crossing would be less than 0.01 acre. These are anticipated to be covered by an USACE issued nationwide permit with preconstruction notification (**Section 7.1**). By definition, projects that meet the conditions of a nationwide permit are considered to have minimal impacts. (33 CFR 330).

During construction of the project, there is a potential for leakage of fuels. Accidental spills could occur during operation of the roadway. Potential adverse effects of these actions are minimized by implementation of the water pollution abatement plan and SW3P. Improvements in mobility would reduce the potential for oil leakage from idling vehicles in the project vicinity. For all of the reasons above, substantial effects to Edwards Aquifer and associated water quality are not anticipated to result from encroachment-alteration effects.

Access-Alteration and Induced Growth Effects

The proposed project would provide new access to, as well as alter existing access to, adjoining properties; however, it would not result in elimination of access. While no adverse or substantial access-alteration effects are anticipated, associated induced growth effects are possible, and will be examined further.

Endangered Karst Species

The study area contains approximately 2,381 acres of Karst Zones 1 and 2 occurring on vacant, potentially developable land, none of which is designated critical habitat. As a result, there is the opportunity for induced growth effects and effects related to induced growth, which will be examined further in Step 6.

Edwards Aquifer Recharge Features and Surface Water Quality

The 2,381 acres of developable lands designated as Karst Zones 1 and 2 are also designated as Edwards Aquifer recharge zone. As a result, there is the opportunity for induced growth effects and effects related to induced growth, which will be examined further in Step 6.

Step 6: Analyze Indirect Effects and Evaluate Results

Analysis of Indirect Effects

To further investigate the influence that the proposed improvements could have on potential future development in the indirect effects study area, an interview and subsequent follow-up discussions were conducted with Richard Martinez, Ph.D., Senior Planner for the City of San Antonio. Dr. Martinez was questioned about factors influencing development in the study area. Then he was asked to identify lands he would expect to be developed by 2030 with the project in place versus without the improvements completed. Other questions focused on the project's influence on development timing, location, type and amount, as well as their knowledge of other existing or future development in the project vicinity.

Dr. Martinez was asked to weigh six factors regarding how they influence development decisions within the indirect effects study area. The weight applied to each factor is shown in **Table 15**.

Table 15: Factors Affecting Development

Factor	Description	Weight
Economy	growth, strength of regional economy, employment centers nearby, other economic factors	35%
Distance	employment, services, retail, medical, entertainment, education	5%
Infrastructure	transportation network, water, wastewater, electric	25%
Development Advantages	low land cost, good availability, natural amenities	10%
Development Constraints	high land cost, low availability, terrain, soils, floodplains, regulatory constraints, environmental regulations, local ordinances	20%
Social Considerations	proximity to schools, churches, neighborhoods, parks	5%
	Total	100%

Source: Dr. Richard Martinez, Senior Planner, City of San Antonio

The economy was identified as the greatest limiting factor to development in the study area, followed by infrastructure (including transportation) and other development constraints. Water infrastructure within the study area is supplied by the San Antonio Water System, from wells from the San Antonio segment of the Edwards Aquifer. Floodplains cover approximately 1,596 acres in study area; development would be expected to be limited in these areas.

According to Dr. Martinez, the type, timing, and intensity of development could be influenced by the project; it is plausible the improvements will hasten the development of developable land. Moreover, to the extent the project increased accessibility to the area, higher density development could become more feasible, which could in turn bring about re-zoning efforts. While noting the improvements may increase the probability that currently available land will be developed, he nevertheless made no distinction between areas of foreseeable development when asked to delineate them for the project build versus no-build scenarios. In summary, it was his conclusion that the remainder of developable land will be developed by 2030 with or without construction of project improvements.

Considering the indirect effects study area’s identified growth trend and the results of the interview/discussions, the proposed project is not expected to influence the *location* of development within the indirect effects study area. However, the *timing* and *intensity* of development may increase to the extent that economic conditions and local ordinances allow with the proposed improvements in place.

As discussed in Step 2, the degree to which the indirect effects study area is already developed, coupled with proposed land use and zoning plans indicate that the indirect effects study area has been rapidly developing and is planned to continue to do so. Because virtually all access to properties abutting the roadway has already been utilized, no discernible access-alteration effect would be anticipated. However, due to the uncertainty of induced development effects within the study area, this subject will be evaluated further in Step 7.

Evaluation of Analysis

The purpose of evaluating the analysis results step is to consider the inherent uncertainty in estimating indirect effects and the risk that the actual outcome will differ from that forecasted.

Dr. Richard Martinez (San Antonio Planning and Development Services) indicated that localized land development, including its timing and intensity, could be affected by the project. While extremely knowledgeable in his field, it is also acknowledged there is some uncertainty regarding the location, timing, and amount of development. It becomes necessary to assess whether this uncertainty might lead to risk of the notable environmental features within the study area.

Development Location: The vacant areas depicted in **Figure 9**, totaling approximately 2,564 acres, indicate the locations of potential future development within the indirect effects study area, according to the City of San Antonio. Approximately 465 acres of this is located in floodplain. Only construction of non-residential structures that cannot be damaged by floodwaters is allowed in these areas (UDC 2009). Because build-out of developable land represents the “worst case”, any modification (lessening) of development would likely result in less impact on notable features.

Development Intensity: Development intensity, or density, in the indirect effects study area, is dependent on the availability of water and wastewater services. Any undeveloped lands lacking this essential infrastructure would have to account for this need.

Development density is also closely tied to the power of the local jurisdiction to regulate development. Current zoning is already in place for the 2,564 acres of vacant developable land, thereby specifying the general densities of development on these lands. Specifically, 937 acres (37%) is zoned residential, 142 acres (6%) is neighborhood preservation, 580 acres (23%) is zoned commercial and industrial, and 76 acres (3%) is zoned Planned Unit Development. The remaining 32% of developable land is zoned for

quarrying operations. Inspection of 2005 aerial photography reveals that approximately half of the land zoned for quarrying is being quarried while the remainder is undisturbed.

Although these areas are zoned, it should be noted that they are subject to re-zoning. According to San Antonio Senior Planner Dr. Richard Martinez, it is theoretically possible that accessibility and mobility improvements provided by the project could make higher density development feasible, which could bring about re-zoning efforts. According to the UDC, however, requested rezoning must be consistent with the master plan policies or the land use element of the applicable neighborhood, community or perimeter plan. The master plan is the comprehensive plan for the physical development of the city, as prescribed in the City Charter. Rezoning is subject to numerous approval criteria of the City Council. It also must be consistent with the city's policy of comprehensive zoning, that is, zoning will not be altered for the special benefit of the landowner when the change will cause substantial detriment to the surrounding lands or serve no substantial public purpose. Lots cannot be rezoned in a way that is substantially inconsistent with the uses of the surrounding area.

The City of San Antonio regulates development and impervious cover within the recharge area of the Edwards Aquifer through Aquifer Protection Ordinance #81491, updated February 16, 2006. This ordinance limits types of development and impervious cover within the city limits, the extraterritorial jurisdiction, and the recharge zone. In this ordinance, the city adopts a goal of nondegradation which maintains or improves the quality of water entering the aquifer, and prohibits land uses which could adversely affect the aquifer, the city's water supply. Proposed development in the recharge zone is subject to approval of an Aquifer Protection Plan by the SAWS Resource Protection Division. Ordinance provisions include development restrictions in floodplains and preservation of floodplain buffer zones parallel to floodplains. This applies to floodplains or creeks with watersheds greater than 100 acres within the city limits and greater than 300 acres in the ETJ. No impervious cover is allowed in these areas within the city, and is restricted to a maximum of 10% in the ETJ. It should be noted, however, this ordinance does not apply to floodplain development permits issued before Jan. 22, 1995. In addition to floodplain development provisions, the ordinance prohibits the sealing of significant recharge features and requires buffer zone around significant recharge features. Proposed development in the recharge zone is classified into one of three categories, Category 1, properties exempted from maximum impervious cover restrictions (built or platted prior to 1994); Category 2 (within the city limits and not Category 1), limited to 30% impervious cover for a single-family residence, 50% impervious cover for multi-family residences, and 65% impervious cover for commercial development (80% within 2500 feet of a highway intersection node, such as the US

281/Loop 1604 interchange); and Category 3 (in the ETJ), limited to 15% impervious cover for all development. Best Management Practices are required for single family residential developments of Category 2 or 3 properties.

In addition, all multi-family and commercial developments must capture and isolate the first 1/2" of runoff to minimize pollutants from entering the aquifer. Also, for road projects, depending on amount of road traffic, sedimentation and filtration basins or hazardous materials traps are required. Lastly, bridges with more than 1,500 vehicles per day are prohibited from discharging directly to the Floodplain Preservation Area directly from the roadway surface.

In summary, in view of UDC requirements regarding rezoning and Ordinance #81491 requirements regarding impervious cover, actual future development densities and impervious cover would likely match current estimates. As a result, project-related effects to development intensity would not be anticipated to put the study area's notable environmental features at risk.

Timing of Development: As discussed above, the economy and water/wastewater and transportation infrastructure in the area are major driving forces in land development. Because of the variabilities of the economic markets over time, there is a high level of uncertainty in the timing of development. However, because the study area is approximately 82 percent developed and because of the ability of San Antonio to regulate development activity in the study area as it pertains to the Edwards Aquifer and endangered karst species occurrence, project-related effects on timing of development would not be anticipated to put the study area's notable environmental features at risk.

Step 7: Assess Consequences and Develop Mitigation and Enhancement Strategies (when appropriate)

Considering the indirect effects study area's potential for growth as identified in local and regional projections, as well as analysis of information provided by the San Antonio Planning and Development Services Department, the proposed project has the potential to influence the location, timing, and intensity of development within the indirect effects study area. However, eventual build-out (2030) of remaining developable land is anticipated with or without the project improvements.

Endangered Karst Species

Development within the study area is subject to the Endangered Species Act and the City of San Antonio's ordinance requiring the reporting of occurrences of endangered species, including endangered karst species, discovered during any construction activity.

As described in **Section 6.4**, a 22-unit, 1,063-acre preserve system designated as critical habitat by the USFWS is intended to ensure protection and contribute to the eventual de-listing of endangered karst species; no development is allowable on these lands without coordination with the USFWS. In addition, TCEQ regulations may give some degree of protection to endangered karst species through protection of significant aquifer recharge features, which are also potential endangered karst species habitats. Likewise, the City of San Antonio Ordinance #81491 requires, in part, identification of critical environmental features and may provide some protection for caves and karst features containing endangered karst species if such features also provide recharge to the Edwards Aquifer. Assuming appropriate implementation of the Recovery Plan and applicable land use planning regulations and local development ordinances, adverse effects to endangered karst species would likely be avoided.

Edwards Aquifer

All development within the study area is subject to the Edwards Aquifer Rules, the goal of which is non-degradation of existing groundwater quality (213.1 Texas Administrative Code). Moreover, the indirect effects study area lies within the jurisdiction of San Antonio which has enacted water quality ordinances further safeguarding aquifer recharge.

Because construction projects in the Edwards Aquifer recharge zone within the indirect effects study area would be subject to the Edwards Aquifer Rules and TPDES, the release of any potential contaminants from the project site would result in insignificant effects. The project would, at a minimum, meet the standards established in the Edwards Aquifer Rules. Assuming appropriate implementation of applicable land use planning regulations and local development ordinances and any substantial effects to the quality of Edwards Aquifer recharge from development within the indirect effects study area would be avoided or minimized compliance with local, state, and federal laws and regulations,.

A significant soils disturbance during the construction at the creek and tributary crossings could potentially exceed the capacity of BMPs to contain it, thereby affecting aquifer recharge water quality. Similarly, a significant chemical spill during or after construction at the creek crossing could likewise exceed BMP capacity, potentially affecting recharge water quality.

The ability of the BMPs to contain normal roadway contaminant loading is easily projected; however, it is difficult to predict the frequency or volume of accidental spills or spills. It is reasonable to assume that, for normal roadway usage and moderate spills;

BMPs implemented in conjunction with the project would largely prevent contamination of downstream surface waters and recharge waters.

Indirect effects to recharge waters would potentially result in a reduction in aquifer water quality affecting aquifer water users. The potential of the proposed project to indirectly affect aquifer water quality from pollutant loading or from soils disturbance or accidental spills during or after construction would be mitigated by the development and implementation of Best Management Practices such as the use of silt fence, rock berms, and/or detention/retention ponds. The construction of permanent BMPs would serve to remove pollutants and sediments.

8.2 Cumulative Impacts Analysis

The CEQ regulations define cumulative effects as:

“Effects on the environment which result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or entity undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.” (40 CFR 1508.7)

A comparison of direct, indirect, and cumulative effects is presented in **Table 16**.

Table 16: Types of Direct, Indirect, and Cumulative Effects

Type of Effect	Direct	Indirect	Cumulative
Nature of Effect	Typical/Inevitable/Predictable	Reasonably Foreseeable/Probable	Reasonably Foreseeable/Probable
Cause of Effect	Project	Project's Indirect Effects	Project's Direct and Indirect Effects and Effects of Other Activities
Timing of Effect	Project Construction and Implementation	At Some Future Time than Direct Effect	At Time of Project Construction or in the Future
Location of Effect	At the Project Location	Within Boundaries of System Affected by the Project	Within Boundaries of System Affected by the Project

Source: NCHRP Report 466, Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects 2002).

The purpose of this section is to assess the cumulative impacts of the interchange project.

As described above, relatively minor individual impacts may collectively result in substantial cumulative impacts. Proposed action-related direct and indirect impacts must be analyzed in the context of non-related impacts that may affect the same resources.

Cumulative impacts are the incremental impacts that the proposed action’s direct or indirect effects have on a resource in the context of the myriad of other past, present and future effects on that resource from unrelated activities. This analysis of cumulative impacts relies heavily on the land use changes anticipated to occur in the limits of improvements addressed in this CE and the effects these changes could have on the resources considered in this analysis. Changes in land use from undeveloped uses to developed uses is the primary cause of cumulative impacts to resources; therefore, land use serves as the background for cumulative impacts analysis and would not be considered a resource itself.

In order to have a cumulative impact on a resource, the proposed action must have: 1) a substantial direct or indirect impact on that resource, or 2) impact a resource in poor or declining health, even if the impacts resulting from the action are relatively minor.

Methodology and Screening

The methodology used to evaluate the cumulative effects of the proposed project follows TxDOT’s current guidance (TxDOT, 2009). The eight step methodology is depicted in **Table 17**.

Table 17: Eight-Step Approach for the Cumulative Impacts Analysis

Step 1. Identify the resources to consider in the analysis.
Step 2. Definition of the study area for each resource. Cumulative impacts are considered within spatial and temporal boundaries. Each resource has its own resource study area (RSA) to best assess the impacts to that individual resource. Each RSA was defined by professionals experienced in the study and analysis of each resource.
Step 3. Description of the current status/viability (health) and historical context for each resource. The examination of the current health and historical context of each resource is necessary to establish a baseline for determining the effects of the proposed action and other reasonably foreseeable actions on the resource.
Step 4. Identification of the direct and indirect impacts that may contribute to a cumulative impact. The analysis of cumulative impacts must look at the impacts of the proposed action in combination with the impacts of other past, present, or reasonably foreseeable actions within the resource study areas. Identification of the direct and indirect impacts of the proposed action will assist in determining the project’s contribution to the cumulative impact on the resource.
Step 5. Identification of other current and reasonably foreseeable actions that may contribute to a cumulative impact.
Step 6. Summary and assessment of potential cumulative impacts to each resource.
Step 7. Report the results.
Step 8. Discussion of mitigation issues for all adverse impacts.

The first step in conducting a cumulative impacts analysis, in accordance with TxDOT’s guidance, is to identify impacted environmental resources and determine the stability and health of those resources. As described above, land use changes provide the main context

for assessing cumulative impacts to resources; therefore, the analysis relies heavily on land use. A review of the direct and indirect effects sections was undertaken to identify resources that 1) are substantially impacted by the project or 2) are impacted to some degree but are in poor or declining health or at risk. As described in the guidance, if a project will not cause direct or indirect impacts on a resource, it will not contribute to a cumulative impact on the resource.

In *Step 2*, a resource-specific study area is defined for each resource. The setting of spatial limits for the study of each resource, a Resource Study Area (RSA), also known as “zone of potential impact”, was established using TxDOT/CEQ criteria, and in consideration of each resource’s physical characteristics, biological relationships, and regulatory jurisdictions. The use of indicators of a resource’s health, abundance, and/or integrity are helpful tools in formulating quantitative or qualitative metrics for characterizing overall effects to resources. These indicators are also key aspects of each resource that have already been evaluated in terms of the project’s direct and indirect impacts, and facilitate greater consistency and objectivity in the analysis of cumulative effects. Development, political, and management realities for each resource are also taken into consideration. The geographic study area is described below for each resource considered in the analysis. Because the cumulative impacts analysis relies heavily on GIS data, the time period for cumulative impacts begins in approximately 1962 or 1974, dates for which aerial photography amenable to use in a GIS is available for, respectively, the northern one-fourth and southern three-fourths of the RSA. The time period extends through 2035 which coincides with the MTP adopted by the San Antonio-Bexar County MPO.

In *Step 3*, the current status/viability and historical context for each resource is addressed. *Step 4* summarizes the direct and indirect effects of the proposed project.

Together, these four steps act as a screening tool to identify potential resources to be carried forward for further cumulative impacts analysis.

The proposed project is not anticipated to have substantial direct or indirect effects to surface water, vegetation, EJ socioeconomic, geological, migratory bird, air quality, historic (structural or archeological), land use, or listed species (excepting the two endangered karst species which may be affected, however are not likely to be adversely affected). As a result, these resources will not be addressed further in this cumulative effects analysis. Conversely, while the project would not be anticipated to have substantial direct or indirect effects to the endangered karst species previously described, these would be considered resources at risk or in poor or declining health. As a result, endangered karst species will be examined further.

Similarly, while the project would not be anticipated to have substantial direct or indirect effects to the Edwards Aquifer, this would be considered a sensitive resource. As a result, the Edwards Aquifer will be examined further.

Steps 1-4 are summarized by resource, below and in **Table 18**.

Endangered Karst Species

As stated previously, the project may directly affect, but is not likely to adversely affect, two endangered karst species. These protected species are two insects (two *Rhadine* ground beetles). Because there remains a remote potential for effects to these species from the project, further analysis of the cumulative effects on these is warranted. The RSA is comprised of contiguous surrounding land located on Karst Zones 1 and 2 – areas with known endangered karst species occurrence and areas with high probability of their occurrence – limited by the western extent of IH-10 (approximately 8.0 miles west of the project area). The RSA is an irregularly shaped area approximately 57,646 acres in size, located in northern Bexar County (**Figure 10**). Approximately 3,530 acres are located within federally-owned Camp Bullis, a military installation (USACE, 2009).

Potential direct effects from the project include disturbance of unknown endangered karst species habitats from placement of direct connector support columns within existing right-of-way and construction of merge and diverge lanes, overpass turnaround lanes, and other safety and mobility improvements within the project limits. Substantial indirect effects are not anticipated from the project (**Section 8.1**). An overview of the current health and historic context of endangered cave species within the study area follows.

Land use changes typically drive loss of the karst habitats of these species. Many features have been paved over or filled in. Others have been altered so that they no longer provide the stable temperatures and high humidity needed to support these animals. Contamination by pollutants is also a threat to endangered karst species survival (*TPWD Wildlife Fact Sheets, 2007*).

Based on examination of aerial photography, an estimated 4,461 acres (8 %), of the RSA was developed by 1974, approximately 10,768 acres (19 %) was developed by 1988, and approximately 40,385 acres (70%) showed evidence of some level of development by 2005. Approximately 14,855 acres of developable land remains in the RSA.

As reported in the Biological Assessment (**Appendix B**), the nine Bexar County karst species were listed as endangered in 2000 (65 FR 81419 – 81433). Designated critical habitat was delineated for seven of the nine species in 2003 (68 FR 17155 – 17231);

critical habitat has not been designated for the Government Canyon Bat Cave meshweaver or for the Government Canyon Bat Cave spider. Lands designated as critical habitat occur in 22 separate units in the county, with a total area of approximately 1,063 acres (USFWS 2003). Four of the 22 units are located within the RSA. All are outside the project action area. Unit 19, the unit closest to the project (approximately 1,000 feet north of Loop 1604), contains one cave (Genesis Cave) that is surrounded by approximately two acres of undeveloped land. The unit is adjacent to several small parcels of undeveloped land.

According to the most recent karst survey and subsequent Biological Assessment (TxDOT 2009), a total of 32 features were evaluated for excavation (to determine their suitability as karst invertebrate habitat). Excavation of these features revealed that nine were potential habitat for endangered karst species; however, no listed karst species were discovered during presence/absence surveys conducted in the nine features.

Because the TxDOT guidance on cumulative impacts analysis requires the National Environmental Policy Act (NEPA) practitioner to evaluate resources that are in poor or declining health or at risk (even if project impacts are minor), cumulative impacts to endangered karst species will be evaluated further.

Edwards Aquifer

Salado Creek and its tributaries traverse the recharge zones of the San Antonio segment of the Edwards Aquifer. The study area for this resource would encompass that portion of the Salado Creek watershed within the recharge zone, limited by the northern extent of available historic aerial photography (approximately 3.5 miles north of the project area), an area covering approximately 46,590 acres (**Figure 11**). Approximately 2,191 acres are located within federally-owned Camp Bullis.

Direct effects from the project include an increase in impervious cover within the RSA of approximately 19.8 acres. Threats to water quality from contaminated runoff from impervious cover would be minimized by engineered water quality controls; therefore, indirect effects (encroachment-alteration) are not anticipated. Moreover, as discussed in **Section 8.1**, substantial access-alteration/induced growth effects are not anticipated. It should be noted that direct and indirect effects summarized here are in reference only to the proposed US 281 North/Loop 1604 interchange improvement project. **Step 6** of this analysis evaluates the cumulative effects of the proposed project and other past, present and reasonably foreseeable future actions occurring in the RSA.

Although this analysis includes an evaluation of the cumulative effects of other reasonably foreseeable transportation projects, a more comprehensive analysis would be included in the environmental documents for those projects, once the direct and indirect effects of those projects are fully established. Those future analyses would include an accounting of the potential effects from the proposed interchange.

An overview of the current health and historical context of the Edwards Aquifer within the RSA follows.

The San Antonio segment of the Edwards Aquifer is designated as a sole source aquifer as it provides the sole source of drinking water for nearly 2 million central Texans. This designation applies to the portion of the aquifer within the RSA. There is the potential for runoff from impervious cover within the recharge zone to affect the quality of this important resource.

The aquifer itself underlies approximately 4,350 square miles within the state. In addition, the aquifer provides habitat for a number of threatened and endangered species. Regulations to protect water quality within the aquifer began on a limited basis in 1970 and evolved over time to cover all construction-related activities with the potential to pollute the aquifer over an eight-county area, including Bexar County.

According to the Edwards Aquifer Authority (EAA), Edwards Aquifer water is generally of such high quality that it normally requires only chlorination to meet public drinking water standards (EAA 2008). However, detection of nitrates, anthropogenic organic compounds, trace quantities of metals such as mercury, are a concern and warrant continued monitoring in the future.

Approximately 19.8 acres of impervious cover would be added by the proposed improvements. Salado Creek (Segment 1910) within the RSA or within five miles downstream of the project area is considered impaired, according to the TCEQ's 2008 303(d) List. BMPs would be in place during construction to protect water quality and reduce pollution of surface and ground water. Moreover, controls engineered in accordance with Edwards Aquifer Rules to safeguard streams from roadway contaminants would be in place at each crossing location.

Based on examination of aerial photography, an estimated 3,061 acres (7 %), of the RSA was developed by 1974, approximately 8,230 acres (18 %) was developed by 1988, and approximately 33,495 acres (72%) showed evidence of some level of development by 2005. Approximately 11,167 acres of developable land remains in the RSA.

Because the TxDOT guidance on cumulative impacts analysis requires the NEPA practitioner to evaluate resources that are in poor or declining health or at risk (even if project impacts are minor), cumulative impacts to Edwards Aquifer will be evaluated further. *Steps 1-4* are summarized in **Table 18**.

Table 18: Resource Indicators and Study Areas for the Cumulative Effects Analysis

Resource Category (Step 1)	Resource Study Area (RSA) (Step 2)	Existing Condition (Step 3)	Direct and Indirect Impacts of Project (Step 4)	Results of Initial Screening
Edwards Aquifer	Salado Creek watershed with Recharge Zone. Approximately 46,590 acres.	Good water quality; Extensive water quality regulations in place; Salado Creek not impaired within the RSA or five mile downstream.	Direct: Approximately 19.8 acres of added impervious cover to recharge and contributing zones. Indirect: No substantial effects because stormwater runoff would be treated	Carried forward for further analysis.
Two Endangered Karst Species	Zones of high probability of occurrence and known occurrences of EKS Approximately 57,646 acres.	Federally-listed; Draft recovery plan issued March 2008; Development restrictions (discovery of endangered species) in place; Critical habitat designated in Bexar County (1,063 acres in 22 units), with 4 units (171 acres) in RSA	Direct: May affect, but not likely to adversely affect two of the nine EKS Indirect: Substantial access-alteration or induced growth effects not anticipated.	Carried forward for further analysis.

Step 5: Reasonably Foreseeable Actions

To identify reasonably foreseeable actions within the endangered karst species and Aquifer RSAs, information from San Antonio city planners was referenced, as well as data provided by the City of San Antonio and data available on the internet. These data included GIS data of subdivision and roadway data and future land use plans.

Endangered karst species

The endangered karst species RSA is mostly developed, with ongoing residential and commercial development of remaining developable land. Approximately 31,671 acres within the RSA has been subdivided, with an average lot size of approximately 1.4 acres. Of that, approximately 19,558 acres have been recently subdivided (since 1998) for development currently under construction or slotted for near future. Current and future developments are listed in **Table 19**.

Table 19: Current and Future Development in the Endangered Karst Species RSA

Subdivision Name	No. of Lots	Acreage	Activity Level
Century Oaks	389	527.6	future
Cibolo Canyon Resort Community	282	2845.9	future
Encino Caliza	246	51.1	future
Green Mountain	2	1423.5	future
Landmark	9	60	future
The RIM	101	769.6	future
Rogers Ranch	1140	1513.2	future
Rogers West Shavano Tract	452	184.6	future
Tradesman Quarry	35	171.8	future
Umbell Oaks	5	58.9	future
TOTAL FUTURE DEVELOPMENTS		7606.2	
Belterra	3	69.5	current
Birdwell Stone Oak	6	118.0	current
Corporate Woods Office Park	5	42.7	current
Canyon Springs	4	1.6	current
Cavalo Ranch	97	25.1	current
De La Vega	1	35.1	current
Encino Commons	52	222.7	current
FCS Fischer	16	190.2	current
Flamingo Homes	150	217.3	current
Fossil Ridge Unit 3	195	400.8	current
Fox Grove	395	411.8	current
Fuentes Property	4	115.6	current
Gold Canyon/ Loop 1604	5	69.0	current
Goldtree	85	190.2	current
Heights at Stone Oak	96	53.7	current
Hidden Oaks Estates	15	177.9	current
Indian Springs	1118	1479.8	current
Laredo Encino	2	154	current
Laredo Springs	136	102.8	current
Links at Canyon Springs	150	43.2	current
Los Caminos	277	136.5	current
Marshall Ranch	18	77.8	current
Mesas of Stone Oak	193	60.2	current

Table 19: Current and Future Development in the Endangered Karst Species RSA

Subdivision Name	No. of Lots	Acreage	Activity Level
McMillin Texas Development	1	2.1	current
Mission Park Stone Oak	10	111.6	current
Northeast ISD	1	3.1	current
Oliver Ranch	1178	660.9	current
Pinon Creek/Encino	92	34.5	current
Promontory Point II	368	97.4	current
Redland Ridge	261	99.6	current
RAD Investments Inc.	1	1.5	current
Villages of Sonterra	25	168.3	current
San Miguel	48	35.3	current
Santikos 281/1604	13	99.2	current
Santikos 281/1604	1	3.8	current
Simon / Rogers	10	350.7	current
Sonterra Park	7	26.7	current
Steubing Estates North	775	1128.0	current
Stone Oak	6767	4609.1	current
Ventana Oaks	2	76.0	current
Village at Encino	185	48.9	current
TOTAL CURRENT DEVELOPMENTS		11,952.2	

Source: City of San Antonio Interactive Web map GIS data

Additionally, roadways comprise a substantial component of construction within the study area. Portions of 25 major roadways occur in the RSA (**Table 20**), three of which are proposed for improvement in the 2035 MTP.

Table 20: Pavement of MTP Roadways – Endangered Karst Species RSA

Roadway	Length in RSA (miles)	Existing Pavement (acres)*	Proposed Improvements in 2035 MTP
Bitters Road	1.7	12.4	No Improvements in MTP
Blanco Road	5.2	37.8	No Improvements in MTP
Bulverde Road	7.5	54.5	Added Capacity on from 1604 to Evans Rd. (3.4 mi.)
Canyon Golf Road	3.1	22.5	No Improvements in MTP
Cibolo Canyon	4.3	31.3	No Improvements in MTP
De Zavala	3.0	21.8	No Improvements in MTP
Evans Road	8.2	59.6	No Improvements in MTP
Hanging Oak	2.7	19.6	No Improvements in MTP
Hardy Oak Blvd	5.3	38.5	No Improvements in MTP
Henderson Pass	0.9	6.5	No Improvements in MTP
Huebner Road	9.4	68.4	No Improvements in MTP
Jones-Maltsberger	0.8	5.8	MTP Improvements outside RSA
Lockhill Selma	2.4	17.5	No Improvements in MTP
Loop 1604	10.5	127.3	Added Capacity on Several Sections within RSA; Direct Connectors to US 281
Military Drive NW	4.1	29.8	No Improvements in MTP
O'Connor Road	5.4	27.5	No Improvements in MTP
Redland	3.8	27.6	No Improvements in MTP
Rogers Ranch	1.3	9.5	No Improvements in MTP
Smithson Valley	1.1	8.0	No Improvements in MTP
Sonterra Blvd	7.6	55.3	No Improvements in MTP
Stone Oak Pkwy	6.3	45.8	No Improvements in MTP
Thousand Oaks	1.6	11.6	No Improvements in MTP
US 281	8.2	99.4	Added Capacity; Direct Connectors to Loop 1604
Vance Jackson	2.3	16.7	No Improvements in MTP
Wilderness Oak	10.1	73.5	No Improvements in MTP
TOTAL	116.8	928.2	

Source: Mobility 2035 San Antonio-Bexar Metropolitan Transportation Plan

*With the exception of US 281 and Loop 1604, for purposes of these calculations all pavement widths are assumed to be 60 feet.

Edwards Aquifer

The Aquifer RSA is mostly developed, with ongoing residential and commercial development of remaining developable land. Approximately 27,226 acres within the RSA have been subdivided, with an average lot size of approximately 0.7 acres. Of that, 15,120 acres have been recently subdivided (since 1998) for development currently under construction or slotted for near future. Current and future developments are listed in **Table 21**.

Table 21: Current and Future Development in the Aquifer RSA

Subdivision Name	No. of Lots	Acreage	Activity Level
Canyon Springs	4	1.6	future
Cibolo Canyon Resort Community	80	358.5	future
Encino Caliza	246	51.1	future
Green Mountain	1	382.6	future
Landmark	9	60	future
The RIM	101	769.6	future
Rogers Ranch	1140	1513.2	future
Tradesman Quarry	35	171.8	future
TOTAL FUTURE DEVELOPMENTS		3308.4	
Belterra	3	69.5	current
Birdwell Stone Oak	6	118.0	current
Cavalo Ranch	97	25.1	current
Century Oaks	389	527.6	current
Corporate Woods Office Park	5	42.7	current
Villages of Sonterra	25	168.3	current
Santikos 281/1604	13	99.2	current
Encino Commons	23	154.5	current
FCS Fischer	16	190.2	current
Flamingo Homes	45	57.8	current
Fossil Ridge Unit 3	154	333.8	current
Fox Grove	395	411.8	current
Fuentes Property	4	115.6	current
Gold Canyon/ Loop 1604	5	69.0	current
Goldtree	85	190.2	current
Heights at Stone Oak	96	53.7	current
Hidden Oaks Estates	15	177.9	current
Indian Springs	1117	1358.8	current
Laredo Encino	2	154	current
Laredo Springs	136	102.8	current
Links at Canyon Springs	150	43.2	current
Los Caminos	277	136.5	current
Marshall Ranch	18	77.8	current
McMillin Texas Development	1	2.1	current
Mesas of Stone Oak	1	1.1	current

Table 21: Current and Future Development in the Aquifer RSA

Subdivision Name	No. of Lots	Acreage	Activity Level
Mission Park Stone Oak	3	57.3	current
Northeast ISD	1	3.1	current
Oliver Ranch	1178	660.9	current
Pinon Creek/Encino	92	34.5	current
Promontory Point II	368	97.4	current
RAD Investments Inc.	1	1.5	current
Redland Ridge	261	99.6	current
San Miguel	48	35.3	current
Santikos 281/1604	1	3.8	current
Simon / Rogers	10	350.7	current
Sonterra Park	7	26.7	current
Steubing Estates North	775	1128.0	current
Stone Oak	6650	4506.2	current
Ventana Oaks	2	76.0	current
Village at Encino	185	48.9	current
TOTAL CURRENT DEVELOPMENTS		11,811.1	

Source: City of San Antonio Interactive Web map GIS data

Additionally, roadways comprise a substantial component of construction within the study area. Portions of 23 major roadways occur in the RSA (**Table 22**), three of which are proposed for improvement in the 2035 MTP.

Table 22: Pavement of MTP Roadways - Aquifer RSA

Roadway	Length in RSA (miles)	Existing Pavement (acres)*	Proposed Improvements in 2035 MTP
Bitters Road	1.7	12.4	No Improvements in MTP
Blanco Road	5.2	37.8	No Improvements in MTP
Bulverde Road	7.5	54.5	Added Capacity on from 1604 to Evans Rd. (3.4 mi.)
Canyon Golf Road	3.1	22.5	No Improvements in MTP
Cibolo Canyon	4.3	31.3	No Improvements in MTP
De Zavala	0.1	0.7	No Improvements in MTP
Evans Road	8.2	59.6	No Improvements in MTP
Hanging Oak	2.7	19.6	No Improvements in MTP
Hardy Oak Blvd	5.3	38.5	No Improvements in MTP
Henderson Pass	0.9	6.5	No Improvements in MTP
Huebner Road	9.4	68.4	No Improvements in MTP
Jones-Maltsberger	0.8	5.8	MTP Improvements outside RSA
Loop 1604	10.0	121.2	Added Capacity on Several Sections within RSA; Direct Connectors to US 281
Military Drive NW	3.8	27.6	No Improvements in MTP
O'Connor Road	5.4	27.5	No Improvements in MTP
Redland	3.8	18.7	No Improvements in MTP
Rogers Ranch	1.3	9.5	No Improvements in MTP
Smithson Valley	1.1	8.0	No Improvements in MTP
Sonterra Blvd	7.5	54.5	No Improvements in MTP
Stone Oak Pkwy	6.3	45.8	No Improvements in MTP
Thousand Oaks	1.6	11.6	No Improvements in MTP
US 281	8.2	99.4	Added Capacity; Direct Connectors to Loop 1604
Wilderness Oak	1.4	10.2	No Improvements in MTP
TOTAL	114.2	844.8	

Source: Mobility 2035 San Antonio-Bexar Metropolitan Transportation Plan

*With the exception of US 281 and Loop 1604, for purposes of these calculations all pavement widths are assumed to be 60 feet.

Step 6: Cumulative Impact Assessment

In this step, cumulative impacts are identified and the magnitude of those effects is evaluated.

Endangered Karst Species

Habitat requirements and potential threats to endangered karst invertebrates in central Texas have been assessed by the USFWS (1994, 2003).

These species require high humidity, stable temperatures, and nutrient inputs from surface sources. Potential threats that may alter the stable physical environment of the cave/karst feature, alter nutrient input, or introduce substances that have the potential to adversely affect karst invertebrates might include physical disruption by construction activities; chemical contamination from ground water or surface drainage; alteration of surface drainage patterns, including increases in impervious cover, such that cave or karst features lack adequate moisture; alteration of surface biological communities and associated nutrient inputs; denudation of the surface plant community leading to fluctuations in cave temperature; and fire ant invasion.

Section 7 of the Endangered Species Act (ESA) of 1973, as amended, requires that, through consultation with the USFWS and construction with federal funding or requiring a federal permit must not jeopardize the continued existence of any threatened, endangered, or proposed species or result in the destruction or adverse modification of critical habitat. The Biological Assessment for the project was prepared by TxDOT to facilitate informal consultation with the USFWS. Twenty-two areas of USFWS-designated critical habitat, totaling approximately 1,066 acres occur in Bexar County; four of these areas, totaling approximately 171 acres, occur in the RSA.

The San Antonio UDC requires habitat acknowledgment by developers for any threatened or endangered species occurring on land proposed for development. Compliance would require investigation of any karst voids discovered during construction for the presence of endangered karst species. The UDC would apply to construction activities within the RSA.

This ordinance requires, in part, identification of critical environmental features and may provide some protection for caves and karst features that provide recharge to the Edwards Aquifer. Development setbacks provided for in the ordinance range from 18.3 to 30.5 meters (60 to 100 feet). These setback distances translate into buffer areas of 0.33 to 0.92 acres. Setbacks from recharge features required by the ordinance may not always be adequate to protect entire hydrogeological areas that provide surface and subsurface

moisture to the cave, associated mesocaverns, and surface communities that provide nutrient input into the cave. Most of the caves known to contain the endangered karst invertebrates are relatively small and do not provide much recharge, so it is uncertain how these caves would be considered under the ordinance. In addition, not all development is subject to this ordinance.

The ordinance classifies property into three categories. Category 1 is any property having already filed official documents, such as development plats, water or sewer contracts, water pollution abatement plans, or zoning changes, or having a valid permit with the city prior to the effective date of the ordinance. The ordinance does not apply to Category 1 properties; thus, allowing up to 100 percent impervious cover. Category 2 properties are those not already designated as Category 1 and that lie within the corporate limits of the City of San Antonio. This category allows 30 percent, 50 percent, and 65 percent impervious cover, respectively, for single-family residential, multi-family, and commercial development. Category 3 property is not within Category 1 or 2, but is within the extra-territorial jurisdiction of the City of San Antonio and within the Edwards Aquifer recharge zone. Impervious cover is limited to 15 percent on Category 3 property. In an update by San Antonio Water System on January 14, 1998, the Water System noted that from January 23, 1995, to the end of 1997, 29.25 percent (23,958 acres) of development within the recharge zone was redesignated from Category 2 or 3 to Category 1.

Approximately 23 percent (13,041.2 acres) of the RSA has been fully developed. The majority of this past development is characterized by medium to high density residential and commercial land use. Another approximately 11 percent (4651 acres) of the land was preserved in parks, endangered karst species critical habitat, or military reservation. Parks and critical habitat are restricted from development.

Camp Bullis Military Training Reservation is designated as „Undeveloped“ on San Antonio’s Future Land Use Plan (Future Land Use Plan, accessed 2009). It is predominantly wild landscape used for military field exercises, and provides habitat for five endangered species including one of the larger nesting populations of golden-cheeked warbler in its nesting range, as well as *R. exilis and infernalis* (USAEC 2009). Camp Bullis, along with City of San Antonio Natural Areas and Wilderness Parks, is recognized by the City of San Antonio as a “lone island of refuge for endangered species” (UDC 2009).

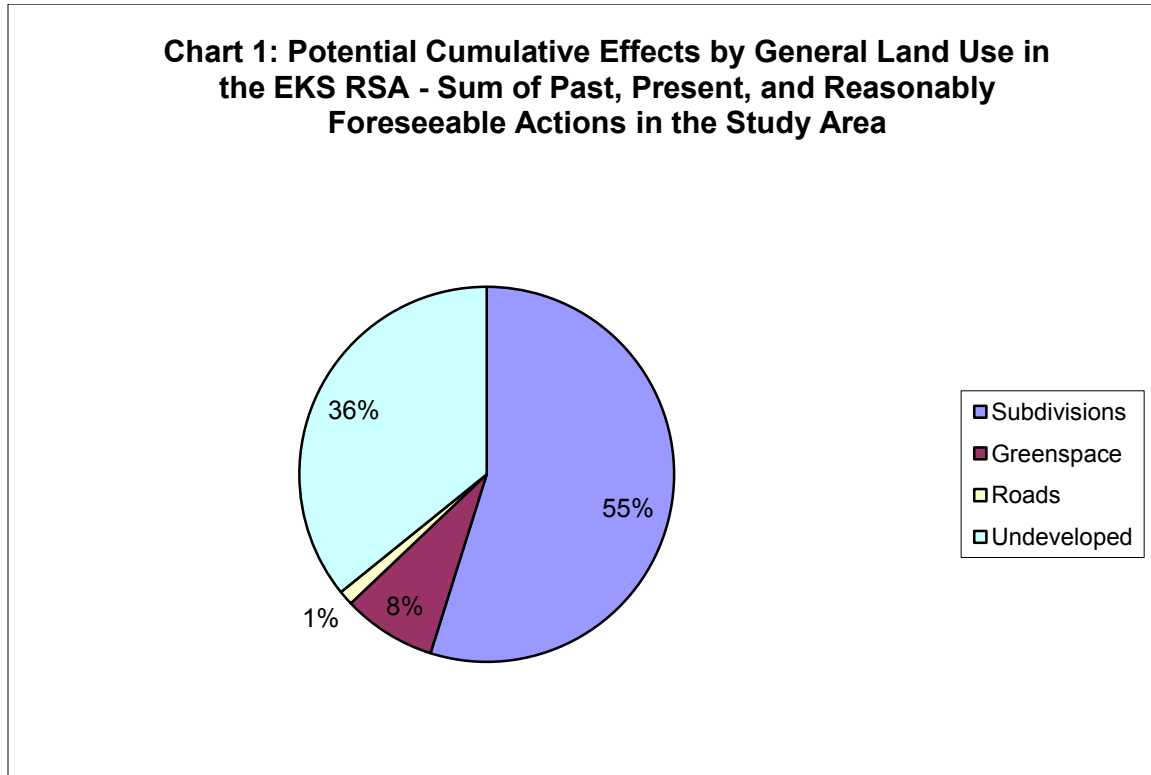
The current action – interchange improvements - accounts for approximately 0.03 percent⁶ of additional development (19.8 acres) within the RSA, an increase of 0.15 percent⁷ over existing conditions. Reasonably foreseeable future actions include developments underway, as well as those planned and platted. These future actions account for another approximately 19,558 acres, or 34 percent of the RSA. See **Table 23** and **Chart 1** for a summary of the potential cumulative effects within the RSA.

Table 23: Potential Cumulative Effect Area Within the EKS RSA

Type of Action	Past Actions	Current Action	Reasonably Foreseeable Actions	Cumulative Effect
Development	12,113 acres subdivisions; 928.2 acres roads	19.8 acres	19, 558 acres subdivisions	32,619.0 acres of development
Conservation	4651 acres parks, karst critical habitat, military reservation	0	0	4651 acres of greenspace, military reservation
Ratio (D:C)				7.0:1

⁶ The percentage of the RSA (57,646 acres) that is comprised by the proposed improvements (19.8 acres): $19.8 / 57,646 = 0.03\%$.

⁷ The proportional contribution of proposed improvements (19.8 acres) to existing development in the EKS RSA (13,041 acres subdivision and roads): $19.8 / 13,041 = 0.15\%$.



Edwards Aquifer

The quality of surface water (including that contributing to aquifer recharge) is correlated to the degree to which an area is developed. Some researchers estimate that water quality begins to decline when impervious cover exceeds as little as 10 percent of a watershed and severe degradation may occur between 30 and 70 percent imperviousness (Klein 1979, Leopold 1968). Impervious cover estimates for the study area are unavailable and methods to meaningfully analyze them have limitations; therefore, this cumulative impacts assessment relies on available GIS data. For these reasons, it is important to review relevant local and state regulations governing development within the RSA.

The Edwards Aquifer Rules (TAC Chapter 213) include planning, reporting, construction, and maintenance requirements throughout all phases of project development within the recharge zone with the express goal of nondegradation, protection of terrestrial and aquatic life and its environments, and economic enhancement. Notably, the rules require that permanent BMPs “must be designed, constructed, operated, and maintained to insure that 80 percent of the incremental increase in the annual mass loading of total suspended solids from the site caused by the regulated activity is removed.” These BMPs can be exempted from low density development if impervious cover is limited to 20 percent or less of the total site.

The TCEQ assumed the authority to administer the NPDES stormwater permit program in Texas as the TPDES permit program in 1992. Development that is indirectly influenced by the project may commonly be subject to two TPDES water quality regulations. Future construction activities that disturb one or more acres (or less in some cases) would be required to obtain authorization under TPDES general permit TXR150000. This permit requires controls and BMPs to reduce erosion, suspended solids, and for control of spills. Moreover, future commercial development is subject to TPDES general permit TXR050000, requiring BMPs to eliminate or reduce contamination of stormwater from industrial activities.

As discussed previously (**Section 8.1, Step 6**), the City of San Antonio regulates development and impervious cover within the recharge area of the Edwards Aquifer through Ordinance #81491, effective January 23, 1995. This ordinance limits types of development and impervious cover within the city limits, the extraterritorial jurisdiction, and the recharge zone. Development setbacks provided for in the ordinance range from 18.3 to 30.5 m (60 to 100 ft). The ordinance classifies property into three categories. Category 1 is any property, within the city limits, having already filed official documents, such as development plats, water or sewer contracts, water pollution abatement plans, or zoning changes, or having a valid permit with the City prior to the effective date of the ordinance. These properties are exempted from the ordinance. Category 2 properties are those not already designated as Category 1 and that lie within the corporate limits of the City of San Antonio. This category allows 30 percent, 50 percent, and 65 percent impervious cover, respectively, for single-family residential, multi-family, and commercial development. There are 30,865 acres (71%) of the RSA within the city limits; properties in this area would be Category 1 or 2, depending on the date of development.

Category 3 property is located in the ETJ of the City of San Antonio, within the Edwards Aquifer recharge zone. Impervious cover is limited to 15 percent for all development on Category 3 property. 15,725 acres (29%) of the RSA are in the ETJ; therefore, development on these properties would be subject to Category 3 stipulations.

Approximately 21 percent (9,954.8 acres) of the RSA has been fully developed. The majority of this past development is characterized by medium to high density residential and commercial land use. Another approximately 8 percent (3504 acres) of the land was preserved in parks, endangered cave species critical habitat, or military reservation. These lands are restricted from development. The current action – interchange

improvements, accounts for approximately 0.04⁸ percent of additional development (19.8 acres) within the RSA, an increase of 0.2⁹ percent over existing conditions. Reasonably foreseeable future actions include developments underway, as well as those planned and platted. These future actions account for another approximately 15,120 acres, or 32 percent of the RSA. See **Table 24** and **Chart 2** for a summary of the potential cumulative effects within the RSA.

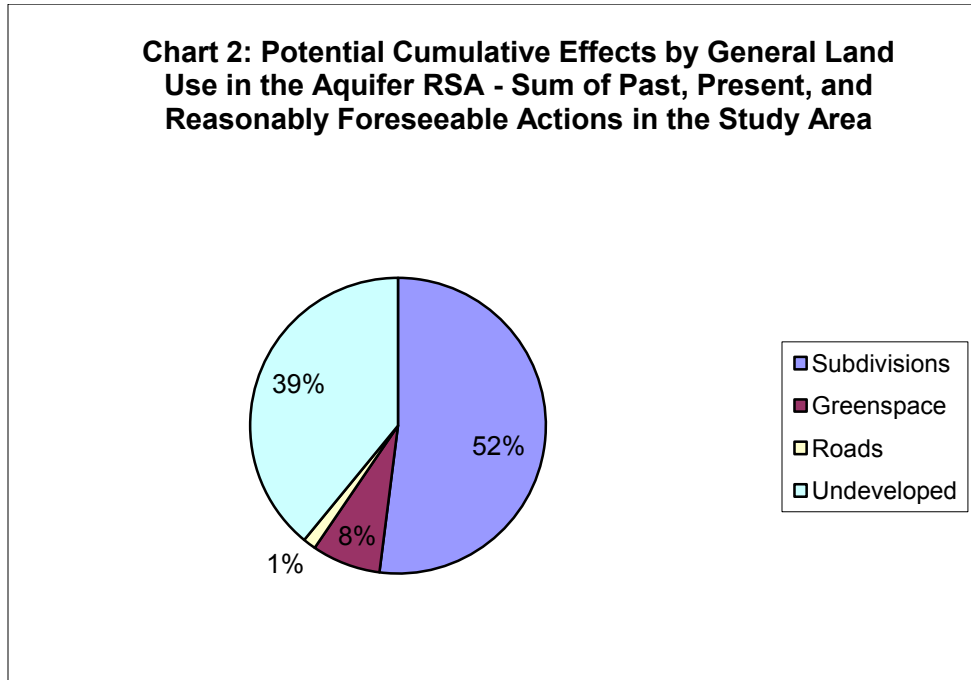
Table 24: Potential Cumulative Effect Area Within the Edwards Aquifer RSA

Type of Action	Past Actions	Current Action	Reasonably Foreseeable Actions	Cumulative Effect
Development	9110 acres subdivisions; 844.8 acres roads	19.8 acres*	15,120 acres subdivisions	25,094.6 acres of development
Conservation	3504 acres parks, karst critical habitat, military reservation	0	0	3504 acres of greenspace, military reservation
Ratio (D:C)				7.2:1

*Amount of additional impervious cover that would result from the proposed interchange improvements.

⁸ The percentage of the RSA (46,590 acres) that is comprised by the proposed improvements (19.8 acres): $19.8 / 46,590 = 0.04\%$.

⁹ The proportional contribution of proposed improvements (19.8 acres) to existing development in the Aquifer RSA (9,955 acres subdivision and roads): $19.8 / 9,955 = 0.2\%$.



Step 7: Report Results

Endangered Karst Species

The threats described in the Bexar County Karst Invertebrates Draft Recovery Plan were reviewed to understand the potential cumulative effect to endangered karst invertebrates within the Endangered karst species RSA. Potential cumulative effects to which the current action could contribute involve habitat loss. Habitat features are lost by being disrupted or filled in during construction activity or by indirectly degrading the habitat. This can happen through altered surface drainage patterns, altered native surface plant and animal communities, contamination by polluted runoff, excessive human visitation, and competition and predation from non-native, invasive species.

The recovery strategy is to reduce threats to the species by securing an adequate quantity and quality of caves including their drainage basins and surface communities upon which they rely, or critical habitat preserves. Currently there are 22 areas of critical habitat (totaling approximately 1,066 acres) in Bexar County, with four of these in the RSA (approximately 171 acres). The criteria for recovery will help confirm the adequacy of the preserves in addressing the threats. Monitoring the population status and threats are also components of recovery. Because many aspects of the population dynamics and habitat requirements of the species are poorly understood, recovery is also dependant on incorporating research findings into adaptive management actions. Because four species are known to occur in only one cave preserve, full recovery may not be possible for these

species. The proposed project's contribution to the overall cumulative effect on the recovery strategy would be limited to the project's potential to influence development (**Section 8.1**), insofar as critical habitat preserves might be affected. As reflected in the indirect effects analysis (**Section 8.1**), substantial access-alteration/induced growth effects are not anticipated as a result of the proposed project. For this reason, the project's contribution to cumulative effects would be minimal, although the cumulative effects of ongoing development in the RSA would be considered more substantial.

The TCEQ regulations may give some degree of protection to major aquifer recharge features; however, the Bexar County karst-dwelling endangered karst species are found in many caves that do not meet the TCEQ definition of a sensitive feature. TCEQ defines a sensitive feature in their *Instructions to Geologists for Geologic Assessments on the Edwards Aquifer Recharge/Transition Zones*, as a

...permeable geologic or manmade feature located on the recharge zone or transition zone where a potential for hydrologic interconnectedness between the surface and the Edwards Aquifer exists, and rapid infiltration to the subsurface may occur.

The TCEQ regulations are designed to protect the water quality of the Edwards Aquifer. This protection is typically accomplished by prohibiting certain activities, for example waste disposal wells or concentrated animal feed lots.

The City of San Antonio Ordinance #81491 requires, in part, identification of critical environmental features and may provide some protection for caves and karst features with endangered karst species that also provide recharge to the Edwards Aquifer.

Edwards Aquifer

Poor quality stormwater runoff from impervious cover would be the most likely cause of recharge water quality degradation within the Edwards Aquifer RSA. Klein estimated that impairment of surface water quality can be prevented if impervious cover is limited to 15%, in general. Recognizing progress of scientific discovery, Klein suggests repeating studies and adjusting these limits as necessary. **Table 25** presents development rates required to achieve this standard.

Table 25: Allowable Watershed Development Rates

Land Use Category	Imperviousness	Maximum Amount of Watershed that can be Developed Based on an Imperviousness of 15%
Individual Residences		
1-acre lot	20%	75%
0.5-acre lot	25%	60%
0.33-acre lot	30%	50%
0.25-acre lot	38%	29%
0.12-acre lot	65%	23%
Townhouse	44%	33%
High-Rise Residential	56%	27%
Industrial District	75%	20%
Commercial/Business Area	85%	18%
Shopping Center	95%	16%

In comparison, approximately 53 percent of the Edwards Aquifer RSA has already been developed in the past or is planned for development in the foreseeable future (including the current project). The segments of Salado Creek within or downstream of the RSA are not considered impaired; however, could be affected by future increases in impervious cover in currently undeveloped areas of the RSA. The City of San Antonio regulates development and impervious cover within the recharge area of the Edwards Aquifer. For all development in the city limits or extra-territorial jurisdiction (ETJ), required development setbacks from recharge features ranges from 60 to 100 feet. Impervious cover requirements do not apply to these properties or properties with official documents, such as development plats, water or sewer contracts, water pollution abatement plans, prior to the effective date of the ordinance (January 23, 1995). For other properties within the corporate limits of the City of San Antonio, 30 percent, 50 percent, and 65 percent impervious cover is allowed for single-family residential, multi-family, and commercial development, respectively (80% for commercial development within 2500 feet of a highway intersection node). For properties within the ETJ, impervious cover is limited to 15 percent.

Because construction projects in the Edwards Aquifer recharge zone would be subject to the Edwards Aquifer Rules, TPDES, and the City of San Antonio Ordinance #81491, this threat would be minimized and abated.

Step 8: Mitigation

Endangered Karst Species

It is anticipated that the development trend in the endangered karst species RSA would continue as the region continues to grow. Accordingly, if development rates increase in intensity, unknown karst habitat features could be degraded over time by construction activity.

Work on the proposed project would cease in the immediate area of any karst feature discovered during construction. The feature would then be investigated by a qualified biologist. If a federally protected species is documented, consultation with the USFWS would be initiated.

As with water quality, it is crucial that karst habitat protections are fully implemented and adhered to. Regarding actions by others, Step 6 describes mitigation measures implemented by local jurisdictions, including TCEQ and City of San Antonio requirements regarding Edwards Aquifer recharge that may also benefit endangered karst species. Lastly, continued support of scientific research aimed at confirmation of the adequacy of the karst preserves in meeting the criteria for endangered karst species recovery will inform adaptive management decisions.

Edwards Aquifer

It is anticipated that the development trend in the Edwards Aquifer RSA would continue as the region continues to grow. However, if development rates increase in intensity, recharge water quality could degrade over time. Thus, it becomes more crucial that water quality protections are strengthened where needed, fully implemented, and consistently enforced.

It is impossible to discuss water quality in the region without addressing mitigation measures, as the value of mitigation and the foresight of local planners to improve and maintain water quality in this sensitive ecosystem has been at the forefront of legislation and rulemaking.

The proposed project would require the preparation of a water pollution abatement plan in accordance with the Edwards Aquifer Rules administered by TCEQ. The plan would include provisions for temporary (construction phase) and permanent water quality best management practices to control and mitigate total suspended solids in stormwater runoff. Prior to initiation of construction, the water pollution abatement plan would be submitted to TCEQ for review; construction would not commence until approval is

received from TCEQ. The proposed project would require the preparation of an SW3P to satisfy requirements of the TCEQ TPDES Water Quality General Permit. The SW3P would include provisions for temporary erosion and sedimentation controls to be employed during construction. The water pollution abatement plan and SW3P regulations include provisions for regular inspection and maintenance of construction-phase best management practices; thus, ensuring on-going effectiveness of stormwater controls. The contractor would take appropriate measures to prevent, minimize and control the spill of hazardous materials in staging areas. Project construction would cease in the immediate vicinity of a previously undiscovered sensitive recharge feature, which would then be investigated by a qualified geoscientist. Appropriate measures would be then followed, in accordance with TCEQ regulations.

Regarding actions by others, Step 6 describes mitigation measures implemented by local jurisdictions as well as a summary of Edwards Aquifer Rules and TPDES requirements. These programs require BMPs to reduce pollution of surface and ground water.

In summary, efforts to protect water quality within the RSA, and the Edwards Aquifer overall, have been extensive. However, it is important that all stakeholders fully comply with all applicable regulations and that BMPs are constructed and maintained effectively.

Cumulative Impacts Summary

The proposed project's proportional contribution to cumulative impacts would be limited to the Edwards Aquifer and endangered karst species, which would not be considered substantial, and to potential indirect effects to the timing and intensity of future development. However, because of the extensive area encompassed by historical development activities that have occurred and reasonably foreseeable future developments that could occur in the RSA, the Edwards Aquifer and endangered karst species are considered sensitive resources that are at risk. It is important for the appropriate decision-makers and interested members of the public to be informed of potential cumulative effects to these resources. The disclosure herein is based on the best available data at this time. Substantial cumulative impacts may occur if appropriate mitigation measures are not implemented during future development and adequate conservation lands protected.

9.0 PUBLIC INVOLVEMENT

On Tuesday, August 25, 2009, the Alamo RMA hosted a community open house for the proposed project. The open house was held at Harvest Fellowship Church, 1270 North Loop 1604 East, San Antonio, Texas. The purpose of the open house, which was

conducted between the hours of 6:00 PM and 9:00 PM, was to provide attendees with an overview of the proposed project, explain projected benefits, solicit public comment and develop a record of public views with regard to the project.

Notice of the open house was published in the San Antonio Express News and La Presna. The 30-day advanced notices were published on July 26, 2009, and 10-day advanced notices were published on August 16, 2009. Notices were published in both English and Spanish. Additional notification was provided in the form of letters to local elected officials and community leaders. Social media (email distribution, Facebook and Twitter) was also used as a notification tool. Dynamic messaging signs were strategically located at high visibility areas along the US 281 and Loop 1604 corridors. The signs, which were operational for the seven-day period preceding the open house, displayed the date, time and location of the open house. A total of 115 people registered their attendance at the open house by signing-in as they entered.

A formal presentation was not made during the open house. Instead, the open house utilized a station approach to engage attendees in specific discussions related to the project. Stations specific to the following topics were set-up: project overview, Loop 1604-specific proposed improvements, US 281-specific proposed improvements, environmental requirements and Alamo RMA information. Each station was manned by members of the project team, who answered questions and interacted with the public. Copies of materials presented at each station are available on the Alamo RMA website (www.AlamoRMA.org) and were posted at noon the day following the open house to allow members of the public an opportunity to review.

Comments from those in attendance were solicited. All written comments received or postmarked by September 4, 2009, were included in the official record of the open house. Verbal comments recorded by the on-site court reporter were also included in the open house report.

Thirty-four individuals submitted comments for the open house record. Eighteen individuals submitted only written comments (via comments cards submitted at the open house, postal mail or email), ten individuals provided only verbal comments via the court reporter, and six individuals submitted both written and verbal comments.

Several comments expressed support for the proposed project (examples: “great plan” and “the people want action now”). Others expressed opposition to the project or specific aspects of it (examples: “it’s ill-conceived to spend Obama money to build half an interchange” and “project should be built by TxDOT, not the RMA”). Several comments

expressed opposition to tolling even though the project is not proposed for tolling. A full report of the open house is on file and available for review at the Alamo RMA office.

A public meeting on the proposed interchange improvements was held on Monday, January 11, 2010, beginning at 5:30 pm. The meeting included an open house from 5:30 p.m. to 7:00 p.m. and was followed by a brief technical presentation and public comment session. Approximately 198 people attended the public meeting. A total of 382 comments, from approximately 39 commenters were received (including written and verbal comments). Comments ranged from "I support the proposed project" to "This is a waste of money and time". A complete summary of the public meeting was prepared, and includes a transcript of the meeting as well as copies of all comments received and responses addressing the comments. A copy of this report is on file and available for public review at the Alamo Regional Mobility Authority office located at 1222 N. Main Avenue, Ste 1000, San Antonio, Texas 78212, online at www.AlamoRMA.org and available for public review at library locations adjacent to the proposed project location.

The Alamo RMA will also provide notice to all individuals who submitted a comment (and supplied contact information) confirming receipt of their comment and its inclusion in the public meeting report. Further, commenters will be notified that the public meeting report is available for review at the locations and on the website referenced earlier.

10.0 CONCLUSION

The engineering, social, economic, and environmental investigations conducted for this document indicate that the proposed project would have no significant impact on the natural or man-made environment. Investigations indicate that this project is the type of improvement that qualifies as a CE and that significant environmental impacts are not expected to occur.

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