LCRA TRANSMISSION SERVICES CORPORATION
COMPETITIVE RENEWABLE ENERGY ZONE TRANSMISSION LINES
ENVIRONMENTAL ASSESSMENT

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APPENDIX

Appendix A. Summary of Public Comments Received on Draft HCP and EA

EXECUTIVE SUMMARY

LCRA Transmission Services Corporation (LCRA TSC) is planning to construct two new 345-kilovolt (kV) overhead electric transmission lines in central Texas. These two lines, Twin Buttes–Big Hill and Big Hill–Kendall, are referred to collectively as the "Priority Projects." They will be constructed by LCRA TSC pursuant to orders of the Public Utility Commission of Texas (PUC) as part of the State of Texas Competitive Renewable Energy Zone Program (CREZ). LCRA TSC is seeking from the U.S. Fish and Wildlife Service (Service) authorization for incidental take of two federally listed endangered species that may occur during the construction, operation, maintenance, and repair (both routine and emergency) of the two transmission lines and associated roads needed to access the transmission line rights-of-way ("Covered Activities"). This authorization would be achieved through the Service's issuance of a section 10(a)(1)(B) incidental take permit (ITP) under the authority of the Endangered Species Act of 1973, as amended (Act) (16 USC 1531 et seq). The two species that would be covered by the requested ITP are the golden-cheeked warbler (*Dendroica chrysoparia*; GCWA) and black-capped vireo (*Vireo atricapilla*; BCVI), collectively referred to as the "Covered Species." The ITP is proposed for a term of 30 years. The Priority Projects will go through Gillespie, Kendall, Kerr, Kimble, Schleicher, Sutton, and Tom Green counties, Texas (Permit Area).

Three alternatives were selected for analysis in this Environmental Assessment (EA): the Preferred Alternative (Alternative A), the Maximum Take Avoidance Alternative (Alternative B), and the No Action Alternative (Alternative C). The Preferred Alternative is issuance of an ITP to LCRA TSC to authorize take of the GCWA and BCVI that may result from the Covered Activities. An explanation of the measures proposed to avoid, minimize, and mitigate those impacts is also provided in the Final Habitat Conservation Plan (FHCP). Mitigation strategies include LCRA TSC purchasing conservation credits from GCWA and/or BCVI habitat conservation banks, providing funding to an entity or conservation program for conservation of the species that would be used prior to any impacts caused by LCRA TSCs activities that could result in take, or a combination thereof.

Under the Maximum Avoidance Alternative, LCRA TSC would request a Section 10(a)(1)B) permit from the Service that would cover a lower level of incidental take of the Covered Species. Reducing the level of take would be achieved by LCRA TSC restricting all clearing and construction to times outside of the Covered Species breeding season, avoiding to the maximum extent practicable clearing of right-of-way and access roads in all potential habitat areas, and stringing wire via helicopter to further avoid habitat impacts.

Under the No Action alternative, LCRA TSC would employ the measures described under the Maximum Take Avoidance Alternative; however, they would not pursue an incidental take permit for the activities.

CHAPTER 1
PURPOSE AND NEED

1.1 INTRODUCTION

The U.S. Fish and Wildlife Service (Service) is proposing to issue a 10(a)(1)(B) incidental take permit (ITP) to LCRA Transmission Services Corporation (LCRA TSC) for impacts to two federally listed endangered species, the golden-cheeked warbler (*Dendroica chrysoparia*, GCWA) and black-capped vireo (*Vireo atricapilla*, BCVI) (Covered Species), during the construction of two new 345-kilovolt (kV) overhead electric transmission lines in central Texas. These two lines, Twin Buttes–Big Hill and Big Hill–Kendall, are referred to collectively as the "Priority Projects." The Priority Projects will go through Gillespie, Kendall, Kerr, Kimble, Schleicher, Sutton, and Tom Green counties, Texas (Permit Area; Figure 1.1). They will be constructed by LCRA TSC pursuant to orders of the Public Utility Commission of Texas (PUC) as part of the State of Texas Competitive Renewable Energy Zone Program (CREZ). Incidental take is expected during the construction, operation, maintenance, and repair (both routine and emergency) of the transmission lines in addition to associated roads to and from the lines (Covered Activities). This Environmental Assessment (EA) examines the impact that issuance of the ITP (Proposed Action) is expected to have on the human environment.

On 19 March 2010, the Service announced its intent to prepare an Environmental Impact Statement (EIS) in connection with a then-contemplated application by LCRA TSC for an ITP. That permit would have authorized take of listed species that might occur in connection with LCRA TSC's construction, operation, maintenance, and repair of four CREZ transmission projects totaling an estimated 450 miles and including several substations. At the time of that announcement, and at the time of the Service's five public scoping meetings, no routes had been selected by the PUC for those four transmission lines, and the Permit Areas (areas of possible impact by the Priority Projects) were quite large—spanning 14 counties. Therefore, the potential draft HCP was viewed as programmatic in nature, in that it would establish a methodology for assessing and mitigating for potential listed species take that could occur in connection with projects to be constructed on as yet unknown routes. Since that time, however, pursuant to actions of the PUC, two of the projects have been eliminated and routes have been selected for the remaining two projects, resulting in a reduction of miles from 450 to 178 (the Priority Projects).

1.2 PROJECT BACKGROUND

1.2.1 CREZ Program

Pursuant to §39.904(g) of the Public Utility Regulatory Act of Texas (PURA), the PUC established CREZ zones in the western and Panhandle regions of Texas. The purpose of these zones is to provide an organized and cost-effective means of delivering electricity produced by wind generation facilities in those regions to areas of greater demand in eastern Texas through the construction of new electric transmission lines and associated facilities. LCRA TSC, a Texas non-profit corporation, is one of several transmission service providers that were formally

required by the PUC to construct these new transmission lines through an Order on Rehearing initially issued in March 2009.[1]

1.2.2 Summary of PUC Routing Process

The PUC regulates the construction of electric transmission lines in the State of Texas under Texas Administrative Code, Title 16, Part II, Chapter 25. Construction of new electric transmission lines by LCRA TSC or any electrical utility provider must first be approved by the PUC. Such approval is typically given only if need for the line is demonstrated adequately and if routing for the line was conducted in accordance with PUC Substantive Rules (PUC 25.101) and factors outlined in PURA. The PUC controls which entities can provide transmission utility service through the issuance of certificates of convenience and necessity (CCNs). A utility wanting to build a transmission line first applies to the PUC for a CCN.[2] Typically, an application to obtain a CCN must describe the proposed transmission line, the need for the line, and the impact that building the line would have on the environment and the affected community.

With respect to CREZ transmission lines, including the Priority Projects to be constructed by LCRA TSC, need for those lines was predetermined by PURA 39.203 and 39.904 and, therefore, transmission service providers constructing CREZ transmission lines were not required to prove need in a CREZ CCN. However, acquisition of a CCN from the PUC was still a prerequisite to gaining approval of a CREZ transmission project.

Prior to submitting an application for a CCN, a utility provider seeking to build a transmission line between two points typically conducts a routing analysis that compares several alternate routes that the line could travel to connect those points. The comparative routing analysis is preceded by an environmental assessment[3] of a Permit Area identified for purposes of analysis. Routes are formulated considering the PUC's *Environmental Criteria for Alternative Route Evaluation* (LCRA TSC 2009). The alternatives are then compared by the utility provider based on a number of prescribed factors to assess the impacts each of the possible routes might have on the environment and the affected community.

The utility then submits its environmental assessment and routing analysis to the PUC as part of its CCN application package, along with identification of its preferred route for the transmission line. As described by the PUC (2009), the commission then decides whether to approve the application for a CCN based on the submitted information, input from the State Office of Administrative Hearings (SOAH), landowners, and other members of the public, and consideration of the additional factors identified in Section 1.5.7.1 of this chapter.

If the PUC approves the application for a CCN, it then selects the route for the transmission line, with the final route not necessarily being the route identified as preferred by the utility in its application package. Under the authority of PURA, once the final route is chosen by the PUC, the utility must construct the line along that route, with exceptions being that, under a highly

[1] See Order on Rehearing, Docket No. 35665, 15 May 2009.
[2] Municipally owned utilities are not required to obtain a CCN prior to constructing transmission lines.
[3] These "environmental assessments" are prepared to comply with Texas State regulations and should not be confused with the Federal National Environmental Policy Act (NEPA) documents of the same name.

Figure 1.1. Location map for the Priority Projects.

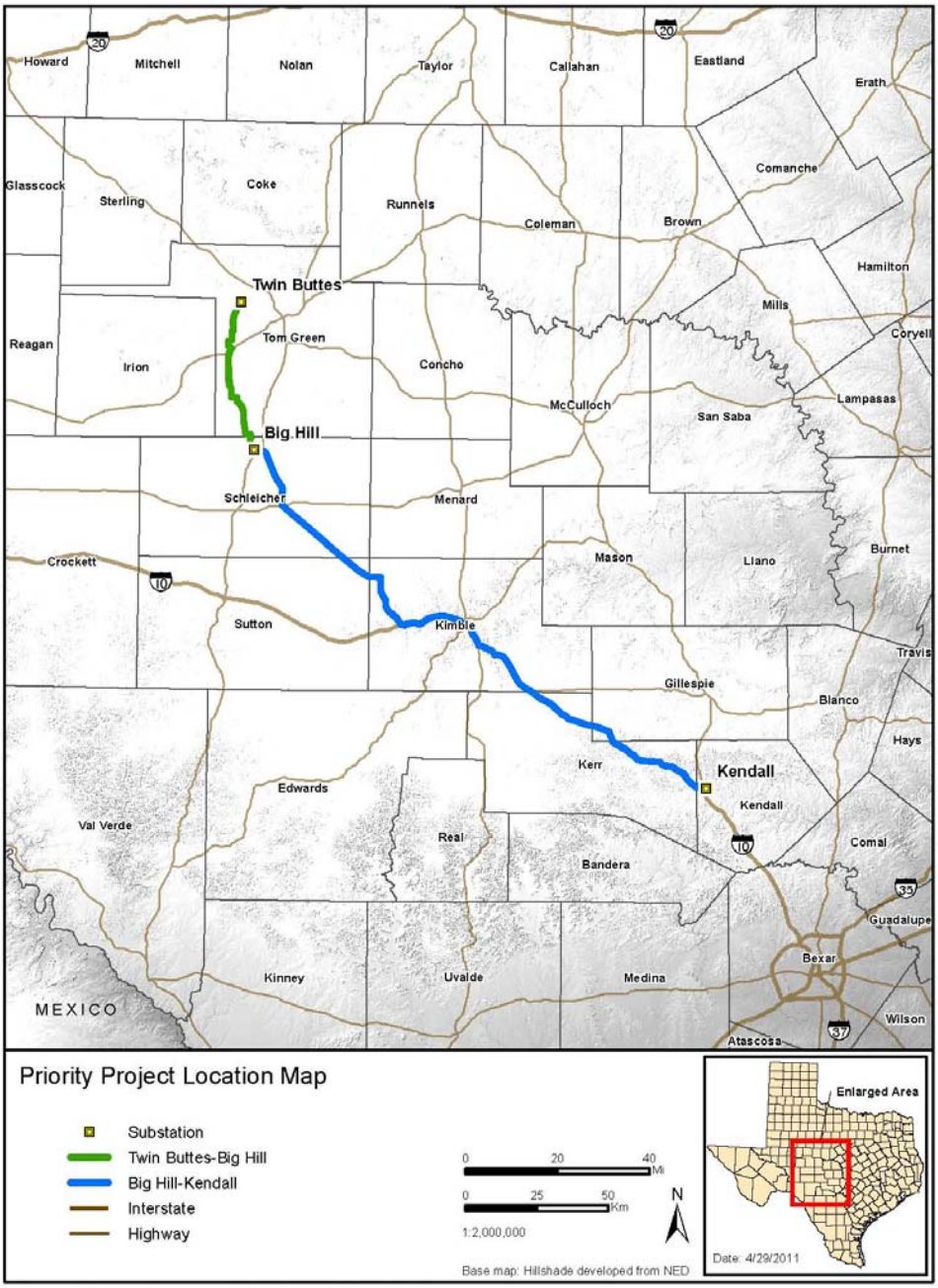

Figure 1.1. Location map for the Priority Projects.

restrictive set of guidelines, the utility can shift small portions of a route if such shifts do not engender cost increases or introduce other impacts.

1.3 SUMMARY OF PRIORITY PROJECTS

On 15 May 2009, the PUC issued an Order on Rehearing (Docket No. 35665, Interchange Item 1340[4]) by which it designated 42 transmission projects for construction. Thirteen of those projects were identified for "priority" construction, with their construction mandated by PURA. Among the "priority" projects, the PUC initially assigned LCRA TSC four transmission lines, only two of which, the Twin Buttes–McCamey D (now Twin Buttes-Big Hill) and Big Hill–Kendall transmission lines, are currently going forward.

LCRA TSC filed its CCN application for the Twin Buttes–Big Hill transmission line with the PUC on 15 January 2010 (LCRA 2010a). On 1 July 2010, the PUC approved the CCN application and identified the route selected for this transmission line. A CCN application package including the Big Hill–Kendall transmission line was filed with the PUC on 28 July 2010. The application for the Big Hill–Kendall project was approved by the PUC on 24 January 2011.

The PUC is requiring LCRA TSC to have the approved Priority Projects built and operational by the fall of 2013.

1.3.1 Twin Buttes–Big Hill Transmission Line

The Twin Buttes–Big Hill transmission line will be approximately 38 miles long and cross portions of western Tom Green and north-central Schleicher counties. This line will connect the Twin Buttes Substation, located approximately nine miles northwest of the City of San Angelo in northwestern Tom Green County, to the Big Hill Substation, in north-central Schleicher County to the north of County Road 431 and west of U.S. Highway 277 (see Figure 1.1 and Figure 2.2 in Chapter 2).

1.3.2 Big Hill–Kendall Transmission Line

The Big Hill–Kendall transmission line will connect the Big Hill Substation to the Kendall Substation, located near the City of Comfort in northwest Kendall County. This transmission line will be approximately 140 miles long and cross portions of Schleicher, Sutton, Kimble, Kerr, Gillespie, and Kendall counties (see Figure 1.1 and Figure 2.2 in Chapter 2).

1.4 PURPOSE AND NEED

The Proposed Action is issuance of a Federal ITP under Section 10(a)(1)(B) of the Act, and all relevant implementing regulations and policies, to LCRA TSC for impacts to the Covered Species. In the absence of an ITP—and the conservation planning entailed by the permit review process—take would violate the Act. Thus, the Proposed Action is needed to ensure that LCRA TSC's projects with the potential to impact listed species are in compliance with the Act. This EA and the associated FHCP specify what steps the Applicant will take to avoid, minimize, and mitigate to the maximum extent practicable the potential impacts to the listed species. Under provisions in the FHCP and requested ITP, the Applicant will establish and implement long-term

[4] Documents officially filed with the PUC are assigned docket and item numbers and posted on the PUC's Interchange Website at http://www.puc.state.tx.us/interchange/index.cfm.

protection of federally listed endangered species and their habitat, while continuing to construct, operate, maintain, and repair two 345-kV overhead electric transmission lines in central Texas.

1.5 REGULATORY FRAMEWORK

1.5.1 National Environmental Policy Act (NEPA)

The Service considers issuance of an ITP a Federal action subject to the requirements of the National Environmental Policy Act (NEPA) (42 USC 4321–4327). NEPA requires Federal agencies to: 1) study proposed Federal actions to determine if they will result in significant environmental impacts to the human environment, and 2) review the alternatives available for the project and consider the impact of those alternatives on the environment (42 USC 4332(c)). NEPA regulations at 40 CFR 1502.14 require that all reasonable alternatives be rigorously explored and objectively evaluated. "Reasonable Alternatives" have been defined by the Department of the Interior as alternatives that are technically and economically practical or feasible and that meet the purpose and need of the proposed action (U.S. Department of the Interior 2004). The scope of NEPA requires that the agency consider the impacts of the action on the "human environment," including a variety of resources such as water, air quality, and cultural and historic resources.

In complying with NEPA, the potential impacts of the Federal action are often first examined by a Federal agency through preparation of an EA. If the proposed project is expected to cause significant environmental impact, then examination of the project must be elevated to the level of an EIS. Given the scale of the Priority Projects, the Service determined that an EA-level examination of the expected impacts from completion of the Priority Projects is appropriate for evaluating the potential environmental impacts of issuing the requested ITP.

1.5.2 Endangered Species Act

Section 9 of the Act prohibits the take of any federally listed endangered wildlife species (16 USC 1538(a)). The Act defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1532(19)). "Harm" is not defined in the statute, but the Service's regulations define it as "an act which actually kills or injures wildlife and may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding or sheltering" (50 CFR 17.3 (2005)). Section 10(a)(1)(B) of the Act (16 USC 1539(a)(1)(B)) authorizes the Service to issue a permit allowing take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

For the Service to issue an ITP an applicant's HCP must identify or satisfy issuance criteria: 1) the impact that will likely result from the taking, 2) the steps the applicant will take to minimize and mitigate the impacts and the funding available to implement those steps, 3) what alternative actions to taking were considered and the reasons the alternatives were not chosen, and (4) other measures that the Service may require as necessary or appropriate for purposes of the conservation plan (16 USC 1539(a)(2)(A)). The Act's implementing regulations also give permittees "no surprises" assurances, which provide certainty as to their future obligations under an HCP (50 CFR 17.22, 17.32).

Section 7(a)(2) of the Act requires that each Federal agency consult with the Service to ensure that agency actions the Service authorizes, funds, or carries out are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat (16 USC 1536(a)(2)). "Jeopardize" is defined by the regulations as engaging in an action that would reasonably be expected, directly or indirectly, to appreciably reduce the likelihood of the survival and recovery of the species in the wild (50 CFR 402.02). Issuance of an ITP is considered an action for which the mandate of consultation applies (Service and NMFS 1996). According to the HCP Handbook, the consultation must include consideration of direct and indirect effects on the species, as well as the impacts of the proposed project on listed plants and critical habitat, if any (Service and NMFS 1996).

1.5.3 Bald and Golden Eagle Protection Act

The Service is the Federal agency with primary statutory authority for managing bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) under the Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. 668–668d). The Service has established permit regulations to authorize limited take of bald and golden eagles under the BGEPA where the take to be authorized is associated with otherwise lawful activities. These regulations also establish permit provisions for intentional take of eagle nests under particular, limited circumstances.

The BGEPA, as modified, defines the ''take'' of an eagle to include a broad range of actions: ''pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb.'' ''Disturb'' is defined in regulations at 50 CFR 22.3 as: ''to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.''

A goal of the Service is to maintain stable or increasing breeding populations of eagles protected by the BGEPA. Regulations under the BGEPA allow us to issue permits for activities that are likely to result in take of eagles provided that the activity is otherwise lawful and the taking is not the purpose of that activity, cannot practicably be avoided, and is compatible with eagle preservation (50 CFR 22.26). These regulations distinguish take that might result from short–term or one–time actions from take that results from ongoing long–term actions (programmatic take). The Service's regulations authorize the removal of bald eagle and golden eagle nests where (1) necessary to alleviate a safety hazard to people or eagles, (2) necessary to ensure public health and safety, (3) the nest prevents the use of a human-engineered structure, or (4) the activity, or mitigation for the activity, will provide a net benefit to eagles.

The Service will authorize take of bald or golden eagles only if we have determined that the take (1) is compatible with the preservation of bald and golden eagles and (2) cannot practicably be avoided. For purposes of the regulations, "compatible with the preservation of Bald or Golden eagles" means "consistent with the goal of stable or increasing breeding populations." Although the biologically–based take thresholds for permitting under these regulations will be based on regional populations, we will also consider other factors, such as cultural significance, that may warrant protection of smaller or isolated populations within a region.

1.5.4 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (16 USC 703-712)(MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of Interior. Even though the MBTA does not have provisions for allowing incidental take of migratory birds, the Service recognizes that some migratory birds may be killed at structures (e.g., radio towers and wind turbines) despite implementing measures intended to avoid take of birds. The Office of Law Enforcement and Department of Justice exercise enforcement and prosecutorial discretion when dealing with individuals, companies, or agencies that practice good faith to comply with the MBTA.

1.5.5 Clean Water Act Section 404

The Clean Water Act (CWA) is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to waters of the United States. The U.S. Army Corps of Engineers (USACE) and the U.S Environmental Protection Agency (EPA) have final authority in determining whether a given site possesses waters of the United States and the limits of those waters. Under Section 404, the USACE regulates the discharge of dredged or fill material into waters of the United States, including wetlands. Activities that discharge dredged or fill material or include mechanized land clearing, grading, leveling, ditching, and redistribution of material in a water of the United States require a 404 permit from the USACE. Applicants for 404 permits must demonstrate that they have avoided or minimized adverse effects to the extent practicable. For the Priority Projects, jurisdictional determinations fall under the authority of the USACE Fort Worth District Regulatory Branch.

1.5.6 National Historic Preservation Act

The National Historic Preservation Act of 1996 (NHPA), and specifically Section 106 of the NHPA and associated regulations at 36 CFR Part 800, requires Federal agencies to take into account the effect that certain undertakings may have on any district, site, building, structure, or object that is included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). NRHP eligibility criteria may be found at 36 CFR 60.4(a–d). Such criteria may include elements significant to American history, architecture, archaeology, and culture as found in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association.

Pursuant to NHPA and its implementing regulations, the Federal action agency, in consultation with the relevant state historic preservation office, must determine, with respect to the undertaking, the area of potential effects (APE); review, seek, and gather information about historic properties within the vicinity; and, based on the information gathered and reviewed, identify any historic properties within the APE. Historic properties are defined by 36 CFR 800.16[l][1] as ”any prehistoric district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places maintained by the Secretary of the Interior.”

1.5.7 State Agencies with Regulatory Authority Over the Priority Projects

1.5.7.1 Public Utility Commission of Texas

As stated in Section 1.2.2, above, the PUC regulates the construction of electric transmission lines in the State of Texas under Texas Administrative Code, Title 16, Part II, Chapter 25, which establishes substantive rule requirements for electric service providers. Specifically, transmission line routing must be conducted in accordance with PUC Substantive Rule 25.101, and factors outlined in the PURA, which indicate that electric lines should be routed to the extent reasonable to moderate the impact on the affected community and landowners unless grid reliability and security dictate otherwise. Specific routing factors considered under the PUC Substantive Rules, PURA 37.056(c), and PUC's interpretation of those statutory provisions and rules are:

- whether the routes utilize existing compatible rights-of-way, including the use of vacant positions on existing multiple-circuit transmission lines;
- whether the routes parallel existing compatible rights-of-way;
- whether the routes parallel property lines or other natural or cultural features;
- whether the routes conform with the policy of prudent avoidance;
- the presence of habitable structures in proximity to the line;[5]
- the engineering constraints on constructing the line; and,
- the cost to construct the line.

1.5.7.2 Texas Commission on Environmental Quality

The Texas Commission on Environmental Quality (TCEQ) administers the Texas Pollutant Discharge Elimination System (TPDES) program, which regulates the discharges of pollutants to Texas surface water (with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas). Under TPDES, when a construction activity disturbs one acre or greater of land, the project proponent (in this case LCRA TSC) must comply with TCEQ's general TPDES permit by preparing and implementing a Storm Water Pollution Prevention Plan (SWPPP). When a construction activity disturbs five acres or greater, the project proponent must notify TCEQ prior to commencement of construction using a Notice of Intent (NOI).

1.5.7.3 Texas Parks and Wildlife Department

Texas Parks and Wildlife Department (TPWD) regulations prohibit the taking, possession, transportation, or sale of any of the animal species designated by State law as endangered or threatened without the issuance of a permit. State laws and regulations prohibit commerce in state-listed plants and the collection of state-listed plant species from public land without a permit issued by TPWD.

[5] For purposes of notice for CCN proceedings for transmission lines greater than 230 kV, an applicant must provide notice to persons from whom an easement would be required and/or any landowners who have habitable structures on their property within 500 feet of a route centerline. For purposes of consideration of habitable structures as part of the routing criteria, the PUC has not determined a particular distance (i.e., "proximity") that would cause structures to be considered. Applicants will report information indicating habitable structure proximity based on PUC application requirements and notice rules which differ for lines above and below 230 kV.

1.6 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

1.6.1 NEPA Scoping Process

Scoping, a process open to the public and conducted early in the project, serves to identify the range or scope of issues to be addressed during the environmental studies and the EA. Public participation is essential for the environmental review process and informed decision making. The public, government entities (Federal, state, tribes, and local), and other interested parties are invited to participate in the scoping process to identify resource management issues of concern, potential effects, possible mitigation measures, and reasonable alternatives to the proposed action.

As described in Section 1.1, above, LCRA TSC was initially tasked by the PUC in 2009 to construct four CREZ priority transmission lines; two of those projects are still under consideration and are addressed in this EA (Twin Buttes–Big Hill [formerly McCamey D] and Big Hill [formerly McCamey D]–Kendall). The other two projects (Kendall–Gillespie and Gillespie–Newton) have since been removed from the CREZ Program and are not addressed in this document. The two cancelled projects were, however, still under consideration during the initial HCP planning process and the NEPA scoping process for the Priority Projects. Thus, the public involvement and agency coordination efforts reported in this section include references to those two transmission lines as well as to the two Priority Projects.

1.6.1.1 Coordination with Federal and State Agencies

The Service and LCRA TSC engaged governmental agencies, elected officials, and the general public in an extensive coordination effort to inform and involve them by soliciting input during the HCP planning process. Table 1.1 identifies the Federal and state agencies and governmental councils contacted during the routing analyses for the four projects, including the Priority Projects.

1.6.1.2 Public Comments Received During the Scoping Process

Five scoping meetings were hosted by the Service during the public scoping process. The meetings were held using an open-house format. At the meetings, the public and interested agencies were given an opportunity to learn about the proposed projects, as they were known at the time, and the contemplated ITP; to discuss regulatory processes and project details with LCRA TSC, project consultants, and proponent representatives; and provide formal written comments or submit verbal comments to a court reporter. LCRA TSC representatives were present to provide an overview of the proposed projects and respond to questions, and Service personnel described the process associated with consideration of the ITP and responded to questions.

Dates and locations of the five public scoping meetings are provided in Table 1.2. A summary of issues identified through verbal and written comments submitted at the public scoping meetings and written comments submitted by mail or e-mail to the Service through 17 June 2010 is provided in Table 1.3. All written comments submitted at the public meetings or directly to the Service, and transcripts of verbal comments provided at the public meetings, are on file with the Service and considered as part of the administrative record for the preparation of this EA.

Table 1.1. Federal and State Agencies and Governmental Councils Solicited by PBS&J on Behalf of LCRA TSC for Comment on the CREZ Transmission Line Projects

Agency/Entity	Twin Buttes–Big Hill	Big Hill–Kendall	Kendall–Gillespie[1]	Gillespie–Newton[1]
Alamo Area Council of Governments	X	X	X	X
Capital Area Council of Governments			X	X
Central Texas Council of Governments			X	X
Federal Aviation Administration	X	X	X	X
Federal Emergency Management Agency	X	X	X	X
Natural Resources Conservation Service	X	X	X	X
Texas Commission on Environmental Quality	X	X	X	X
Texas Department of Transportation	X	X	X	X
Texas Historical Commission	X	X	X	X
Texas Parks and Wildlife Department	X	X	X	X
Texas Water Development Board	X	X	X	X
U.S. Army Corps of Engineers	X	X	X	X
U.S. Environmental Protection Agency	X	X	X	X
U.S. Fish and Wildlife Service	X	X	X	X
Concho Valley Council of Governments	X	X	X	X
Texas Department of Aviation	X	X	X	
City of San Angelo, District Engineer	X	X	X	
City of San Antonio, District Engineer	X	X	X	
City of Austin, District Engineer	X	X	X	

[1] These projects were still under consideration for construction by LCRA TSC during the routing analysis.

Table 1.2. Summary of Public Scoping Meetings

Meeting Date	City	County	Location	Time
19 April 2010	San Angelo	Tom Green	La Quinta Inn and Suites	6:30–8:30 p.m.
21 April 2010	Comfort	Kendall	Comfort Park Pavilion	6:30–8:30 p.m.
22 April 2010	Junction	Kimble	Coke R. Stevenson Memorial Center	6:30–8:30 p.m.
26 April 2010	Lampasas	Lampasas	Holiday House	6:30–8:30 p.m.
27 April 2010	Fredericksburg	Gillespie	Pioneer Pavilion	6:30–8:30 p.m.

Table 1.3. Summary of Issues Raised During the Public Scoping Process

Issue		Issue
Human Environment		Geological and Soil Impacts
Negative impact on economy/tourism		Negative geological impacts
Reduction of property value and holdings		Impacts of soil erosion
Reduction of aesthetic appeal/feeling of open space		Water Resources
Negative impact on hunting		Impact from stream crossings/water quality/wetlands
No benefit to locals		Biological Resources
Adverse impact of public health		Negative impact on environment
Impacts of electromagnetic fields		Habitat fragmentation
Impact on land use		Impact to Mexican free-tailed bat populations
Security concerns		Impact on migrating birds
Property access issues		Increase invasive species
Lines would be too close to homes		Spread of oak wilt
Negative impact on community		Loss of red and gray fox
Cultural Resources		Federal and State Special Status Species
Historical heritage		BCVI

Table 1.3. Summary of Issues Raised During the Public Scoping Process

Impacts to archaeological sites		Bald eagle
Wind Energy		GCWA
Wind energy lacks economic sense[2]		Texas horned lizard
Wind energy is not efficient[2]		Tobusch fishhook cactus
Procedural		Whooping crane
Prefer to develop on existing corridors		Freshwater mussels
Unsatisfied with comment process/meeting structure[2]		Karst invertebrates
Poor environmental assessments (by PBS&J)[2]		Texas snowbells
The need for the transmission line is controversial		Zone-tailed hawk

[2] Consideration of this issue is outside the scope of this EA.

1.6.1.3 Publication of Draft EA

Prior to the Applicant filing its formal application with the Service for an ITP, the scope of the anticipated Covered Activities was reduced significantly. Specifically, what was once to be an application covering take associated with construction, operation, maintenance, and repair of four 345-kV transmission lines, whose routes were unknown and which could touch all or a portion of fourteen counties, became an application for a permit authorizing potential take of listed species in connection with construction, operation, maintenance, and repair of two 345-kV transmission lines and their associated access roads whose routes are known. Additionally, potential species impacts have been reduced substantially. Therefore, a Notice of Availability of the draft EA, draft HCP, permit application, and announcement of public hearings was published in the *Federal Register* on October 24, 2011 (76 FR 65744). Two public hearings on the draft documents were held November 28 and 29, 2011, in the cities of Kerrville and Junction, Texas. The public comment period closed December 23, 2011.

We received seven comment letters: two were from private citizens; two represented local groups; two were from state agencies; and one was from a Federal Agency, the National Park Service, that stated that they had no comments. Appendix A includes all comments and responses to comments and references to sections of the EA and/or HCP where clarifications were made, or responses to the comments are contained. Several comments were made regarding the PUC, their process, or how LCRA TSC proceeded with their application with the PUC. These comments were responded to by LCRA TSC and those comments have been inserted into the table. Additionally, there are several responses by LCRA TSC that are for clarification or corrective purposes. Those too are included in the table.

1.6.2 Connected Actions

For purposes of better organizing and scoping the necessary environmental effects analysis, the Service is required to consider connected actions, cumulative actions, and similar actions (40 CFR 1508.25). In this case, the proposed action is issuance of an ITP to LCRA TSC to authorize take of certain listed species that may result from the Covered Activities.

As set forth in 40 CFR 1508.25, connected actions are actions that are “closely related and therefore should be discussed in the same impact statement.” Actions are considered “connected” if they:

(i) Automatically trigger other actions which may require an EIS.

(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.
(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

Aside from the fact that LCRA TSC must meet Section 10(a)(1)(B) and (2)(A) requirements of the Act for issuance of an ITP, the Service has determined that there are no connected actions to the Priority Projects.

1.7 PERMIT AREA

For purposes of this EA, the Service has defined the "Permit Area" to include the counties traversed by the Priority Project routes. The counties traversed by the approved alignments are Tom Green, Schleicher, Sutton, Kimble, Kerr, Gillespie, and Kendall (Permit Area). The Priority Projects include the designated rights-of-way (ROWs), as well as an area 300 feet on either side of such ROWs within which the Covered Species may experience indirect effects. Since it is possible that some of the resources covered by this EA (e.g., socioeconomic resources) may experience indirect effects at greater distances from the ROW, the Service determined to use the aforementioned counties as the Permit Area. This also has the advantage of making available numerous data sets which are collected at the county level.

1.8 SUPPORTING ENVIRONMENTAL DOCUMENTS

The following resource documents were used to support preparation of this EA:

- Environmental Assessment and Alternative Route Analysis for the Proposed McCamey D to Kendall to Gillespie 345-kV CREZ Transmission Line Project in Schleicher, Sutton, Menard, Kimble, Mason, Gillespie, Kerr, and Kendall counties, Texas (PBS&J 2010a)
- Environmental Assessment and Alternative Route Analysis for the Proposed Twin Buttes–McCamey D 345-kV CREZ Transmission Line Project Tom Green, Irion, and Schleicher counties, Texas (PBS&J 2010b)
- LCRA Transmission Services Corporation Draft Competitive Renewable Energy Zone Transmission Lines Draft Habitat Conservation Plan (SWCA 2011a)

CHAPTER 2
PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

An EA examines the environmental impacts of a proposed major Federal action, the "Proposed Action," where potential impacts to the human environment may be significant (42 USC 4332(C)). In this case, the Proposed Action is issuance of the ITP to LCRA TSC to authorize potential take of the Covered Species that may result from the Covered Activities.

NEPA regulations require, among other things, the examination of all reasonable alternatives to the Proposed Action (Preferred Alternative), including taking no action (40 CFR 1502.14). The No Action alternative in this case demonstrates the consequences of not issuing an ITP to LCRA. With respect to this EA, the Service has analyzed in detail the Preferred Alternative, the Maximum Take Avoidance Alternative, and the No Action Alternative. In addition to describing these three alternatives, this chapter discusses alternatives that were considered, but eliminated from detailed analysis, with an explanation of why the alternatives were not considered further.

2.2 ALTERNATIVE A – ISSUANCE OF SECTION 10(A)(1)(B) PERMIT (PREFERRED ALTERNATIVE)

The Preferred Alternative is issuance of an ITP to LCRA TSC to authorize take of the Covered Species that may result from clearing and other activities associated with construction, operation, maintenance, and repair (both routine and emergency) and associated access roads to the Priority Projects. Both Priority Projects are expected to affect habitat for the BCVI, and the Big Hill–Kendall transmission line is expected to affect habitat for the GCWA.

2.2.1 Description of the FHCP

Along with LCRA TSC's application for an ITP, they prepared and submitted a FHCP, which, among other things, identifies potential impacts to the Covered Species, as well as minimization and mitigation measures that would be implemented by LCRA TSC.

Two groups of species are addressed in the FHCP: "Covered Species" and "Evaluation Species." Covered Species are those for which incidental take authorization is being sought. The Covered Species are the federally listed endangered GCWA and BCVI, since both bird species breed in the region in which the Priority Projects would be built. Evaluation Species are the federally listed, candidate, proposed, recently delisted, and petitioned species known to occur in—or considered by the Service or TPWD as having potential to occur in—one or more counties through which the Priority Projects traverse (Table 3.8). With the implementation of the minimization measures identified in the FHCP, the Covered Activities are not expected to result in take of the Evaluation Species.

Incidental take of the GCWA and BCVI is expressed as the number of acres of known and potential habitat that will be directly and indirectly impacted by Covered Activities, since quantifying the actual number of individuals is impracticable. This approach to take assessment has been uniformly applied by the Service for the Covered Species in numerous contexts. This approach is also supported by case law (*Oregon Natural Resources Council v. Allen*, 476 F.3d

1031, 1037 (9th Cir. 2007) and *Ariz. Cattle Growers' Ass'n v. U.S. Fish and Wildlife Service*, 273 F.3d 1229, 1249-50 (9th Cir. 2001)) where quantifying the actual number of species members taken is not practicable.

Despite the impracticability of identifying the number of GCWAs and BCVIs expected to be taken, an estimate can be made for the number of GCWAs and BCVIs expected to be taken through authorization of this permit. Since we do not know the quality of habitat within or along the ROW, it is impossible to implicitly state a number for each species. However, if you take the average territory size of a GCWA (20-80 acres) and BCVI (1-10 acres) and divide the number of acres authorized to be effected, the result is 14-57 GCWA pairs and 244-2,446 BCVI pairs (Pulich 1976, Graber 1957). It is important to note that the majority of habitat (848 acres for GCWA and 1,902 acres for BCVI) authorized to be affected through permit issuance will actually remain intact and is only expected to be indirectly affected by the Covered Activities. Therefore, the expectation for take of pairs is expected to be on the lower end of the ranges given. Additionally, while LCRA TSC is authorized for incidental take of birds or nest during emergencies that demand the immediate removal of GCWA or BCVI habitat during their breeding seasons this is expected to be a rare occurrence. However, the acreages above include a 10 percent contingency for these types of emergency situations.

2.2.1.1 Estimated Impacts to Covered Species Habitat

As set forth in Sections 4.1 and 4.2 of the FHCP, the maximum number of acres of GCWA and BCVI habitat that would be directly and indirectly affected by the Priority Projects is provided below. See section 4.7.3.1.1.2 below for the methods used to derive these estimates.

- GCWA
  - Acres directly affected: 298.0 acres
  - Acres indirectly affected: 848.0 acres
  - Total acres of GCWA habitat affected: 1,146.0 acres
- BCVI
  - Acres directly affected: 544.4 acres
  - Acres indirectly affected: 1,902.1 acres
  - Total acres of BCVI habitat affected: 2,446.5 acres

The amount of incidental take authorized by the requested ITP would be based on these estimates. As noted below, however, during final design and construction, LCRA TSC may make additional reasonable efforts to further minimize impacts and will prepare and submit a final preconstruction impact assessment to the Service for its concurrence. Based on this final assessment, LCRA TSC will mitigate for the full amount of actual direct and indirect impacts.

2.2.1.2 Avoidance, Minimization, and Mitigation Measures for Covered Species Impacts

The FHCP identifies several general and species-specific measures intended to minimize and/or avoid impacts of the proposed taking of the Covered Species. The minimization measures that would be incorporated into the Priority Projects for the benefit of the Covered Species are summarized in Section 5.3 of the FHCP and Section 4.7.3 below.

LCRA TSC will provide compensatory mitigation for impacts to Covered Species habitat prior to undertaking activities impacting habitat by providing for the permanent preservation and management of Covered Species habitat. In its FHCP, LCRA TSC has identified two alternatives for achieving this off-site preservation: 1) purchase of a number of conservation credits from a Service-approved species conservation bank equal to the acres of mitigation proposed for each of the respective Covered Species; or 2) provide funds to a Service-approved third-party entity, sufficient to enable such entity to acquire and preserve, in perpetuity, the proposed acres of mitigation prior to any incidental take. With respect to the second alternative, any such third party entity would be required to implement a Covered Species management plan approved, in advance, by the Service.

After applying mitigation ratios for direct and indirect effects, the FHCP estimates that the following number of conservation credits (normally one credit is equal to one acre of habitat) would be required to offset the maximum number of acres of GCWA and BCVI habitat that could be directly and indirectly impacted by the Priority Projects:

- GCWA – 1,318 conservation credits
- BCVI – 2,584.3 conservation credits

Mitigation funding will be assured prior to the occurrence of any authorized take. The Applicant is financially capable of ensuring proper planning, management, and completion of the mitigation proposal described in the FHCP. Compensatory mitigation for the Covered Species, or a guarantee of such payment (i.e., stand-by letter of credit), will be provided in full before any clearing of woody vegetation occurs within 300 feet of areas identified as known or potential habitat for these species. Such funds, if provided to a conservation entity, would be required to be used for acquisition of habitat prior to the occurrence of any take authorized under the Permit.

2.2.1.3 Changed Circumstances

Changed circumstances that can reasonably be anticipated by the Service and the Applicant, and which are planned for in the FHCP, are: 1) Covered Species habitat needing to be cleared during the breeding season because of tight project schedules and delays caused by extended periods of wet weather, problems with contractors or equipment, etc.; 2) a species covered by the FHCP becomes delisted because it is considered recovered; 3) the bald eagle becomes re-listed or another species becomes listed; and 4) an emergency requires LCRA TSC to clear Covered Species habitat without providing prior notification to the Service. These changed circumstances are described in Section 5.6.5.1 of the FHCP.

In the event that the clearing of potential Covered Species habitat must be performed during the breeding season for the respective species, LCRA TSC will first provide the Service with a pre-clearing notification of its need to perform the clearing activity. Before any clearing occurs, LCRA TSC will implement—with Service concurrence—the impact minimization measures described in Section 5.6.5.1 of the FHCP. These measures are too extensive to repeat here but involve a regime of daily monitoring and surveys, the results of which will dictate when and where clearing may occur.

LCRA TSC has added a 10 percent contingency to the amount of Covered Species habitat expected to be directly and indirectly impacted through clearing of the transmission line ROW to account for direct and indirect habitat impacts expected to be caused by the clearing of habitat in response to emergencies and other potential sources of take that cannot be quantified at this time (e.g., clearing for access roads). Whenever possible, LCRA TSC will in an emergency situation have a qualified biologist search the habitat needing to be cleared to verify that no active nests of the Covered Species are present in the area. For emergencies that demand the immediate removal of habitat, LCRA TSC will submit to the Service a report on the clearing of habitat within 14 days of performance of the activity. The report will identify for Service concurrence the number of acres of habitat that were cleared directly, and the number of acres of habitat expected to be indirectly impacted by the clearing activity. LCRA TSC will assume presence of active nests at such sites and will mitigate for the taking at a ratio of 4.5:1.

In addition to mitigating for expected loss of habitat, LCRA TSC is proposing to acquire a "bank" of mitigation credits that would be held in reserve to compensate for unanticipated direct impacts should they occur (for example, if a tower collapsed onto habitat or construction activities had to be performed when one or both species were present in the area, and a bird or occupied nest were inadvertently harmed as a result, or in the unlikely event that a GCWA or BCVI were to collide with a transmission line. These credits would be allocated on a case-by-case basis in coordination with the Service, with expectation that mitigation for actual loss of birds would be provided at a ratio of 4.5:1 (1.5 times the 3:1 ratio for direct impacts to habitat). All events that could result in the unanticipated direct impact of habitat for Covered Species are expected to occur rarely if at all. The "bank" of mitigation credits to be allocated in the event they are needed to compensate for unanticipated direct impacts will be established through the previously described (see Section 2.2.1.2) application of a 10 percent contingency to the number of acres of habitat expected to be directly and indirectly impacted as a result of clearing of the Priority Project ROWs. As discussed, these contingency credits would also be used to compensate for habitat directly and indirectly impacted by construction of access roads.

If, following construction, an active bald eagle nest is found to occur within 1.3 miles of Priority Project transmission line, LCRA TSC will mark all sections of the transmission line that lie within 1.3 miles of the eagle nest site that were not marked previously during the construction process as described in the FHCP. The transmission line will be marked using traditional marker balls, spiral vibration dampeners, or air flow spoilers. Markers will be placed on the shield wire with a spacing dependent on the type of marker used. These markers will subsequently be inspected and replaced as necessary as part of routine maintenance.

If a pair of bald eagles builds a nest on a Priority Project transmission line structure, LCRA TSC will promptly notify the Service upon discovery of the nest. If not already marked, LCRA TSC would then mark all sections of the transmission line within 1.3 miles of the nest site as described above. This marking would be performed following the conclusion of the breeding season in which the nest was discovered and before commencement of the next breeding season.

It is possible that a maintenance vehicle traveling a transmission line ROW could ignite a wildfire through contact between the catalytic converter of the vehicle and the underlying grass. It is also possible that a transmission line could break, or otherwise spark and ignite a wildfire.

In either event, such a wildfire could spread and destroy habitat for the GCWA or BCVI outside of the ROW for the Priority Projects. LCRA TSC and its contractors have emergency response plans, which includes preventative measures to reduce the chances of fires while performing construction or maintenance activities, including but not limited to, requirements for firefighting equipment, chain of communication, and prohibitions on smoking in work areas. These plans also include steps for responding to such an event (Irby Construction 2011). While these plans reduce the likelihood of wildfires, they cannot completely eliminate the risk of wildfire. LCRA TSC is not seeking to cover such habitat fire damage under its ITP. LCRA TSC will to the extent allowed by its control of land damaged by fire, allow any habitat for the Covered Species that is damaged by fire to regenerate in burned areas. LCRA TSC will promptly report to the Service any fires generated by performance of the Covered Activities.

It is conceivable, though unlikely, that LCRA TSC vegetation clearing activities will allow oak wilt to spread from its ROW. LCRA TSC is not seeking to cover damage to Covered Species habitat from oak wilt under its Permit. LCRA TSC gains easements but does not own the land contained within its transmission line ROW. As a result, even if LCRA TSC wanted to, it does not have the requisite property rights to employ the larger-scale measures that are typically employed to stop the spread of oak wilt, such as, trenching, vibratory plowing or chemical root disruption. LCRA TSC will adhere to its corporate Oak Wilt Prevention Policy (LCRA 2006), which is based on Texas Forest Service oak wilt guidelines, when undertaking any covered activities that have potential to impact oak trees.

2.2.2 Description of the Priority Projects

The Priority Projects consist of construction, operation, maintenance, and repair (both routine and emergency) and associated access roads of the Twin Buttes–Big Hill and Big Hill–Kendall transmission projects. Both Priority Projects would consist of new, bundled-conductor, 345-kV transmission wires, strung primarily on double-circuit-capable lattice or pole structures[6] as determined by the PUC. More detailed information on the transmission wires and supporting structures is provided in Section 2.2.3, below. Both lines are expected to be contained in ROWs cleared to a width of 100 to 160 feet. Typical methods that would be used to construct these transmission lines are described in Section 2.2.2. Construction schedules are provided in Section 2.2.5. Expected maintenance and repair activities and maintenance schedules are described in Section 2.2.6.

2.2.2.1 Twin Buttes–Big Hill Transmission Line

The Twin Buttes–Big Hill transmission line would connect the existing Twin Buttes Substation, located in northwestern Tom Green County, to the Big Hill Substation, to be located in northern Schleicher County. The Twin Buttes–Big Hill transmission line will be located in portions of Tom Green and Schleicher counties. Length of the transmission line will be approximately 38 miles. The route selected for this transmission line is shown on Figure 2.1.

[6] A single-circuit line, also called a three-phase line, consists of three electrical wires (conductors), while a double-circuit line consists of two sets of three conductors, or six conductors total. A double-circuit-capable structure has the capacity to support a double-circuit transmission line. If such structures are initially strung with only a single-circuit, the resulting transmission line is called a “single-circuit, double-circuit-capable” line.

The northernmost approximately 7 miles of this route lies directly adjacent to an existing overhead transmission line. LCRA TSC plans initially to install a single 345-kV circuit on double-circuit-capable structures, and install a second 345-kV circuit when necessary.
As indicated on Figure 2.1, the transmission line will travel largely in a north-south direction to the west and southwest of the City of San Angelo and will cross westernmost Tom Green County and a portion of north-central Schleicher County. This transmission line will cross the Middle Concho River, Spring Creek, and Dove Creek to the west of San Angelo; all three water bodies drain into Twin Buttes Reservoir. The route lies approximately 6 miles west of O.C. Fisher Reservoir and approximately 2.75 miles west of Twin Buttes Reservoir.

The route selected for the Twin Buttes–Big Hill transmission line was approved by the PUC in part because it was agreed to by all landowners who formally involved themselves in the PUC's decision-making process (interveners), and because relatively few (four) habitable structures are located within 500 feet of the ROW centerline. In addition, relative to the eight alternatives evaluated by PBS&J (2010b), the approved route:

- Is among the shortest, resulting in the least disturbance of soil, vegetation, and wildlife.
- Crosses the fewest number of streams; least amount of bottomland riparian wetlands; no known *occupied* habitat for endangered species; and among the least amount of grazing land/rangeland that support native wildlife.
- Crosses more floodplain already converted to farmland or otherwise developed.
- Fragments fewer large blocks of existing upland vegetation and wildlife habitat.
- Adversely impacts the least amount of intact woodland/scrub in the vicinity of Dove Creek, which could contain potential habitat for the BCVI.

2.2.2.2 Big Hill–Kendall Transmission Line

The Big Hill–Kendall transmission line will be a double-circuit 345-kV line connecting the proposed Big Hill Substation to the existing LCRA TSC Kendall Substation. The Kendall Substation is located on Flat Rock Creek Road to the northeast of the City of Comfort in western Kendall County, to the east of Interstate Highway 10 (I-10), and approximately one mile north of the Guadalupe River.

LCRA TSC will install both circuits on this transmission line as it is constructed. By default, the end points of this transmission line will be located in Schleicher and Kendall counties. Between those points it will cross through portions of Sutton, Kimble, Gillespie, and Kerr counties. This transmission line will be approximately 140 miles long. Sixty possible routes for the Big Hill–Kendall transmission line were evaluated by LCRA TSC and PBS&J (2010a). The route ultimately selected by the PUC for this transmission line is shown in Figure 2.2. The alignment for this transmission line originates at the Big Hill Substation in Schleicher County. The route proceeds south, southeast out of the Big Hill Substation diagonally through Schleicher County, passes through the northeast corner of Sutton County, enters the northwest corner of Kimble County, and proceeds for a short distance until it reaches Ranch Road (RR) 1674, follows RR 1674 south until it reaches I-10, then parallels I-10 for most of the rest of the route, passing through the towns of Junction and Kerrville until just before it reaches the Kendall Substation near the town of Comfort, Texas, at which point it leaves I-10 traversing approximately 2 miles cross-country to the Kendall Substation.

2.2.3 Description of Transmission Lines and Support Structures

The proposed 345-kV transmission lines will consist of two types of wires: conductors, which conduct the electricity, and shield wires, which protect the conductors from lightning strikes. The conductors will be suspended below the shield wires and consist of large-diameter, bundled (i.e., two lines per phase spaced 18 inches apart) wires. Shield wires will be smaller in diameter and strung in the uppermost (i.e., highest) position. The configuration of the conductor and shield wires will provide adequate clearance for operation at 345-kV, considering icing and wind conditions. All transmission lines will be designed to meet or exceed the electrical clearances specified by the National Electrical Safety Code (NESC) and with an appropriate clearance distance to vegetation based on North American Electric Reliability Corporation (NERC) Standard FAC-003-1.

The style of structures to be used for the Priority Projects is determined by the PUC, with its selections based on a variety of factors, including cost, safety, and reliability. To support the wires, LCRA TSC intends to use 345-kV double-circuit lattice towers for typical tangent, angle, and dead-end structures. LCRA TSC may also use support structures other than lattice towers, including tubular poles, tower poles, and spun-concrete poles for tangents; tubular poles for angles; and twin-tubular poles for dead-ends (i.e., one tubular pole per circuit, thus two tubular poles for double-circuit dead-ends). LCRA TSC may also use structure types other than lattice towers in limited locations (for example, use tubular poles for short and low-tension spans located in close proximity to a line terminal). Regardless of which type, all of these structure types are capable of being constructed, operated, and maintained within a 100- to 160-foot-wide ROW (PBS&J 2010a, 2010b). The supporting structures are expected to range from 120 to 180 feet tall and will be spaced at an average frequency of 4 to 6 structures per mile. Average base dimensions of lattice towers are expected to be 625 square feet for tangent structures and 900 square feet for angle structures.

2.2.4 Construction Methodologies

Construction of transmission lines involves vegetation clearing, access road construction, installation of footings, structure assembly, erection of towers, stringing of conductor and shield wire, and, finally, site restoration/cleanup. LCRA TSC anticipates using contractors to perform these tasks for the Priority Projects (E. Huebner/LCRA TSC pers. comm. to SWCA on 21 Sept. 2010). A general description of each of the construction steps is provided below. This information was adapted from PBS&J (2010a, 2010b).

2.2.4.1 Right-of-Way Preparation

LCRA TSC typically clears a transmission line ROW of trees and brush only to the extent needed to provide access and ensure safe operation of the line. Methods used for vegetation clearing are devised to take into account soil stability, prevention of silt deposition in water courses, and practical measures for the protection of natural vegetation and adjacent resources (e.g., wildlife habitat). For the Priority Projects, a flail mower or similar equipment may be used to clear ROW instead of bulldozers with dirt blades, where such use would preserve the cover crop of grass, low-growing brush, and similar vegetation. Grading is typically not performed except if needed at structure locations or set-up sites; however, if grading is necessary, it is performed in a manner that minimizes potential for erosion and conforms to local topography.

Figure 2.1. PUC-approved route for the Twin Buttes–Big Hill transmission line.

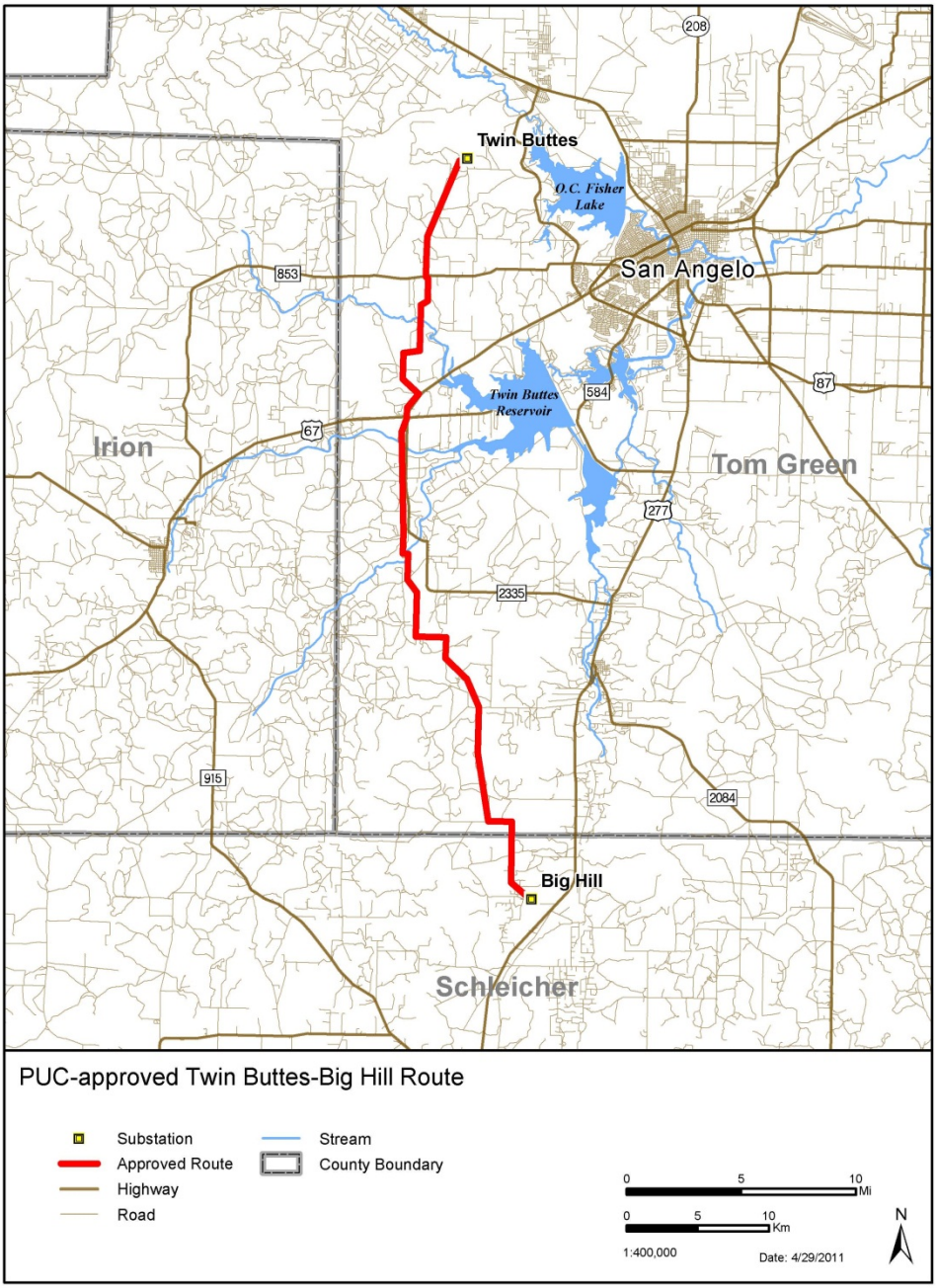

Figure 2.1. PUC-approved route for the Twin Buttes-Big Hill transmission line.

Figure 2.2. PUC-approved route for the Big Hill–Kendall transmission line.

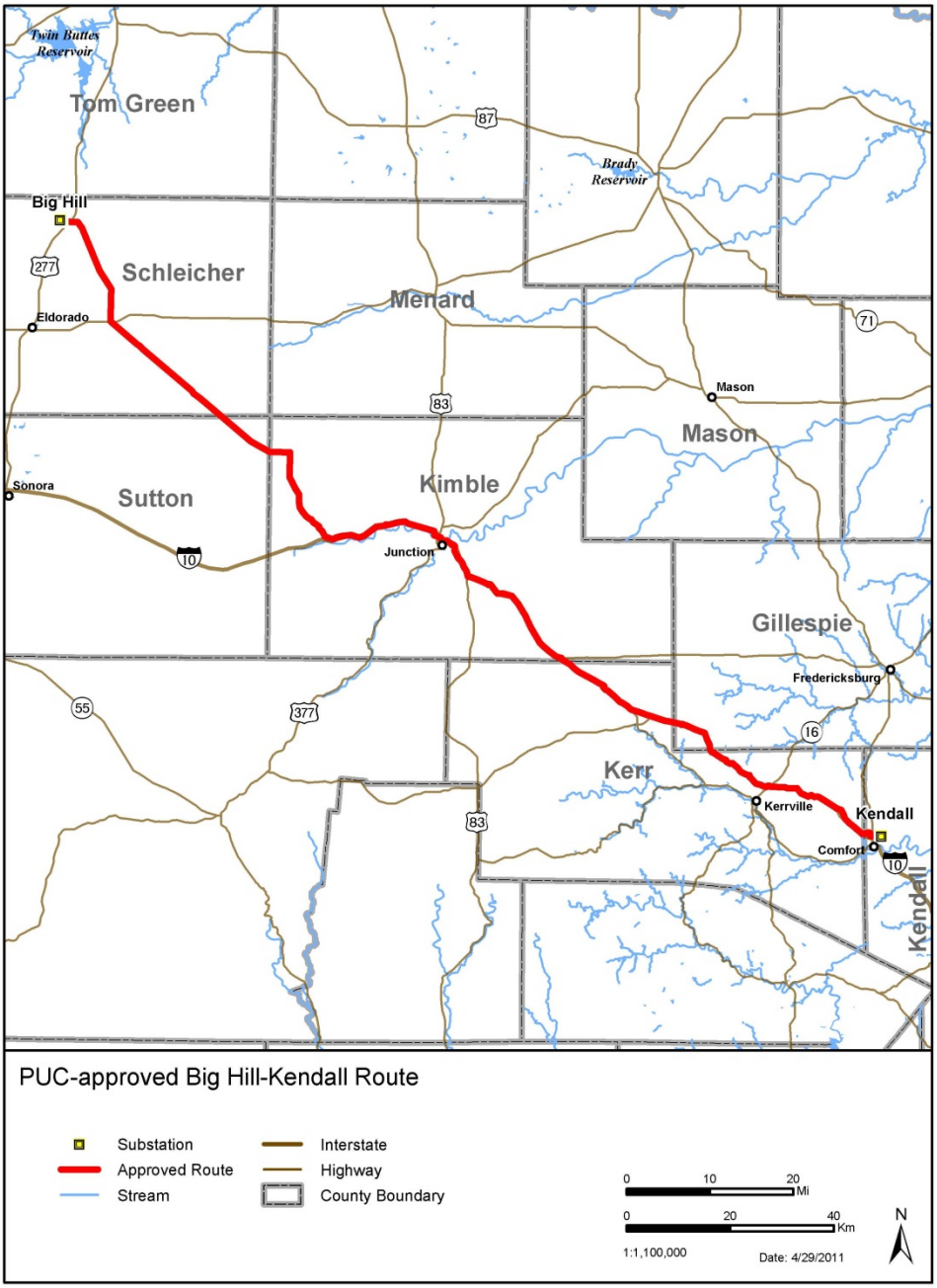

Figure 2.2. PUC-approved route for the Big Hill-Kendalll transmission line.

No vegetation is removed from a ROW until after a SWPPP has been prepared and a Notice of Intent has been submitted to the TCEQ.

The ROW provides the primary vehicular access to a transmission line alignment during construction operations. Because a new ROW may cross lands where no roads existed previously, creating a new ROW often requires the installation or repair of fences and installation of gates. In areas with rugged topography or at stream and river crossings, limited ingress and egress through private property is often negotiated to reduce construction-related impacts.

Such ingress and egress can include the use of private roads but may require the construction of new access roads outside of the ROW. LCRA TSC may install at-grade or culverted vehicular crossings at ephemeral or intermittent streams. For creeks in which culverts are not used, crossings may be facilitated through addition of clean rock or cobble to creek bottoms to ensure stability in wet weather.

During the construction phase, a two-track road typically develops from vehicle use in flatter portions of the ROW, while an actual road may be constructed within the ROW in more rugged areas. Constructed roads are provided with erosion-control measures, such as side drainage ditches and culverts in accordance with the SWPPP. Roads are stabilized if constructed on steep slopes. These service roads are rarely maintained after construction ends, but are used for accessing the line for maintenance and repair purposes, and may also be used by landowners and their assigns (e.g., hunters). If used with some regularity, these roads persist through time. If not, these roads typically revegetate naturally.

2.2.4.2 Structure Assembly and Erection

Transmission line structures are provided with concrete foundations. Structure locations are first staked or otherwise marked, and soil testing is then performed to inform foundation design. Foundations are installed by construction crews. After the concrete has cured, crews erect the structures and install conductor and shield wire suspension assemblies. Equipment used to erect structures typically includes trucks and cranes. Conductor suspension assemblies include porcelain and/or polymer insulators. Each structure is also grounded, either through use of an external ground rod or other standard grounding methods. In some areas, structures are provided with avian-perch deterrents above suspension assemblies.

2.2.4.3 Conductor and Shield Wire Installation

Conductors and shield wires are installed via a tensioning system. Tensioning systems typically use ropes threaded through stringing blocks or dollies for each conductor and shield wire. Conductor and shield wires are pulled by the ropes and held tight by a tensioner to prevent the wires from being damaged by contact with the ground and other objects.

During the stringing process, guard structures (temporary wood-pole structures) are installed where the transmission line crosses roads or over other overhead utility lines, or any other areas where an additional margin of safety is deemed prudent during wire installation. After the wire is tensioned to the required sag, the wire is taken out of the stringing blocks and attached to the suspension assembly.

2.2.4.4 Cleanup

Cleanup operations are performed concurrent with, and after completion of, the transmission line construction process. These operations involve removal of debris, stabilization and revegetation of disturbed areas, and restoration of any items damaged during construction, such as fences, gates, cattle guards, private and public roads, culverts, and crops.

Construction equipment, materials, and supplies are dismantled as needed and removed from the ROW when construction is complete. Construction waste, with the possible exception of cut vegetation, is removed prior to completion of the project. Cut vegetation may be mulched, in which case it may be spread out over the ROW. Mulch may also be given to the landowner or to a local nursery as a product for beneficial use, or picked up and taken to a landfill. Cut vegetation is not typically burned, although burning may be used to dispose of vegetation if no other practical alternative exists.

Any soil excavated during construction and not used is evenly backfilled onto a cleared area and spread to conform to local terrain, or is removed from the site. Any soil replaced adjacent to water crossings is placed on a slope less than the normal angle of repose for that soil type. During this phase, any temporary roads are removed and original contours are restored and revegetated as required by the SWPPP. If natural revegetation is considered incapable of providing ground cover in a reasonable length of time, or if proactive measures are required to control erosion or invasive species, seeding, sprigging, or hydro-seeding may be used in restored areas to encourage growth of ecologically desirable grasses and other vegetation. If site-specific factors make it unusually difficult to establish a protective vegetative cover, other restoration procedures, such as the use of gravel, rocks, or concrete, may be used to prevent erosion. Unless otherwise agreed to or requested by the landowner, each affected landowner's property is returned to original contours and grades, except to the extent necessary to establish and maintain appropriate ROW and access to the transmission line.

2.2.5 Construction Schedules

Construction schedules are contingent upon many variables including weather, topography, geology, real estate negotiations, access, seasonal endangered species restrictions, etc. The PUC is requiring LCRA TSC to have the approved Priority Projects built and operational by the winter of 2013.

Typically, LCRA TSC clears the entire length of ROW for a new transmission line prior to erecting the structures and stringing the conductor and shield wire. On average, crews may spend one–three days for clearing/clean-up of a half-mile segment of ROW (note: this depends on machinery used, type of vegetation, topography, soil/geology type, etc.). For shield wire/conductor stringing, which includes stringing, tensioning, checking sag, and clipping in, a crew may spend, on average, about one week per half-mile of line. Time between clearing, structure construction, and stringing can depend on access and crew size. These activities are expected to be consecutive and continuous, but can change due to unforeseen circumstances as mentioned above (LCRA 2010b).

For the Priority Projects, LCRA TSC and its construction contractors may work six to seven days per week. During hunting season, LCRA TSC often observes landowners’ requests and may

restrict construction activities to weekdays during the respective hunting season, or to periods agreed upon by both parties (LCRA 2010b).

2.2.6 Maintenance and Repair

The maintenance and repair activities that could be performed in Priority Project ROW are listed below.

Manual clearing of vegetation	Gate repair	Structure replacement
Application of herbicides	Line replacement	Insulator repair/replacement
Access road repair	Line tensioning	Installation of bird diverters
Fence repair	Structure repair	Mowing / shredding

LCRA TSC performs periodic inspection of transmission line ROW, structures, and wire to ensure safety and reliability of its transmission lines. Inspections are typically performed by driving the ROW, although aerial inspections are also sometimes performed. Inspections include searches for soil erosion problems and fallen timber, and observation of the condition of vegetation. As an erosion-control measure, native shrubs, forbs, or grasses may be planted where deemed necessary.

The primary ROW maintenance activity is the removal of trees and other woody vegetation that poses a potential danger to conductor wires or structures, or prohibits access. Native vegetation of value to wildlife that does not impair access or endanger the safe operation and maintenance of a transmission line is typically allowed to grow in the ROW. Herbicides are not typically used for vegetation maintenance purposes. However, if used, only EPA-approved herbicides will be used, and they will be applied carefully to minimize effects on desirable indigenous plant life (SWCA 2010).

It may be necessary to replace transmission line structures during the life of the ITP. Maintenance inspection intervals for the Priority Projects will be established by LCRA TSC. Typically, ROW inspections are performed at a frequency of once every three years. Routine maintenance activities are performed when access roads are firm or dry.

2.3 ALTERNATIVE B – MAXIMUM TAKE AVOIDANCE

One of the alternatives considered by LCRA TSC was employing measures to minimize potential impacts to the Covered Species to the greatest extent practical while still constructing the Priority Projects. The routes followed under the Maximum Take Avoidance alternative would be the same as under the Preferred Alternative. To avoid take to the maximum extent possible LCRA TSC would implement the following measures:

- Restrict all clearing and construction to times when the Covered Species are not present on their breeding grounds to avoid the potential for such activities to directly impact the birds or their eggs and nests;
- Avoid to the maximum extent practicable clearing of ROW in all Covered Species habitat; and
- String conduit via helicopter to minimize the amount of Covered Species habitat that would need to be cleared within the ROW to allow vehicle access.

By utilizing these measures, LCRA TSC estimated that impacts to potential habitat would be reduced from 1,146.0 acres to 881.2 acres of potential GCWA habitat, and from 2,446.5 acres to 1,852.8 acres of potential BCVI habitat. Because Covered Species habitat would be removed only from support structure sites and access roads (and not from ROW), only about 80 acres of GCWA habitat and 154 acres of BCVI habitat would be directly impacted, and this loss would occur in hundreds of small, widely separated patches spread over 178 miles.

The reduced level of habitat impacts under this alternative would result in a concomitant reduction in mitigation for the Covered Species and in increased costs and safety and reliability concerns for LCRA TSC due to uncleared ROW. Increased costs include the need for taller and more expensive support structures to allow sufficient distance between vegetation in the ROW and conductors to meet industry standards. Uncleared ROW also increases the risk of fire and service disruption due to accidents and impeded access for repairs.

2.4 ALTERNATIVE C – NO ACTION

Under the No Action alternative LCRA TSC would not apply for and the Service would not issue an ITP. LCRA TSC examined whether it was possible to construct transmission lines along the routes selected by the PUC without violating Section 9 of the Act. However, potential Covered Species habitat occurs along the alignments for both Priority Projects. Therefore, this alternative would be similar to the Maximum Take Avoidance alternative in that LCRA TSC would still implement the following measures:

- Restrict all clearing and construction to times when the Covered Species are not present on their breeding grounds to avoid the potential for such activities to directly impact the birds or their eggs and nests;
- Avoid to the maximum extent practicable clearing of ROW in all Covered Species habitat; and
- String conduit via helicopter to minimize the amount of Covered Species habitat that would need to be cleared within the ROW to allow vehicle access.

However, impacts to Covered Species habitat would still occur, but without an ITP. Based on discussions with LCRA and the fact that LCRA TSC has been formally required by the PUC to construct these new transmission lines through a Final Order issued on 30 March 2009 (PUC Docket No. 35665, Interchange Item 1324) it is likely that the Priority Projects will go forward whether they have a permit or not. However, the No Action alternative would not include mitigation measures to benefit the Covered Species.

2.5 ALTERNATIVES ELIMINATED FROM FURTHER ANALYSIS

2.5.1 Alternative Transmission Line Routes

As discussed in greater detail in Sections 1.3.2.3 and 3.1 of the FHCP, the PUC regulates the construction of electric transmission lines in the State of Texas under Texas Administrative Code, Title 16, Part II, Chapter 25. Construction of a new electric transmission line by LCRA TSC or any electrical utility provider must first be approved by the PUC. Now that the final routes have been selected by the PUC, LCRA TSC is required to construct the transmission lines along those approved routes. Only under a highly restrictive set of guidelines may LCRA TSC

shift small portions of the PUC-selected route (i.e., make minor route adjustments)—and any such minor route adjustments must not engender cost increases or introduce other impacts not considered by the PUC. Thus, the Priority Projects must either be built in the PUC-mandated corridors or not be built at all. Because the Service has no legal authority or discretion to implement alternative routes for the Priority Projects, alternative actions involving alternative routes are neither reasonable nor feasible. Therefore, alternative actions involving alternative routes will not be carried forward for further analysis in this EA.

2.5.2 Underground Transmission Lines

Underground facilities may offer certain advantages compared to overhead transmission facilities. For example, they may eliminate some visual impacts associated with overhead lines and transmission towers; thus, may be considered more aesthetically pleasing, although underground transmission lines still require clearing of ROW in order to construct the underground facility. Underground lines also reduce damage and subsequent power outages due to high winds, ice storms, falling trees, and animal interference with transmission equipment. Maintenance costs for ROWs are also lower for underground systems (Hall 2009). However, underground facilities also suffer from numerous and serious disadvantages, which make them inadvisable for use as important bulk power and/or special purpose transmission lines such as the 345-kV CREZ Priority Projects. In addition, underground facilities for large 345-kV lines require periodic surface facilities consisting of relatively large substation-like footprints. Typical construction of high-voltage, double-circuit transmission lines requires excavation of a continuous trench between endpoints and construction of a tunnel large enough to admit workers. This results in major ground disturbance along the entire length of ROW and little opportunity for habitat avoidance and minimization measures. Underground transmission facilities also entail substantially higher construction and repair costs, as well as typically longer power outages should they occur (Hall 2009). Studies summarized by Hall (2009) show that, compared to overhead systems:

- Underground facilities are up to 10 times more expensive to construct, with higher material costs, labor costs, and longer installation timeframes.
- Underground facilities have more complex operational needs; visual inspection is impossible, making the lines more costly to maintain and repair.
- Damage to underground facilities typically takes longer to locate and longer to repair, thus outages are typically longer.
- Underground facilities are subject to damage from digging in the ROW by landowners and others.
- Underground cables have poor heat-dissipation qualities and heat can cause damage to the cables.
- Underground facilities have a shorter life span; typically 40 percent shorter.
- Facility replacement costs are higher.

Therefore, placing the transmission lines underground was not considered a viable alternative by LCRA TSC or the PUC for two primary reasons. First, the initial CREZ Transmission Optimization Study conducted by the Electric Reliability Council of Texas (ERCOT) assumed overhead lines, which is the industry norm for high-voltage transmission lines due to the reasons listed above. Second, the cost of building transmission lines underground, particularly 345-kV

transmission lines, is much higher than that of overhead lines, greatly increasing the cost of electrical power for the end user. The PUC did consider a specific application of underground systems to address certain localized constraints during at least one CCN review process (Big Hill–Kendall, then referred to as McCamey D–Kendall) and rejected it due to cost.

2.5.3 Individual Section 10(a)(1)(B) Permits

Individual Section 10(a)(1)(B) permits for each of the Priority Projects was considered. This alternative held the benefit of perhaps gaining Service approval for one of the Priority Projects if gaining approval for the other project proved problematic. However, this approach is inefficient. While not necessarily doubling the effort it would take to obtain one permit covering both projects, seeking two individual permits would greatly increase the amount of work required by the Service and LCRA TSC to achieve the same results expected to be gained by covering both projects under one permit. Preparation of habitat conservation plans that must accompany any application for an incidental take permit is an expensive endeavor, requiring many hours of biological and legal review and drafting, and Service resources to review such plans are limited. While information contained in separate habitat conservation plans would likely be similar, the Service would still be required to review thoroughly each habitat conservation plan.

2.6 SUMMARY OF POTENTIAL IMPACTS

Table 2.1 summarizes the potential direct and indirect impacts to the human environment of implementing each of the three alternatives. These potential impacts are analyzed in detail in Chapter 4 of this document. Chapter 4 also provides definitions of the terms used in this table; for example, “negligible, minor, moderate, and major.” For a discussion of cumulative and unavoidable impacts, as well as irretrievable commitments of resources, see Chapter 5.

Table 2.1. Summary of Environmental Consequences for Alternative A (Preferred Alternative), Alternative B (Maximum Take Avoidance), and Alternative C (No Action).

Impact Topic	Alternative A (Preferred Alternative)	Alternative B (Maximum Take Avoidance)	Alternative C (No Action)
Visual and Aesthetic Qualities	Construction of the Priority Projects is expected to result in long-term, adverse, and minor to major impacts to the visual and aesthetic quality of the region. Temporary impacts would include views of clearing and cleanup activities in the ROW, assembly and erection of the support structures (towers), and stringing of the wires. Permanent impacts would include foreground, middle ground, and background views of the transmission lines and their structures, and more limited views of the cleared ROS. Beneficial impacts would include the establishment of permanent woodland and shrubland preserves that would retain their aesthetic integrity over the long term.	Visual impacts would be similar to those of the Preferred Alternative, except less woodland and shrubland vegetation would be cleared from the ROW, reducing the visual impact of the ROW. Approximately half the acres of woodland and shrubland would be preserved compared to the Preferred Alternative.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefits to visual and aesthetic resources of establishing preserves will likely not be realized.
Climate and Climate Change	Project emissions may contribute to the cumulative effect of all global greenhouse gas emissions on climate change; however, it is not currently feasible to quantify the effects of individual projects on climate change. If climate change occurs and hotter- and drier-than-normal conditions become more typical in the future, the threat of wildfire damage to facilities, including the Priority Projects, would increase.	Impacts on climate and climate change would be substantially the same as under the Preferred Alternative. If hotter- and drier-than-normal conditions become more typical in the future, the threat of wildfire damage to the Priority Projects would be somewhat higher than under Alternative A because less woody vegetation (potential fuels) would be removed from the ROW.	Impacts on climate and climate change and the potential impact of climate change on the Priority Projects would be substantially the same as under Alternative B.
Air Quality	Emissions from construction, maintenance, and repair of the Priority Projects could have negligible adverse, short-term impacts to air quality in the Permit Area.	Impacts would be similar to those of the Preferred Alternative. Pollutants emitted by the extensive use of helicopters are expected to be offset by the reduced use of construction vehicles and vegetation clearing equipment.	Impacts would be similar to those of Alternative B.
Soils and Geology	Construction of the Priority Projects could result in minor, adverse, short-term impacts to soils, including prime farmland. Minor adverse impacts are expected to other geological resources of the Permit Areas. Soils and geological resources on preserves established for the Covered Species would be protected from the impacts of development.	Impacts would be similar to those of the Preferred Alternative, except more vegetation would be left intact in the ROW to anchor soil, decreasing the potential for soil erosion. Less soil would be protected in preserves from the potential effects of development.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established.

Table 2.1. Summary of Environmental Consequences for Alternative A (Preferred Alternative), Alternative B (Maximum Take Avoidance), and Alternative C (No Action).

Impact Topic	Alternative A (Preferred Alternative)	Alternative B (Maximum Take Avoidance)	Alternative C (No Action)
Water Resources	Disturbance from construction of the Priority Projects could result in negligible to minor, adverse, short-term impacts to surface water, wetlands, floodplains, and groundwater. Over the long term, impacts would be negligible. Water resources on preserves established for the Covered Species would be protected from the impacts of development.	Impacts would be similar to those of the Preferred Alternative, except the potential for siltation would be reduced because the potential for soil erosion would be reduced. The potential for protecting water resources in preserves would be reduced.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefits to water resources of establishing preserves may not be realized.
Vegetation	Construction of the Priority Projects could result in the disturbance or removal of up to an estimated 3,452 acres of vegetation over approximately 178 miles. This would result in moderate, direct, adverse, short- and long-term impacts within the Permit Area. The potential for adverse impacts would be offset and reduced by the woodland and shrubland mitigation preserves proposed for the Covered Species.	Impacts would be similar to those of the Proposed Action, except approximately 608 fewer acres of vegetation would be disturbed or removed. Less vegetation would be protected in preserves, which would be approximately one-half the size as under the Proposed Action.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefits to vegetation of establishing preserves may not be realized.
General Wildlife	The disturbance of up to an estimated 3,452 acres of wildlife habitat over approximately 178 miles would result in moderate, direct and indirect, short- and long-term impacts to wildlife habitat. The potential for adverse impacts would be offset and reduced by the mitigation preserves proposed for the Covered Species.	Impacts would be similar to those of the Proposed Action, except approximately 608 fewer acres of wildlife habitat would be disturbed or removed. Less wildlife habitat would be protected in preserves, which would be approximately one-half the size as under the Proposed Action.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefits to wildlife of establishing preserves may not be realized.
GCWA	The estimated direct and indirect disturbance of up to 1,318.0 acres of potential GCWA habitat would result in minor, primarily indirect, adverse short- and long-term impacts to the species. Adverse impacts would be offset by the establishment of up to 1,026.7 conservation credits[1] in permanent woodland preserves. The preserves could contribute to the long-term conservation of the species.	Impacts would be similar to those of the Proposed Action, except less potential GCWA habitat would be directly and indirectly affected (up to 881.2 acres). Less potential GCWA habitat would be preserved (up to 559.7 conservation credits).	Impacts would be similar to those of Alternative B, except adverse impacts are not proposed to be offset with establishment of GCWA preserves.
BCVI	The estimated direct and indirect disturbance of up to 2,446.5 acres of potential BCVI habitat would result in minor, primarily indirect, adverse short- and long-term impacts to the species. Adverse impacts would be offset by the establishment of up to 2,584.3 conservation credits in permanent shrubland preserves; the preserves could contribute to the long-term conservation of the species.	Impacts would be similar to those of the Proposed Action, except less potential BCVI habitat would be directly and indirectly affected (up to 1,852.8 acres). Less potential BCVI habitat would be preserved (up to 1,312.7 conservation credits).	Impacts would be similar to those of Alternative B, except adverse impacts are not proposed to be offset with establishment of BCVI preserves.

Table 2.1. Summary of Environmental Consequences for Alternative A (Preferred Alternative), Alternative B (Maximum Take Avoidance), and Alternative C (No Action).

Impact Topic	Alternative A (Preferred Alternative)	Alternative B (Maximum Take Avoidance)	Alternative C (No Action)
Evaluation Species	Construction of the Priority Projects is expected to have negligible to minor, primarily indirect, adverse, short- and long-term impacts on all the Evaluation Species. The Preferred Alternative could result in the clearing of up to 1,253.3 acres of potential Tobusch fishhook cactus habitat and result in minor, adverse, short- and long-term impacts to the species; construction Best Management Practices (BMPs) may offset impacts. Depending on where the Covered Species preserves are established, they may provide protected habitat for one or more of the Evaluation Species.	Impacts would be similar to those of the Preferred Alternative, except less potential Tobusch fishhook cactus habitat would be cleared (approximately 956.8 acres). Construction BMPs may offset impacts. The potential for preserves to provide protected habitat for any of the Evaluation Species would be reduced.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefits to the Evaluation Species of establishing preserves will likely not be realized.
State Special Status Species	Construction of the Priority Projects is expected to have negligible to minor, primarily indirect, adverse, short- and long-term impacts to state threatened species and state Species of Concern. The Preferred Alternative could result in the disturbance or removal of up to an estimated 3,452 acres of vegetation over approximately 178 miles. Depending on where the Covered Species preserves are established, they may provide protected habitat for one or more of the state special status species.	Impacts would be similar to those of the Preferred Alternative, except less wildlife habitat would be disturbed or removed (2,898 acres). The potential for preserves to provide protected habitat for any of the state special status species would be reduced.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefits to the state special status species of establishing preserves will likely not be realized.
Invasive Species	Due to minimization measures (e.g., use of clean gravel and certified seed mixtures, etc.) the rate of spread of invasive species is not expected to increase measurably with the construction of the Priority Projects. Establishing and managing preserves for the Covered Species may hinder the spread of invasive species on the land included in the preserves.	Impacts would be similar to those of the Preferred Alternative, except less acreage would be disturbed in the ROW, resulting in a lower potential for invasion by undesirable species. Less land would be protected in preserves, reducing the amount of land that may be managed to limit the spread of invasive species.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefit to the control of invasive species of establishing preserves will likely not be realized.
Cultural Resources	Adverse impacts to cultural resources from building the Priority Projects are expected to be direct and long-term. But, with implementation of BMPs, coordination with relevant agencies, and implementation of minimization and mitigation measures, these impacts are also expected to be minor. Cultural resources on preserves established for the Covered Species would be protected from the impacts of development.	Impacts would be similar to those of the Preferred Alternative, except fewer cultural resources may be protected since less land would be protected in preserves.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established. Any potential benefits to cultural resources of establishing preserves will likely not be realized.

Table 2.1. Summary of Environmental Consequences for Alternative A (Preferred Alternative), Alternative B (Maximum Take Avoidance), and Alternative C (No Action).

Impact Topic	Alternative A (Preferred Alternative)	Alternative B (Maximum Take Avoidance)	Alternative C (No Action)
Land Use	Construction of the Priority Projects could result in minor, adverse, indirect and direct, short- and long-term changes to uses of some land in the Permit Area. Establishment of Covered Species preserves would add to the amount of conserved land in the region.	Impacts would be similar to those of the Preferred Alternative, except less ROW would be cleared, possibly resulting in fewer changes in the use of that land. Less land would be conserved.	Impacts would be similar to those of Alternative B, except woodland and shrubland preserves are not proposed to be established.
Socioeconomic Resources	Construction of the Priority Projects could result in no net gain of jobs in the long term. Economic benefits related to construction and impacts on human population size are expected to be negligible; impacts to the value of most properties are expected to be negligible over the long-term, with some select properties possibly declining in value. Some minor, beneficial, short-term benefits would be expected in the local economy during construction.	Impacts would be similar to those of the Preferred Alternative, except fewer workers would likely be needed during the construction phase because less ROW would be cleared.	Impacts would be similar to those of Alternative B.
Environmental Justice	No minority or low income population is expected to be disproportionately affected under this alternative.	No minority or low income population is expected to be disproportionately affected under this alternative.	No minority or low income population is expected to be disproportionately affected under this alternative.
Roads and Aviation Facilities	Construction of the Priority Projects has the potential to result in minor, direct, adverse short-term impacts to roadways and local traffic. The increase of 178 miles of transmission lines has the potential to result in a minor increased risk of collision of low-flying aircraft.	Impacts would be similar to those of the Preferred Alternative, except the use of helicopters would increase the presence of low-flying aircraft in the area, although It is unlikely that these flights would interfere with or pose a risk to other aircraft.	Impacts would be similar to those of Alternative B.
Human Health and Safety	Construction of the Priority Projects could result in negligible to minor, adverse, short- and long-term potential impacts to human health and safety.	Impacts would be similar to those of the Preferred Alternative.	Impacts would be similar to those of the Preferred Alternative and Alternative B.
Noise	Construction of the Priority Projects could result in minor to moderate, adverse, short-term increases in noise levels during the construction phase. Over the long term, noise impacts generated by the wires or by maintenance activities is expected to be negligible to minor.	Impacts would be similar to those of the Preferred Alternative, except the noise generated by helicopters would replace the noise generated by ROW-clearing equipment in areas not cleared. Noise disturbance in those areas would likely be of shorter duration. Noise receptors more distant from the ROW would be exposed to the sound of helicopters flying to and from the job site.	Impacts would be similar to those of Alternative B.

[1] A Conservation Credit is normally the equivalent of 1 acre of habitat.

CHAPTER 3
AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter discusses the environmental setting of the Priority Projects. The Permit Area for the purposes of analysis includes a seven-county area: Gillespie, Kendall, Kerr, Kimble, Schleicher, Sutton and Tom Green (Figure 1.2).

3.1.1 Regional Environmental Setting

Except for small areas in Tom Green County the Permit Area is located on the Edwards Plateau. The Edwards Plateau is largely composed of moderately dissected, flat-lying sedimentary rocks, mostly marine carbonates (Spearing 1991). The predominant carbonate geology has resulted in widespread presence of karstic (cave-forming) topography in the region. In the far eastern and southeastern margins of the Edwards Plateau (in Kendall, and Kerr counties), faulting and stream erosion has created a rugged topography composed of canyons, hills, and ridges known as the Balcones Canyonlands or, more commonly, the Hill Country (Spearing 1991). West and north of the Balcones Canyonlands, the greater portion of the Edwards Plateau in the Permit Area is characterized by rolling to gently rolling topography. Local relief on most of the Edwards Plateau ranges mostly from 100 to 300 feet, except in the small areas of hills, where relief ranges from 300 to 500 feet (McNab and Evers 1994). The only part of the Permit Area not on the Edwards Plateau is a patch of gently rolling prairie in Tom Green County (the Red Prairie of the Central Great Plains Ecoregion) (Griffith *et al.* 2007).

Average precipitation in the Permit Area generally follows a gradient of decreasing rainfall from east to west, ranging from 30–32 inches per year in the eastern counties down to 18–20 inches per year in the western counties (Larkin and Bomar 1983). Winters are generally mild and summers hot. Native vegetation in the Permit Area reflects precipitation and topographic patterns. Rocky ridges and many of the undulating uplands, especially in the eastern and southern portions of the Edwards Plateau, support a dense woodland of shrubs and small trees, mostly oaks (*Quercus fusiformis* and other species) and Ashe juniper (*Juniperus ashei*) (Davis *et al.* 1997). In the northwestern regions, this woodland vegetation grades into a short-grass savanna with mesquite (*Prosopis glandulosa*) dotting expanses of grass.

3.1.2 Resources Analyzed in this Environmental Assessment

Within the Permit Area, the resources listed below could potentially be affected by implementation of the three alternatives evaluated in this EA. The existing conditions for each of these resources are described in this chapter, and the potential impacts to these resources resulting from each of the alternatives under consideration are analyzed in Chapter 4.

- Visual and Aesthetic Qualities
- Air Quality
- Climate and Climate Change
- Soils and Geology
- Water Resources
- Land Use
- Socioeconomics
- Environmental Justice
- Roads and Aviation
- Cultural Resources
- Biological Resources
- Noise
- Human Health and Safety

3.1.3 Resources Not Considered for Detailed Analysis

Potential impacts to ecologically sensitive resources such as Wilderness, Wild and Scenic Rivers, and Coastal Management Zones must be addressed in NEPA documents should they occur in the area of potential effect. No designated Wilderness, Wild and Scenic River, or Coastal Management Zones are present within the Permit Area; therefore, these topics have been dismissed from analysis.

3.2 VISUAL AND AESTHETIC QUALITIES

The information provided in this section, exclusive of photographs, was taken from PBS&J environmental assessment reports prepared for the PUC routing processes for the Priority Projects (PBS&J 2010a, 2010b).

Visual resources are physical features that make up the visible landscape and include such features as land, water, vegetation, and anthropogenic (manmade) elements. Factors used to assess the visual experience and aesthetic qualities of an area may include:

- Uniqueness of visual elements and landscape to the region
- Cultural significance of visual elements and landscape to the region
- Juxtaposition of visual elements (e.g., foreground, middle ground, or background)
- Scale, compatibility, and contrast of visual elements in the landscape
- Number of potential viewers
- Frequency and duration of exposure to the view
- Amount of disturbance to the landscape

Most of the region comprising the Permit Area is a rural environment, lightly inhabited, and generally supporting ranching and some crop production. Elements of the viewshed include level to rolling crop fields, rangeland, creeks and ditches, and occasional wooded areas interspersed with rural residences and farm structures. The majority of residents in the Permit Area live on large tracts of land surrounded by cultivated fields and open range. Residences and businesses are also scattered along state and county roads. The level of human impact to the area is relatively high, mainly due to widespread agricultural land use, oil and gas operations, and, to a lesser extent, urban development (PBS&J 2010b).

The Texas Heritage Trails Program, maintained by the Texas Historical Commission (THC), has identified ten scenic driving routes throughout Texas. One of these, the Texas Forts Trail, runs through the eastern portion of the Permit Area along US 277, highlighting historic sites in San Angelo and Christoval (THC 2009, PBS&J 2010b). In 1998, the Texas Department of Transportation (TxDOT) published a list of some of the best "Scenic Overlooks and Rest Areas" in Texas, each of which presented particularly strong aesthetic views or settings (TxDOT 1998). A review of this list indicated that two of these facilities are located in the Permit Area. Both are rest areas located along I-10. One of these is located approximately 10 miles west of the City of Comfort in Kerr County, with the other located in Sutton County approximately 5 miles west of the City of Sonora. Neither Priority Project would be visible from the rest area in Sutton County, which lies at least 25 miles from either transmission line. The Big Hill-Kendall transmission line passes within 600 to 900 feet of the Kerr County rest area. Expected impacts to views from this rest areas as a result of the Priority Projects are identified in Section 4.2.

No other outstanding aesthetic resources, designated scenic views, scenic roadways, or unique visual elements were identified from the literature review or from field reconnaissance of the Permit Area. Portions of the Permit Area exhibit a medium to high level of aesthetic value. The western portion of the Permit Area typically contains level to rolling fields, rangeland, and water bodies, including creeks, while the eastern portion is characterized by increasing topographic relief and woodlands. In the Balcones Canyonlands region, the Texas Hill Country features steep hillsides forested with oak and Ashe juniper, water-carved canyons, natural springs, and abundant wildlife. As with most landscapes, water features in the Permit Area that provide rivers and streams with constant water flow and well-developed areas of riparian vegetation possess aesthetic value.

Various groups, agencies, and municipalities have developed a number of self-guided driving tours along existing roadways in the Hill Country that emphasize the region's natural beauty, outdoor activities, wineries, cultural events, and other attractions. Several scenic driving loops that are part of the Texas Heritage Trails Program are located in the vicinity of the Priority Projects, three of which are crossed or followed by the alignment for the Big Hill-Kendall transmission line (THC 2009). These include the Texas Forts Trail, which follows U.S. Highway 277 and U.S. Highway 190 through Schleicher County, the Texas Pecos Trail, which follows I-10 and U.S. Highway 377 in Kimble County, and the Texas Hill Country Trail, which follows State Highway 16 in Kerr County. Additional information on the Texas Heritage Trails Program can be found in the PBS&J Environmental Assessments on file with the Service and considered as part of the administrative record for the preparation of this EA. Expected impacts to views available from these driving loops as a result of construction of the Priority Projects are identified in Section 4.2.

3.3 CLIMATE AND CLIMATE CHANGE

3.3.1 Climate

Climate in the Permit Area falls within two broad climate classifications: the subtropical subhumid climate and the subtropical steppe climate (Larkin and Bomar 1983). The subhumid climate is characterized by strong seasonal variations in precipitation, with relatively dry winters and wet late spring and early fall months as cool northern frontal air masses collide with warm moist Gulf air masses from the south (Anaya 2004). The steppe climate is characterized by semi-arid to arid conditions throughout the year, with rainfall more likely in the summer months (Larkin and Bomar 1983). Average precipitation across the Permit Area generally follows a gradient of decreasing rainfall from east to west, ranging from 30–32 inches per year in the easternmost counties down to 18–20 inches per year in the westernmost counties (Larkin and Bomar 1983). Light snow occurs a few days each winter in most areas. Average temperatures vary little across the Permit Area. Average annual temperature is approximately 70°F (21°C), with monthly averages ranging from around 52°F (11°C) in January to 86°F (30°C) in August (Davis *et al.* 1997). Highs of 105°F (41°C) in July are common and lows of 15°F (-9°C) in January can occur.

3.3.2 Climate Change

According to the American Meteorological Society (AMS), global mean temperatures have been rising steadily over the last 40 years (AMS 2007). This trend is expected to continue, both

globally and, in many cases, regionally. Climate change may be influenced by a number of variables, including natural external forces, natural internal processes of the climate system, or human activities (Cohan 2009). In the case of the current and predicted global warming trend, the cause is likely related to greenhouse gases, primarily carbon dioxide (CO_2), accumulating in the earth's atmosphere as a result of human activity (EPA 2010c). According to the EPA (2010c), energy-related activities account for over 85 percent of human-generated greenhouse gases in the United States. This is mostly in the form of CO_2 emissions from burning fossil fuels. Industrial processes (such as the production of cement, steel, and aluminum), agriculture, forestry, and waste management are also important sources of greenhouse gas emissions in the United States (EPA 2010c).

Over the next century, climate in Texas is likely to become warmer and experience wider extremes in both temperature and precipitation (EPA 1997). Based on projections made by the Intergovernmental Panel on Climate Change (IPCC; 2007), climate conditions in the Permit Area are expected to become warmer and drier. By the year 2050, the average annual temperature throughout the Permit Area could increase by 3.6 to 4.5 ^{o}F (1.5 to 2.5 ^{o}C). Average annual precipitation is predicted to decease little in the northwestern portion of the Permit Area, but could decrease by as much as 7 inches or more per year in the southeastern portions of the Permit Area (IPCC 2007).

3.4 AIR QUALITY

Land use in the Permit Area is mostly agricultural with relatively few urban centers and no major cities. The Permit Area likely enjoys better air quality than more populated areas because it has fewer large-scale point source emissions (e.g., from industrial plants and fossil fuel-fired power plants) and non-point source emissions (e.g., from automobiles and trucks). As a result, air quality in such an area is rarely systematically monitored. This is true for the Permit Area. The TCEQ, which is responsible for overseeing air quality in Texas, has no monitoring stations within the Permit Area boundaries.

While air quality is expected to be generally good in the Permit Area, air pollution can exist in rural environments. This can be caused by distant urban emissions dispersing downwind and by local rural emissions, such as particulate matter arising from cultivation, animal feeding operations, diesel engine exhaust, and agricultural burning (NRCS 2010). Smoke from agricultural burning in Mexico and Guatemala can affect air quality in central Texas, particularly in April and May (NASA 2006). Gas and oil fields, such as those in the westernmost counties in the Permit Area may also be a source of air pollutants.

3.4.1 Air Quality Standards and Regional Compliance

Air quality is measured by the level of airborne substances that are potentially harmful to humans, other living organisms, or any human need or purpose. The Clean Air Act (CAA) requires the Environmental Protection Agency (EPA) to set air quality standards, referred to as the National Ambient Air Quality Standards (NAAQS). The CAA identified six criteria pollutants that can be harmful to human health and the environment: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10}, $PM_{2.5}$), ozone (O_3), and sulfur dioxide (SO_2). Two types of standards have been established: primary standards set to protect

public health and secondary standards to protect public welfare, including damage to buildings, animals, and vegetation. The NAAQS are shown in Table 3.1.

Areas that do not meet the NAAQS are referred to as non-attainment areas. Monitors around the State of Texas are used to measure the concentration of criteria pollutants in the ambient air. The closest monitors to the Permit Area are located in northwestern Travis County and northwestern Bexar County. Both counties are urban (Austin in Travis County and San Antonio in Bexar County) and are not representative of the Permit Area, which is primarily rural.

Table 3.1. National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
CO	9 ppm (10 mg/m^3)	8-hour	None	
	35 ppm (40 mg/m^3)	1-hour		
Pb	0.15 µg/m^3	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
NO_2	53 ppb	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour	None	
PM_{10}	150 µg/m^3	24-hour	Same as Primary	
$PM_{2.5}$	15.0 µg/m^3	Annual (Arithmetic Average)	Same as Primary	
	35 µg/m^3	24-hour	Same as Primary	
O_3	0.075 ppm (2008 std)	8-hour	Same as Primary	
	0.08 ppm (1997 std)	8-hour	Same as Primary	
	0.12 ppm	1-hour	Same as Primary	
SO_2	0.03 ppm	Annual (Arithmetic Average)	0.5 ppm	3-hour

Source: EPA 2010b

However, air pollutants generated in large urban areas are transported downwind and can affect the ambient air quality of relatively remote areas. In Texas, predominant wind directions for much of the year are from the south, southwest, and southeast (Bomar 2008). This is particularly true during the summer, when a southerly wind occurs approximately 90 percent of the time in the southern regions, and at least 80 percent of the time in the north. As a result, pollutants from urban centers to the south and southeast may affect the ambient air quality in the Permit Area.

The nearest such centers are Austin and San Antonio, although the more distant cities of Houston and Corpus Christi may also contribute criteria pollutants. Both the Austin-Round Rock Area and the San Antonio Area are currently in attainment status for all criteria pollutants, meaning both areas have met the standards for NAAQS. However, on 10 March 2009, the governor of Texas recommended to the EPA that both Travis and Bexar counties be designated non-attainment for the 2008 national eight-hour ozone standard (EPA 2010a). In January 2010, EPA issued a proposed rule to lower the eight-hour ozone primary standard from 0.075 ppm to 0.060–0.070 ppm (EPA 2010d), which, if finalized, would increase the likelihood that Austin and San Antonio will be declared non-attainment areas for ozone.

3.5 SOILS AND GEOLOGY

3.5.1 Soils

In this section, soils in the Permit Area are summarized according to a classification used by the Natural Resources Conservation Service (NRCS 1999). Information is also provided about the occurrence of prime farmland soils. Soils in the Permit Area are predominantly shallow to moderately shallow, fine in texture, and relatively dry (McNab and Evers 1994). Soils are shallower on plateaus, ridges, and hills, and deeper on plains and valley floors. They are classified by the NRCS mostly as Ustolls, a suborder of Mollisols (Anaya 2004). Ustolls develop under grass or savanna type vegetation in subhumid to semiarid climates, which results in a nutrient-enriched surface soil (A horizon) high in organic matter (NRCS 1999). Such soils drain easily and have: 1) a thermic temperature regime, which means the average annual soil temperature is 59–72°F (15-22°C); usually measured at a depth of 20 inches); 2) a ustic moisture regime, which means they have a moderate to pronounced seasonal moisture deficit; and 3) carbonate and clay mineralogy (McNab and Evers 1994, NRCS 1999). This mineralogy, which is alkaline, reflects a predominately limestone source (i.e., parent material). In the Balcones Canyonlands portion of the Edwards Plateau, the soils are mainly classified as Inceptisols (Anaya 2004). Such soils have little soil horizon development (i.e., little differentiated layering) and form on steep slopes of young geomorphic surfaces in a humid to subhumid climate (NRCS 1999). Soils in a band across the western edge of the Permit Area (Schleicher and Sutton counties) are classified as Vertisols, which are clay-rich, tend to shrink and swell, and crack easily (NRCS 1999, Anaya 2004). Soils of the Llano Uplift region (mostly in Llano County) tend to be acidic compared to the predominantly alkaline soils of the rest of the Edwards Plateau (U.S. Geological Survey [USGS] undated). In the Llano Uplift, soils in the uplands are shallow, stony, sandy loams over granite, gneiss, and schist bedrock, while in the valleys, soils are typically deeper sandy loams.

3.5.1.1 Prime Farmland Soils

Prime farmland soils are defined at 7 USC 4201(c)(1)(A) as those soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. They have the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. Potential prime farmland soils are those that meet most of the requirements for prime farmland but fail because they lack adequate drainage and/or sufficient natural moisture. The U.S. Department of Agriculture (USDA) would consider such soils prime farmland if water management facilities (drainage and/or irrigation) were installed.

According to the NRCS (2009a, 2009b), approximately 47.7 percent (470,356 acres) of Tom Green County contains prime farmland soils, with 4.5 percent being included as prime farmland if it were irrigated. Other than in Tom Green County, prime farmland soils are not generally widespread within the Permit Area counties. According to the NRCS (2009a, 2009b), prime farmland soils occupy approximately 19.7 percent (165,081 acres) of Schleicher County and 10.2 percent (94,876 acres) of Sutton County. Additional Permit Area prime farmland soils occupy approximately 11.4 percent (91,492 acres) of Kimble County, with 1.1 percent included if irrigated; 8.3 percent (58,486 acres) of Kerr County, with 1.5 percent included if irrigated; 11.9

percent (80,583 acres) of Gillespie County, with 8.9 percent included if irrigated or protected from flooding; and 11.9 percent (50,537 acres) of Kendall County, with 4.7 percent included if irrigated.

3.5.2 Geology

The majority of the Permit Area is located on the Edwards Plateau. Approximately 10 to 20 million years ago (Miocene Epoch), the Edwards Plateau underwent more than 1,100 feet (335 m) of uplift along the Balcones Fault Zone as part of a regional tectonic event across the western United States (Spearing 1991). With the exception of Quaternary alluvial deposits (e.g., sand, silt, clay, gravel), surface geology within the Permit Area consists primarily of Cretaceous carbonate rocks (limestones and dolomites), some Permian age sandstones and gypsums, and locally exposed Precambrian granites, gneisses, and schists and Paleozoic carbonates and sandstones in the Llano Uplift portion of the plateau. The predominant carbonate geology has resulted in the widespread presence of karstic (cave-forming) topography. Small cavities and fissures are ubiquitous in such rock, and caves large enough for human entry are common. According to a database maintained by the Texas Speleological Society (TSS 2009), caves and sinkholes are located within the Permit Area. Caves may provide recreational opportunities for human visitors, and karst features in general serve important ecological functions by providing a means for surface water to recharge underground aquifers and by providing habitat for cave-dwelling species. While karstic topography dominates the Permit Area, no federally listed karst species are known to occur there.

Portions of the Llano Uplift region occur in Gillespie County. Here, ancient Precambrian igneous and metamorphic rocks, which are deeply buried under other rocks in the rest of Texas, are exposed on the surface (Spearing 1991). Many minerals are found in the Llano Uplift. Two of these minerals are of particular value to gem and mineral collectors: llanite and topaz, particularly blue topaz, the Texas state gemstone. Neither mineral is mined commercially. Llanite is a rhyolite or granite imbedded with blue quartz and orange feldspar crystals (Barnes 1988).

3.6 WATER RESOURCES

3.6.1 Surface Water Resources

Based on data from the *National Hydrography Dataset* (NHD), surface waters cover less than one percent of the Permit Area (USGS 2010a). Wetlands are limited in this largely semi-arid landscape (Dahl 1990) but are expected to include floodplain and riparian wetlands; seep, spring, and slope wetlands; fringe wetlands surrounding lakes and reservoirs; and other freshwater depressional systems (NatureServe 2010, Comer *et al.* 2003). Waterways range from dry, ephemeral tributaries to high-quality perennial rivers. Water bodies include natural ponds and depressions, upland created stock ponds, and impoundments along waterways. No natural lakes occur in the Permit Area. USGS topographic maps indicate a number of inundated gravel pits, upland stock ponds, and on-channel impoundments.

3.6.1.1 Twin Buttes–Big Hill

The Twin Buttes–Big Hill route lies in the Middle Colorado-Concho river basin. Major surface waters in the Twin Buttes–Big Hill portion of the Permit Area are the Concho River, including

the North, Middle, and South Concho tributaries; Spring and Dove creeks; Lake Nasworthy; and O.C. Fisher, Twin Buttes, Rust, and Ripple reservoirs (USGS 2010a). Other surface waters include Millers Branch; Bois D'Arc Draw; and Brushy, Bull Run, Burks, Dry Rocky, East Rocky, Pecan, Walnut, and West Rocky creeks, as well as numerous unnamed ephemeral and intermittent tributaries. Twin Buttes and O. C. Fisher reservoirs act primarily as flood protection for the City of San Angelo. The city still draws its primary water supply from Lake Nasworthy, and uses the reservoirs for secondary water-supply sources, irrigation, and water conservation (Texas State Historical Association 2010).

Ecologically Significant Segments. Along the Twin Buttes–Big Hill route, TPWD (2010b) has identified a segment of Spring Creek as ecologically significant based on criteria pertaining to biological function, hydrological function, riparian conservation areas, water quality, aquatic life, aesthetic value, and the presence of threatened or endangered species or unique communities. The ecologically significant reach of Spring Creek extends from the FM 2335 crossing in Tom Green County to its headwaters located 4 miles south of the corner common to Schleicher, Irion, and Crockett counties. This segment exhibits high water quality, exceptional aquatic life, high aesthetic value, high water quality, a diverse benthic macroinvertebrate community, and is an ecoregion reference stream.

Clean Water Act Section 303(d) Impaired Waters. Under the Federal Clean Water Act Section 303(d), the TCEQ is required to identify and prioritize a list of water bodies that do not comply with state water quality standards. No impaired waters are intersected by the approved Twin Buttes–Big Hill alignment, but three such waters occur within the Twin Buttes–Big Hill portion of the Permit Area, all in Tom Green County. They are as follows:

- Segment 1421_07. The Concho River, from a dam near Vines Road upstream to the confluence of the North Concho River and the South Concho River in the City of San Angelo. This segment is listed due to an impaired macrobenthic community
- Segment 1421_08. The North Concho River, from the confluence with the South Concho River upstream to O.C. Fisher Dam. This segment is listed due to bacteria levels and depressed dissolved oxygen.
- Segment 1425. O.C. Fisher Lake, which impounds North Concho River, from San Angelo Dam up to normal pool elevation of 1908 feet. The entire reservoir is listed due to chloride levels.

3.6.1.2 Big Hill–Kendall

The Big Hill–Kendall approved route lies in the Middle Colorado-Concho, Middle Colorado-Llano, and Guadalupe River basin-watersheds (USGS 2010a). The major surface waters in this portion of the Permit Area are the South Concho, North Llano, and Llano rivers. Other waterways include Bear, Cedar Hollow, Copperas, Cypress, East Town Goat, Hasenwinkel, Joy, Middle Copperas, North (one each in Kerr County and Kimble County), North Fork Cypress, Quinlan, Stark, Sycamore, Town, and West Copperas creeks; Dry, Fall, Fessenden, and West Dry branches; Elm Slough; Johnson Fork; and the Middle Valley and North Valley Prongs of the San Saba River and the San Saba River itself. There are also numerous named and unnamed ephemeral and intermittent tributaries in the area.

Ecologically Significant Stream Segments. No ecologically significant stream segments intersect the approved Big Hill–Kendall route. However, within the Big Hill–Kendall portion of the Permit Area, TPWD (2010b) has identified the following stream segments as ecologically significant based on criteria pertaining to biological function, hydrological function, riparian conservation areas, water quality, aquatic life, aesthetic value, and the presence of threatened or endangered species or unique communities:

- Fessenden Branch – From the confluence with Johnson Creek upstream to Fessenden Springs. This segment is important because of its valuable hydrologic function relating to groundwater discharge.
- Guadalupe River – From the Kerr-Kendall County line upstream to the confluence of the North Fork Guadalupe River and the South Fork Guadalupe River in Kerr County. This segment includes a riparian conservation area (Kerrville-Schreiner Park), has high water quality, exceptional aquatic life, high aesthetic value, a valuable hydrologic function relating to groundwater recharge and discharge of the Edwards Aquifer. This segment also provides habitat for only one of four known remaining populations of the state-listed as threatened Texas fatmucket (*Lampsilis bracteata*) freshwater mussel and golden orb (*Quadrula aurea*) freshwater mussel. TPWD rates this segment the second-best scenic river in Texas.
- Guadalupe River – From the confluence of the Comal River in Comal County upstream to the Kendall/Kerr County line, with the exception of Canyon Reservoir. This segment includes a riparian conservation area (Guadalupe River State Park), and has high water quality, exceptional aquatic life, and high aesthetic value. TPWD also rates this segment the second-best scenic river in Texas. Portions of this segment (outside the seven-county Permit Area) are within the Edwards Aquifer Recharge Zone.
- James River – From the confluence with the Llano River in the central part of Mason County to its headwaters south of Noxville in the southeastern part of Kimble County. This segment is considered significant because of high water quality, exceptional aquatic life, high aesthetic value, its overall use, and because it is an ecoregion reference stream.
- Johnson Creek – From the confluence with the Guadalupe River in Kerr County to a point 0.7 mile upstream of the most upstream crossing of SH 41 in Kerr County. This segment exhibits high water quality, exceptional aquatic life, and high aesthetic value. Johnson Creek is spring fed and flows for approximately 21 miles to the point of confluence with the Guadalupe River. The water quality in Johnson Creek has no impairments or concerns and maintains an exceptional aquatic life use designation (Guadalupe-Blanco River Authority 2008). Rural areas with very low residential development surround Johnson Creek and during the summer months, recreational swimming is primary water-use in some sections of the creek.
- Pedernales River – From the Kimble-Gillespie county line to FM 385 in Kimble County. This segment was a National Wild and Scenic Rivers System nominee for significant natural areas and wildlife values, as well as having exceptional aesthetic value.
- Pedernales River – From FM 385 in Kimble County downstream to a point immediately upstream of its confluence with Fall Creek in Travis County. This segment was a National Wild and Scenic Rivers System nominee for significant natural areas and wildlife values. This segment includes riparian conservation areas (Pedernales Falls State

Park, Stonewall Park, Lyndon B. Johnson State Park, and Lyndon B. Johnson National Historical Park), has high water quality, exceptional aquatic life, and high aesthetic value.

- South Llano River – From the confluence with the North Llano River at Junction near the center of Kimble County upstream to the Kimble/Edwards county line. This segment includes a riparian conservation area (South Llano River State Park and Wildlife Management Area), has high water quality, exceptional aquatic life, high aesthetic value, diverse benthic macroinvertebrate and fish communities, and is an ecoregion reference stream. This segment is a genetic refuge for a pure population of Guadalupe bass (*Micropterus treculi*).

Clean Water Act Section 303(d) Impaired Waters. No impaired waters are intersected by the approved Big Hill–Kendall alignment, but two impaired waters occur within the Big Hill–Kendall portion of the Permit Area. They are as follows:

- Segment 1806A_03. The upper 9 miles of Camp Meeting Creek west of Kerrville in Kerr County). This segment is listed due to depressed dissolved oxygen.
- Segment 1908_02. Upper Cibolo Creek in Kendall County, from approximately 2 miles upstream of Hwy 87 in Boerne to the confluence of Champee Springs. This segment is listed due to bacteria levels.

3.6.2 Groundwater Resources

The information below on groundwater resources was compiled from PBS&J environmental assessment reports prepared for the PUC process for the Priority Projects (PBS&J 2010a, 2010b). These reports are on file with the Service and considered part of the administrative record for the development of this EA.

The karstic carbonate rocks of the Edwards Plateau have resulted in presence of local and regional-scale groundwater systems. These systems are typically composed of a recharge zone and contributing zone. In the recharge zone, porous rock exposed at the surface allows precipitation or stream flow to infiltrate the bedrock. An underground network of conduits, caverns, and other void space either holds water to create an aquifer, or allows the water to travel down-gradient to be discharged back to the surface at a spring. A contributing zone is a watershed area that conveys surface water runoff to a recharge zone, where it can then infiltrate the ground.

A significant water-bearing unit in the Permit Area is the Cretaceous-aged Edwards-Trinity (Plateau) Aquifer (hereafter referred to as the Edwards-Trinity Aquifer), which underlies the Edwards Plateau. The water-bearing rocks of the Edwards-Trinity Aquifer include saturated sediments of Lower Cretaceous-aged Trinity Group formations and overlying limestones and dolomites of the Comanche Peak, Edwards, and Georgetown Formations. Maximum saturated thickness of the Edwards-Trinity Aquifer is over 800 feet.

The chemical quality of the water in the Edwards-Trinity Aquifer is typically fresh, although hard, with dissolved-solids concentrations averaging less than 500 milligrams per liter (mg/l) to more than 5,000 mg/l, with some slightly saline. The interface between fresh and slightly saline water represents the extent of water containing less than 1,000 mg/l (Rees and Buckner 1980).

Within a short distance down-gradient of this “bad water line,” the groundwater becomes increasingly mineralized. Dissolved solids are mostly made up of calcium and bicarbonate, and salinity tends to increase towards the west. Certain areas may have unacceptable levels of fluoride (Texas Water Development Board [TWDB] 1995).

Most recharge occurs from the infiltration of seasonal precipitation over Edwards-Trinity outcrops and sinkholes, and from stream loss from intermittent water courses (TWDB 1995). Although the water levels in the aquifer are influenced by climate, they have remained fairly constant, except in areas of the northwestern part of the aquifer where a general trend of declining water levels is a result of increased irrigation pumpage (TWDB 1995). Well yields range from less than 50 gallons per minute, where saturated thickness is thin, to more than 1,000 gallons per minute, where large-capacity wells are completed in cavernous and jointed limestone.

In addition to the Edwards-Trinity Aquifer, a very small portion of the Permit Area contains local aquifers of varying quantity and quality. Other aquifers located within the Permit Area may include the Edwards, Trinity, and Ellenburger-San Saba. The southeastern portion of the Big Hill–Kendall Permit Area is located within the outcrop of the Early Cretaceous-aged Trinity Aquifer. The water-bearing rocks of the Trinity Aquifer include three subdivisions representing three separate rock formations. These subdivisions are, from youngest to oldest, the Upper Trinity Aquifer, consisting of the Paluxy Formation; the Middle Trinity Aquifer, consisting of the upper and lower members of the Glen Rose Formation; and the Lower Trinity Aquifer, consisting of the Twin Mountains-Travis Peak Formation. The chemical quality of the water in the Trinity Aquifer is characterized as calcium carbonate water, which is usually neutral to hard and ranging from fresh to slightly saline in most cases. Reported permeability and transmissivity values for the Upper Trinity Aquifer are low. Therefore, yields are generally very small to small (TWDB 1995). Groundwater in the aquifer within the Permit Area yields up to about 100 gallons per minute. The primary mechanism of recharge to the Upper Trinity is vertical infiltration of water on the outcrop. Rainfall is the source of most of the recharge, but lesser amounts are attributable to infiltration from irrigated areas (e.g., golf courses, residential lawns), seepage from septic system drainfields, and seepage from local streams. Discharge from the aquifer occurs from well withdrawals, movement through the aquifer down-gradient of the Permit Area, and discharge to local streams (TWDB 1995).

In addition to the two aquifers described above, an area in the east-central portion of the Permit Area, which lies on the edge of the Llano Uplift, contains minor local aquifers. The Ellenburger-San Saba minor aquifer outcrops in portions of the Permit Area but also within Mason and Menard counties. The down-dip portions are located in eastern Menard, eastern Kimble, Gillespie, and northern Kendall counties. The down-dip sections extend to depths of approximately 3,000 feet below land surface, and regional block faulting has isolated the aquifer. The aquifer occurs in limestone and dolomite facies of the San Saba member of the Cambrian-aged Wilberns Formation and the Honeycut, Gorman, and Tanyard Formations of the Ordovician-aged Ellenburger Group. Solution cavities formed along faults and related fractures contain most of the water in the aquifer, which is considered hard and usually has less than 1,000 mg/L of dissolved solids (TWDB 1995). About 75 percent of the groundwater is used for municipal water supplies for the City of Fredericksburg.

Kerr, Kendall, and southwestern Gillespie counties occur within the contributing zone for yet another aquifer, the Edwards Aquifer (Eckhardt undated). Subchapter B of 30 Texas Administrative Code, Chapter 213, applies to construction-related or post-construction activity in the Edwards Aquifer contributing zone. Activities that disturb the ground or alter a site's topographic, geologic, or existing recharge characteristics may require sediment controls or a Contributing Zone Plan to protect water quality during and after construction, although this Subchapter only applies to developments of 5acres or larger.

3.7 BIOLOGICAL RESOURCES

This section summarizes technical information on the biological resources of the Permit Area. Included in this discussion are sections on Vegetation, Wildlife (including migratory birds), Covered Species, Evaluation Species, State Special Status Species, and Invasive Species. The information below on biological resources was compiled from an SWCA technical report prepared for LCRA TSC (SWCA 2011b). This report is on file with the Service and considered part of the administrative record for the development of this EA.

3.7.1 Background

The Priority Projects are proposed for construction in central Texas, where vegetation and wildlife communities typical of the southwestern United States and the Great Plains meet with those typical of the southeastern part of the country (Griffith *et al.* 2007). Vegetation and wildlife communities occurring in the southwestern counties of the Permit Area also share some affinities with those of northeast Mexico (Blair 1950). A comparatively high diversity of plants and animals is present in the Permit Area. Contributing to the diversity of plants and animals are geologic and hydrologic features that have led to a level of species endemism.

3.7.2 Vegetation

The Permit Area lies mostly within the Edwards Plateau Level III ecoregion as described by Griffith *et al.* (2007). The Edwards Plateau consists primarily of a dissected limestone plateau typified by rolling to hilly topography, shallow rocky soils, and woodlands dominated by Ashe juniper, plateau live oak (*Quercus fusiformis*), and mesquite. The Edwards Plateau is subject to periodic drought, and can alternately be exposed to dry winds from the west and moist air from the Gulf of Mexico. Griffith *et al.* (2007) describes the Semiarid Edwards Plateau ecoregion as transitional between the deserts of the western Texas and live oak savannas to the east. As with the remainder of the Edwards Plateau, the Semiarid Edwards Plateau is characterized by being underlain by Cretaceous carbonate geology and having shallow, rocky soils, but is differentiated by having an average annual rainfall of less than 20 to 22 inches. This amount of rainfall is near the minimum needed to support full-sized trees, so upland woody communities within the Semiarid Edwards Plateau are typically brushlands rather than woodlands (Griffith *et al.* 2007).

3.7.2.1 Twin Buttes–Big Hill

The route selected for the Twin Buttes–Big Hill transmission line lies almost wholly within the Semiarid Edwards Plateau Level IV ecoregion of the Edwards Plateau Level III ecoregion as mapped by Griffith *et al.* (2007).

An approximately 2.0-mile segment of the route crosses the Red Prairie Level IV ecoregion of the Central Great Plains Level III ecoregion where the route crosses the Middle Concho River

valley. Vegetation communities occurring along the Twin Buttes–Big Hill route as mapped by TPWD include Mesquite-Juniper Shrub, Mesquite-Juniper-Live Oak Brush, and Live Oak-Ashe Juniper Parks (McMahan *et al.* 1984). Broad scale mapping of the vegetation communities and other land covers occurring along the Twin Buttes–Big Hill route was performed by SWCA based on field work conducted in early September and 13 October 2010. This field mapping was supported through review of 2008 true-color, 1-meter pixel resolution digital aerial photography because landowner access had not been granted for all parcels crossed by the route at the time of the SWCA field visits. Vegetation occurring on unavailable parcels was mapped by matching the digital signatures of those vegetation communities not able to be observed directly against those of the communities that were able to be inspected in the field.

The distribution of vegetation communities along the route for the Twin Buttes–Big Hill transmission line is controlled primarily by geology and land use. Mesquite-dominated communities are predominant along the northern half of the route where surface geology consists primarily of Quaternary alluvial deposits and the Cretaceous Antler Sands Formation.

Communities containing oak trees and shrubs are largely restricted to limestone substrates. As a result, oak-bearing communities are mostly restricted to the southern half of the route where surface geology is largely Cretaceous limestone. The amount of shrubby vegetation present in woody communities along the length of the route is highly variable, owing primarily to differences in land management. Crop lands are restricted in occurrence to the valley bottoms of rivers and major creeks.

Riparian woodland communities along the route are quite rare, but where they occur they likely include eastern cottonwood, black willow, American sycamore, little walnut (*Juglans microcarpa*), bald cypress, Texas sugarberry, green ash (*Fraxinus pennsylvanica*), box-elder (*Acer negundo*), red mulberry (*Morus rubra*), China-berry (*Melia azedarach*), Texas oak, and plateau live oak (Baccus and Wallace 1997, McMahan *et al.* 1984, PBS&J 2010a). Understory species present in riparian woodlands are expected to include rough-leaf dogwood (*Cornus drummondii*), possumhaw holly (*Ilex decidua*), common hop-tree (*Ptelea trifoliata*), Carolina buckthorn (*Frangula caroliniana*), gum elastic, false indigobush (*Amorpha fruticosa*), poison ivy (*Toxicodendron radicans*), greenbrier (*Smilax bona-nox*), grape (*Vitis* spp.), and dewberry (*Rubus trivialis*) (Baccus and Wallace 1997). Many of the rivers and larger creeks that will be crossed by the transmission lines contain braided channels and gravel bars periodically scoured by floodwaters. The gravel bars typically support scrubby and herbaceous vegetation, often composed of Ashe juniper, seep willow, common buttonbush, little walnut, prickly pear, ragweed (*Ambrosia* spp.), and bermudagrass (PBS&J 2010a).

Smaller creeks and drainages of the Permit Area likely supports cedar elm, little walnut, live oak, and Texas sugarberry trees, as well as Texas oak, shin oak (*Quercus* spp), Texas ash, and western soapberry trees (PBS&J 2010a, Griffith *et al.* 2007). These smaller creeks and drainages are expected to much more locally support species with greater water requirements such as pecan, American elm, black willow, and eastern cottonwood, and likely do not support bald cypress. According to McMahan *et al.* (1984) and PBS&J (2010a), grasses typical of bottomland and riparian habitats of the area include switchgrass (*Panicum virgatum*), Canada

wildrye (*Elymus canadensis*), Virginia wildrye (*E. virginicus*), Johnsongrass (*Sorghum halepense*), and Lindheimer's muhly (*Muhlenbergia lindheimeri*).

The margins of the rivers and perennial creeks that cross the Permit Area are expected to locally support wetland fringes, as are the margins of stock tanks and other impoundments. Emergent plant species expected to occur in wetland habitats of the Permit Area include spikerushes (*Eleocharis* spp.), rushes (*Juncus* spp.), sedges (*Carex* spp.), flatsedges (*Cyperus* spp.), smartweeds (*Polygonum* spp.), cattails (*Typha* spp.), common buttonbush, and black willow (PBS&J 2010a).

The approximate number of acres of major land cover types crossed by the Twin Buttes–Big Hill route, assuming a 160-foot ROW, are identified in Table 3.2. The maximum total footprint on this route potentially occupied by the ROW will be 742 ac, 62 percent of which will be in grassland/scrubland, 28 percent in upland woodland, 9 percent in croplands and less than 1 percent in riparian/wetlands.

3.7.2.2 Big Hill–Kendall

The Big Hill–Kendall transmission line is fully contained within the Edwards Plateau Level III ecoregion as mapped by Griffith *et al.* (2007), and contains portions of four of its sub-regions. The route crosses largely through the Edwards Plateau Woodland Level IV ecoregion, passing through the Semiarid Edwards Plateau and Balcones Canyonlands Level IV ecoregions only on their northwest and southeast ends, respectively. Vegetation communities as mapped by TPWD occurring in the Semiarid Edwards Plateau portion of the Permit Area include Mesquite-Juniper Shrub and Mesquite-Juniper-Live Oak Brush. Most *Juniperus* trees and shrubs occurring in the Semiarid Edwards Plateau ecoregion are expected to be redberry juniper. Griffith *et al.* (2007) describes the Edwards Plateau Woodland Level IV ecoregion as being underlain by flat-lying Cretaceous carbonate formations, having topography characterized by rolling hills interspersed with broad river valleys, and having upland soils that are shallow and rocky. The ecoregion receives an average of 22 to 34 inches of rain annually, with average rainfall decreasing from east to west. Average rainfall is sufficient to support trees, so the ecoregion generally supports woodlands rather than the brushlands typical of the Semiarid Edwards Plateau ecoregion (Griffith *et al.* 2007). Much of the land in the ecoregion is used for grazing livestock. Because of the rocky, shallow soils, crop lands are uncommon and restricted largely to alluvial valleys where soils are deeper (Griffith *et al.* 2007).

Vegetation communities occurring in the Edwards Plateau Woodland portion of the Permit Area have been mapped primarily by the TPWD as Live Oak-Mesquite-Ashe Juniper Parks and Live Oak-Ashe Juniper Parks (McMahan *et al.* 1984). Grasses typical of these communities include little bluestem, Texas wintergrass, Texas grama, Halls panicum (*Panicum hallii*), three-awn, hairy tridens, and curly mesquite (McMahan *et al.* 1984). Restricted areas of the Mesquite-Juniper Shrub and Mesquite-Juniper-Live Oak Brush communities are mapped as occurring on the west edge of the ecoregion. As with the Twin Buttes–Big Hill transmission line route, riparian and wetland communities for the Big Hill–Kendall route are quite rare and composed primarily of species similar to that described

A small area of the extreme southeast portion of the Big-Hill Kendall transmission line traverses the Balcones Canyonlands ecoregion. This ecoregion includes Live Oak-Ashe Juniper Woods, Live Oak-Ashe Juniper Parks, and, to a lesser extent, Live Oak-Mesquite-Ashe Juniper Parks. While vegetation within the Balcones Canyonlands ecoregion is mapped by TPWD as generally being similar to that present in the Edwards Plateau Woodland ecoregion, the presence of springs, spring runs, and seeps generally allows for the development of more mesic woodlands within canyons and better developed riparian woodlands. Deciduous oak trees such as Texas oak and shin oak are generally more common in the Balcones Canyonlands ecoregion than elsewhere on the Edwards Plateau. Tree and shrub species present in oak-juniper woodlands of the Balcones Canyonlands ecoregion that are rare in or absent from woodlands of other Level IV Edwards Plateau ecoregions include Lacey oak (*Quercus glaucoides*), escarpment black cherry, Arizona walnut (*Juglans major*), box-elder, bigtooth maple (*Acer grandidentatum*), Carolina basswood (*Tilia caroliniana*), and red buckeye (*Aesculus pavia*).

The approximate number of acres of major land cover types crossed by the Big Hill–Kendall route, assuming a 160 foot ROW, are identified in Table 3.2. The maximum total footprint on this route potentially occupied by the ROW will be 2,715 acres, 73 percent of which will be in grassland/scrubland, 26 percent in upland woodland, less than 1 percent in croplands and less than 1 percent in riparian/wetlands.

Table 3.2. Approximate Distribution of Land Cover Types Traversed by the Proposed Twin Buttes–Big Hill and Big Hill–Kendall Approved Transmission Lines

Land Cover Type	Twin Buttes–Big Hill[1]		Big Hill–Kendall[2]	
Croplands/Barren	66 ac	9%	10 ac	< 1%
Grassland/Scrubland	457 ac	62%	1,982 ac	73%
Upland Woodland	206 ac	28%	706 ac	26%
Riparian/Wetland	8.0 ac	< 1%	17 ac	< 1%
Total Footprint	737 ac	100%	2,715 ac	100%

[1] Based on aerial photography and field surveys conducted by SWCA Environmental Consultants in 2010.
[2] Modified from SOAH (2010).

No native plant species of particular commercial importance are present in the Permit Area (PBS&J 2010a, 2010b). Ashe juniper trees are cut locally so that their trunks can be used for fence posts and other trees, such as oak and mesquite, are cut for firewood or for use as fuel for cooking. Woody and herbaceous plants of the woodlands and rangelands of the region are important insofar as they support a wide variety of wildlife and livestock. Regionally important browse and forage plants include acacia (*Acacia* spp.), hackberry (*Celtis* spp.), Texas persimmon, and mesquite, along with many species of grasses and forbs (PBS&J 2010a, 2010b). Mast-producing trees such as oak (*Quercus* spp.) and pecan are important for white-tailed deer (*Odocoileus virginianus*), eastern fox squirrel (*Sciurus niger*), and wild turkey (*Meleagris gallopavo*), while bunchgrasses provide important nesting cover for northern bobwhite (*Colinus virginianus*).

Portions of the Permit Area are known for their springtime display of wildflowers in fields, woodland clearings, and roadsides. Wildflowers that occur commonly to abundantly in the Permit Area include prairie paintbrush (*Castilleja purpurea*), phlox (*Phlox* spp.), Mexican hat (*Ratibida columnaris*), firewheel (*Gaillardia pulchella*), purple horsemint (*Monarda citriodora*),

primrose (*Oenothera* spp.), golden-wave (*Coreopsis* spp.) prairie verbena (*Verbena bipinnatifida*), and winecup (*Callirhoe* spp.).

Oak trees in woodlands of the Edwards Plateau are susceptible to a fungal disease known as oak wilt, which can kill oak trees by disabling their water-conducting system. Oaks of the red oak group (e.g., Texas oak) are especially susceptible to oak wilt, while oaks of the white oak group (e.g., post oak) are resistant to the fungus (Texas Oak Wilt Information Partnership 2007). Plateau live oak trees, which are the most abundant oak tree in the Permit Area are moderately susceptible to oak wilt, but also readily transmit the disease from tree to tree via shared root systems (Texas Oak Wilt Information Partnership 2007). The fungus that causes oak wilt can also be spread by contaminated tree-cutting equipment, and by insects, which can carry fungal spores from contaminated trees to healthy trees. Healthy trees can only be contaminated if their protective bark has been freshly breached, such as can occur from a limb breaking or being cut off.

Within the Permit Area, oak wilt has been found in Gillespie, Kendall, and Kerr counties (Texas Forest Service 2010). The Texas Forest Service has issued guidelines on how to control the spread of oak wilt when performing land clearing/management activities. These guidelines include seasonal restrictions on when cutting and pruning of oak trees is performed (no cutting 1 February–1 July), sanitization of pruning/cutting equipment between trees, and immediate painting of tree wounds to prevent contact by contaminated insects (Texas Forest Service 2010). LCRA TSC will utilize the LCRA Oak Wilt Prevention Policy, which is based on Texas Forest Service guidelines, when undertaking any Covered Activities potentially impacting oak trees (LCRA 2006).

3.7.3 Wildlife

The Permit Area lies within the Balconian Biotic Province as delineated by Blair (1950). The limits of this biotic province are essentially the same as the limits of the Edwards Plateau. The vertebrate communities of the Balconian Biotic Province are primarily a combination of species from adjacent biotic provinces, with those defined by Blair (1950) as Austroriparian, Chihuahuan, Kansan, and Tamaulipan. This means that the vertebrate fauna of the Balcones Biotic Province is essentially a mix of species that are variously also found in eastern forests, grasslands of the Great Plains, southwestern deserts, and the thornscrub of South Texas and northeastern Mexico.

As described by Blair (1950), no species of mammal, reptile, frog, or toad are endemic to the Balconian Biotic Province. Review of range maps provided in Sibley (2000) indicates that the province also has no endemic species of birds. Because of its unique karstic limestone geology, the Balconian Biotic Province does claim endemic salamander and fish fauna (Blair 1950, Thomas *et al.* 2007).

Wildlife habitats within the Permit Area generally correspond to the vegetation types described in Section 3.7.2. Because the Permit Area also encompasses some communities, towns, and small cities, some of the wildlife species that are known or expected to occur in the region are typical of those encountered in areas of human inhabitations. Aquatic habitats within the Permit Area include reservoirs, rivers, creeks, ponds, stock tanks, springs, and, within the Llano Uplift

region, the potential for vernal pools (Poole *et al.* 2007). Aquatic habitats provide habitat for fish, water birds, aquatic mammals, amphibians, some snakes, mollusks, and a variety of arthropods, and also provide a source of drinking water for many non-aquatic species. The following paragraphs discuss common or typical wildlife species that are known or likely to occur within the Permit Area.

3.7.3.1 Fishes

Most of Texas, including the Permit Area, provides many recreational fishing opportunities in various freshwater streams and reservoirs. Widespread and popular freshwater sport fish in Texas include largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), white crappie (*Pomoxis annularis*), black crappie (*Pomoxis nigromaculatus*), various sunfish (*Lepomis* spp.), white bass (*Morone chrysops*), striped bass (*Morone saxatilis*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis olivaris*), and blue catfish (*Ictalurus furcatus*) (TPWD 2009a). Other widespread freshwater fish in Texas include native, nonsport fish such as the longnose gar (*Lepisosteus osseus*), spotted gar (*Lepisosteus oculatus*), and the introduced common carp (*Cyprinus carpio*), as well as small fish such as shiners (*Notropis* spp. and *Cyprinella* spp.) and darters (*Etheostoma* spp.) (TPWD 2009a, Thomas *et al.* 2007).

Nearly all the Permit Area lies within the Colorado River basin; however, a small portion of the Permit Area lies within the Guadalupe River watershed.

3.7.3.2 Amphibians and Reptiles

According to Blair (1950), the Balconian Biotic Province supports more species of urodele amphibians (salamanders and newts) than any other biotic province in the state except for the Austroriparian Biotic Province. Much of this diversity is restricted to the Balcones Canyonlands ecoregion, where several spring-dwelling or aquifer-dwelling neotenic (retention of juvenile characteristics) salamander species occur. No species of newt are known or expected to occur in the Permit Area (Dixon 2000). Because most of the Permit Area contains comparatively xeric uplands, salamanders are expected to be localized in occurrence and decrease in abundance from east to west as average annual rainfall decreases and habitats become overall more xeric. Non-neotenic salamanders within the Permit Area are expected to be limited in occurrence to humid environments such as bottomland or mesic canyon woodlands and near-surface karst features, and aquatic habitats such as stock tanks. Neotenic spring salamanders are known to occur in Gillespie, Kendall, and Kerr counties (Dixon 2000). Neotenic salamanders could occur within the Permit Area in those counties if appropriate spring or cave habitats are present.

Within the Permit Area, frogs are expected to largely be restricted to aquatic habitats such as creeks and the margins of ponds. Cliff chirping frogs (*Syrrhophus marnockii*) occur in humid, rocky upland environments, and leopard frogs (*Lithobates* sp.) can occur in wet pastures some distance from water. Toads, which are better adapted to terrestrial conditions, are expected to occur widely and in a variety of upland and lowland habitats throughout the Permit Area. Blair (1950) indicates that 16 species of lizard were known to occur in the Balconian Biotic Province at that time. Most species of lizards and snakes occurring in the Permit Area are species that are comparatively widespread in the western United States (Blair 1950). In general, lizards are expected to occur most commonly in open or semi-open areas where ground cover includes patches of bare ground. The exceptions being the non-native Mediterranean gecko

(*Hemidactylus turcicus turcicus*), which is largely restricted to cultural areas, and woodland dwelling species such as Texas spiny lizard (*Sceloporus olivaceus*), green anole (*Anolis carolinensis*), and Texas alligator lizard (*Gerrhonotus liocephalus infernalis*). One lizard of the Permit Area, the Texas horned lizard (*Phrynosoma cornutum*), has disappeared or become extremely uncommon across much of its former range in the state. This species is discussed in more detail in Section 3.7.6.7 under State Special Status Species).

According to Blair (1950), 36 species of snake were known to occur at that time in the Balconian Biotic Province. Snakes in general are expected to occupy nearly all types of habitats present in the Permit Area. Across the Permit Area from east to west as average annual rainfall decreases, it is expected that some species will decrease in relative abundance while other species increase. Species of snake expected to be relatively common throughout the Permit Area include checkered garter snake (*Thamnophis marcianus marcianus*), Texas patchnose snake (*Salvadora grahamiae lineata*), bullsnake (*Pituophis catenifer sayi*), western coachwhip (*Masticophis flagellum testaceus*), and western diamond-backed rattlesnake (*Crotalus atrox*).

Most turtles in the Permit Area are expected to occur in close association with aquatic habitats such as rivers, creeks, reservoirs, stocktanks, and ponds. Two species of map turtle expected to occur along rivers in the Permit Area, Cagle's map turtle (*Graptemys caglei*) and Texas map turtle (*G. versa*), are endemic to central Texas. The former is restricted to the Guadalupe River watershed and the latter to the Colorado River watershed. Cagle's map turtle was formerly a candidate for Federal listing as threatened or endangered and is discussed further in Section 3.7.6.6, State Special Status Species. One terrestrial turtle, the ornate box turtle (*Terrapene ornata*), may occur in appropriate habitat throughout the Permit Area.

3.7.3.3 Birds

The Permit Area occurs within a landscape supporting a diverse avifauna that includes many permanent resident species, as well as migratory species that typically are present in the region only during the breeding or non-breeding seasons. Many other bird species that breed and winter outside of the Permit Area can occur regularly in the region during the spring and fall migration periods. A smaller number of bird species recorded in the area occur on an irregular or rare basis, with most of these species being migrants that usually pass east or west of the Permit Area, birds that usually winter farther north or west, or individuals of species whose breeding ranges lie south of the Permit Area that on very rare occasion travel northward for some reason.
The status of birds within the Permit Area is studied regularly by volunteers through participation in Breeding Bird Surveys (BBSs) and Christmas Bird Counts (CBCs). BBSs are conducted across the United States and Canada and are coordinated jointly by the USGS and Canadian Wildlife Service. These surveys are performed by driving routes that are 24.5 miles long, with the surveyor stopping every 0.5 mile to count all birds seen or heard at that stop. Five BBS routes are surveyed regularly in the Permit Area. Two of these, identified by the USGS as Wall and Eldorado, occur in relative proximity to the Twin Buttes–Big Hill transmission line route. Three BBS routes occur in the proximity of the Big Hill–Kendall transmission line; these are identified by the USGS as the Allen, Boerne, and Harper routes. BBS data (USGS 2010b) and Lockwood (2001) were reviewed to characterize the breeding birds of the Permit Area.

3.7.3.3.1 Migratory Birds

The discussion of birds in the previous section concentrated primarily on those species expected to breed or winter in the Permit Area. However, the Permit Area lies within the Central Flyway, used by many species of migratory birds as they travel to and from their wintering grounds in Texas, Mexico, or Central or South America (TPWD 2007). Consequently, many species of birds that do not breed or winter in the Permit Area occur regularly in the region during the spring and/or fall migration periods.

As of August 2010, 637 species of birds have been accepted by the Texas Bird Records Committee as having had occurred in the State of Texas (Texas Bird Records Committee 2010). Lists of the bird species expected to occur within the Permit Area can be found in the Technical Report prepared by SWCA (SWCA 2011b), which is included in the administrative record for this EA.

3.7.3.4 Mammals

At least 184 species of mammals are expected to occur in the wild in Texas (Schmidly 2004). Fifty-seven species were known to occur in the biotic province at the time of Blair (1950), with 66 native species now perhaps occurring regularly in the province based on range maps and county records produced by Schmidly (2004). A few additional species of native mammals (e.g., American black bear [*Ursus americana*] and some bats) likely range into the biotic province on occasion, and several introduced species of free-roaming hooved mammals occur in the province. Not all mammal species expected to occur in the Balconian Biotic Province are known or expected to occur in the Permit Areas.

Comparatively few species of mammals were observed by SWCA along the approved transmission line routes during its 2010 and 2011 inspections of those routes. Some mammals occurred historically in the Permit Area but have since been extirpated from the State of Texas (e.g., red wolf [*Canis rufus*]), and there are some species that have been recorded historically in the Permit Area, but have only a remote chance of re-occurrence (e.g., jaguar [*Panthera onca*]). Several species of exotic game animals are known to be kept on Hill Country ranches within the Permit Area but are not discussed in this document.

Perhaps the most conspicuously abundant small mammal occurring in the Permit Area is the Brazilian (Mexican) free-tailed bat (*Tadarida brasiliensis mexicana*). Brazilian free-tailed bat is a migratory species that is largely absent from the Permit Area during the winter months (Schmidly 2004). During the spring and summer, this species breeds in colonies that can number in the millions of individuals. The nightly emergences of Brazilian free-tailed bats from some breeding sites in central Texas have become tourist attractions. One major colony of Brazilian free-tailed bats is known to occur in the Permit Area. The Old Tunnel Wildlife Management Area (WMA) is owned and managed by the TPWD. The WMA is located in northwest Kendall County and hosts up to three million Brazilian free-tailed bats and 3,000 cave myotis (*Myotis velifer*) annually (TPWD 2009b).

A variety of other bat species occur in the Permit Area, with some expected to occur only as migrants. Bats as a rule are difficult to study because of their nocturnal habits and because non-colonial, non cave-dwelling bats are rarely encountered during the day when roosting. Seven

species of bats are expected to occur throughout the Permit Area, although for many of those species this expectation is inferred from limited county records obtained from within and surrounding the Permit Area.

3.7.4 Covered Species

Covered Species are those species for which incidental take authorization is being sought by LCRA TSC during the construction, operation, repair, and maintenance of its Priority Projects. These species include the federally listed endangered GCWA and BCVI. Both are songbirds that are known to breed in portions of the Permit Area. The following section summarizes the Covered Species' status, distribution, and habitat.

3.7.4.1 GCWA

The golden-cheeked warbler (*Dendroica chrysoparia*, GCWA) was emergency listed as endangered on May 4, 1990 (55 FR 18844). The final rule listing the species was published on December 27, 1990 (55 FR 53160). No critical habitat is designated for this species. LCRA TSC is seeking incidental take coverage for this species during performance of its Covered Activities. See Section 2.4.1.1 of the FHCP for a more detailed description.

3.7.4.1.1 Seasonal Status, Distribution, and Habitat

The breeding range of the GCWA is largely restricted to woodlands of the Edwards Plateau and Cross Timbers regions of central and north-central Texas. The GCWA Recovery Plan depicted the breeding range of the species as encompassed in a 35-county area (Service 1992). Since that time, GCWAs have been found outside the 35-county area in Dallas, Jack, and Young counties.

Most GCWAs arrive on their breeding grounds in early to mid-March, with the females typically arriving a bit later than the males. GCWA breeding habitat typically consists of relatively dense and mature woodland composed of a combination of Ashe juniper and broad-leafed hardwood tree species, especially oaks such as Texas red oak and plateau live oak. Mature Ashe juniper is a requisite component of GCWA habitat as the birds use strips of bark from these trees to construct their nests.

GCWAs generally begin their migration south in July or early August and winter in the highlands of southern Mexico and northern Central America (Service 1992). Winter habitat requirements are not well understood but research by Rappole *et al.* (1999, 2000) indicates that GCWAs prefer oak or oak/pine woodlands occurring at elevations between approximately 3,600 to 7,900 feet.

3.7.4.1.2 Threats

The greatest threat to the continued existence of the GCWA is habitat loss resulting from urbanization and clearing associated with agricultural practices (Service 1992). The birds are affected both directly by loss of habitat and indirectly by influences associated with habitat fragmentation and reduction in habitat patch sizes. Populations of GCWAs also appear to be less stable in small habitat patches surrounded by development (Coldren 1998, Engels 1995, Arnold *et al.* 1996, Moses 1996). Some studies indicate that the abundance of the GCWA is reduced within 656 to 1,640 feet of an urban edge (Engels 1995, Arnold *et al.* 1996, Coldren 1998).

Coldren (1998) reported that warbler occupancy declined with increasing residential development and roadway width.

GCWAs, like most North American songbirds, are subject to nest parasitism by brown-headed cowbirds (*Molothrus ater*) and predation or nest depredation by a variety of predators. Known and suspected predators on GCWAs include Texas rat snakes (*Pantherophis obsoletus*), Great plains rat snakes (*Pantherophis emoryi*), American crows (*Corvus brachyrhynchos*), western scrub-jays (*Aphelocoma californica*), blue jays (*Cyanocitta cristata*), and, in the case of nestlings, red imported fire ants (*Solenopsis invicta*) (Service 1992, Ladd and Gass 1999, Stake *et al.* 2004, Service 2004, Peak 2007, Reidy *et al.* 2009).

The EPA recently identified the GCWA as highly vulnerable to climate change (EPA 2009). This designation was based on modeling that included, among others, factors such as population size, historic trends in population and range size, estimated physiological vulnerability to temperature and precipitation change, and likely extent of habitat loss due to climate change. Data used by the model concerning trends in warbler population and range was almost two decades old and may no longer reflect current conditions. Nonetheless, GCWAs appear much more vulnerable to climate-change related impacts than many other species given that their breeding range has a restricted latitudinal extent.

3.7.4.1.3 Population

The Service estimated the GCWA population as of 1990 to be approximately 13,800 territories (Service 1992) based largely on the work of Wahl *et al.* (1990). This estimate was based on availability of suitable habitat as assessed through examination of satellite imagery taken in the 1970s and early 1980s (Wahl *et al.* 1990). Wahl *et al.* (1990) estimated that approximately 834,946 acres of GCWA habitat were extant at that time.

Habitat loss has continued since the warbler was listed as endangered as suburban developments spread into GCWA habitat along the Balcones Escarpment, especially in a growth corridor from Austin to San Antonio between Interstate Highway 35 and U.S. Highway 281. At the same time, grazing and browsing pressure by goats has been reduced greatly in rural areas. The decline in number of goats on the rural landscape of the Edwards Plateau over the past 50 years, and consequent reduction in browsing pressure appears to have allowed Ashe juniper/oak woodland to develop on many lands that were formerly kept cleared of trees and brush to facilitate goat production.

Morrison et al. (2010), Loomis-Austin, Inc. (2008), and Diamond (2007) all mapped potential GCWA habitat, but limited their mapping to the 35-county area identified in the Recovery Plan as the breeding range of the GCWA. However, in all cases, the results of their mapping efforts depict potential GCWA habitat extending right up to the western and northern edges of the 35-county area. This suggests that GCWAs may now occur in some counties outside of the 35-county area beyond just Dallas, Jack, and Young. Other counties that appear likely candidates for warbler occurrence outside the 38-county area include McCulloch, Mills, Parker, Sutton, and Val Verde. It is doubtful though that any of these counties support more than a small number of GCWAs.

3.7.4.1.4 Recovery

The GCWA Recovery Plan (Service 1992) divided the range of the species into eight recovery regions and identified a goal of protecting a viable breeding population in each of the regions as a criterion of recovery. The Permit Area lies within portions of GCWA Recovery Regions 3, 4, 5, 6, and 7. According to a population and viability analysis a viable population may need to be as large as 1,000 pairs in un-fragmented habitat and 3,000 pairs in fragmented habitat (Service 1996a, Alldredge *et al.* 2002).

Since the time of listing, several conservation actions have occurred or have been initiated that have resulted in, or are expected to result in, the preservation of substantial amounts of GCWA habitat. These include, but are not limited to, the establishment of the Balcones Canyonlands National Wildlife Refuge (BCNWR) in Burnet, Travis, and Williamson counties; the Balcones Canyonlands Preserve (BCP) in Travis County; the Williamson County Regional Habitat Conservation Plan; the pending Hays County and Comal County regional habitat conservation plans; the conceptual Southern Edwards Plateau Regional Habitat Conservation Plan; and acquisition of the Morton Tract by Comal County. The Nature Conservancy and other private conservation organizations such as Environmental Defense Fund and Texas Land Conservancy also hold or manage lands that protect GCWA habitat. In addition, several private conservation banks for the species have been established or are under development. Protected populations of the GCWA by recovery region are identified in Table 3.5. This table provides the number of male GCWAs occurring on the identified properties where known. Population numbers for state parks and state natural areas were provided by Mark Lockwood of the TPWD, with these numbers based on surveys that, except for Kickapoo Cavern State Park, were performed from 10 to 15 years ago. Numbers for Kickapoo Cavern State Park are based on recent surveys.

The amount of potential GCWA habitat present in each of the eight recovery regions as identified by Loomis-Austin, Inc. (2008), Diamond (2007), Morrison *et al*. (2010), and Wahl *et al*. (1990) is presented in Table 3.3. Loomis-Austin, Inc. subdivided the potential habitat identified by its model into three categories: potential habitat not likely to be occupied, potential habitat that may be occupied, and potential habitat likely to be occupied. Table 3.3 provides both the total amount of potential GCWA habitat identified in each recovery region by Loomis-Austin, Inc., and the amount of habitat identified as likely to be occupied. Acreages presented for Diamond were obtained from Diamond Model C, which used forest/woodland cover as identified in the USGS National Land Cover Dataset as adjusted to account for patch size and edge effects (Diamond 2007). Wahl *et al*. (1990) provided its habitat acreages on a county-by-county basis as it was prepared prior to listing of the species and preparation of the Recovery Plan. Several counties are split by recovery region boundaries. To present the Wahl *et al*. (1990) data in Table 3.3, habitat from split counties was assigned to whichever recovery region in which the majority of the county occurs. Wahl *et al*. (1990) identified small amounts of potential warbler habitat in Comanche, Guadalupe, McCulloch, Mills, and Sutton counties. These totals were included in their adjacent recovery regions. Note that Table 3 in Wahl *et al*. (1990), which presents total amount of potential warbler habitat on a county-by-county basis, identifies a total habitat acreage (835,969 acres) that differs from the 834,946 acres used herein, which was derived by summing the individual county totals presented in Table 3.3 of Wahl *et al*. (1990).

While Table 3.3 indicates that the amount of potential GCWA habitat in each recovery region appears to have increased greatly since the Wahl *et al*. (1990) study, the most striking increase is seen in Recovery Region 1, where the amount of potential habitat identified by Wahl *et al*. was a mere 195 acres. Table 3.4 provides the amount of potential GCWA habitat identified by Diamond (2007) by Permit Area county and GCWA recovery region. County-by-county totals of potential habitat were not provided by Loomis-Austin, Inc. (2008) or Morrison *et al*. (2010).

3.7.4.1.5 Status in the Permit Area

The Service and the TPWD Natural Diversity Database (NDD) have few records of the GCWA from the counties of the Permit Area outside of those made on state-owned lands (TPWD 2010c). In general, GCWAs are considered likely to occur in all woodlands of appropriate structure, tree species composition, and extent within the Permit Area.

Table 3.3 Acres of Potential GCWA Habitat as Identified by Loomis-Austin, Inc. (2008), Diamond (2007), Morrison *et al*. (2010), and Wahl *et al*. (1990) by Recovery Region

Recovery Region	Potential GCWA Habitat (Ac.)				
	Loomis-Austin, Inc.		Diamond	Morrison *et al.*	Wahl *et al.*
	Total	Likely to be Occupied			
1	389,155	90,653	372,559	280,783	195
2	488,549	64,929	350,548	369,236	29,781
3	501,864	65,854	412,788	414,427	48,113
4	400,654	85,449	627,994	597,862	52,260
5	601,307	188,291	514,104	628,790	240,645
6	689,259	242,625	769,581	389,436	160,703
7	460,728	137,534	481,190	695,726	124,700
8	617,961	289,228	1,245,432	771,879	178,549
Range-wide Total	**4,149,478**	**1,164,563**	**4,774,196**	**4,148,138**	**834,946**

Table 3.4. Acres of Potential GCWA Habitat by Permit Area County and Recovery Region as Identified by Diamond (2007); Counties Lacking Such Habitat Are Not Included

County	Recovery Region					
	3	4	5	6	7	Total
Gillespie	---	92,510	---	91,208	---	183,718
Kendall	---	---	---	138,646	---	138,646
Kerr	---	---	---	138,005	110,786	248,791
Kimble	---	---	---	---	169,935	169,935
Total						**741,090**

Table 3.5. Number of GCWAs Occurring on Protected Lands by Recovery Region

Property[1]	County	Ownership	No. of Male GCWs[2]
Recovery Region 1			
Possum Kingdom SP	Palo Pinto	State	10
Recovery Region 2			
Dinosaur Valley SP	Somervell	State	10–15
Meridian SP	Bosque	State	15
Recovery Region 3			
Fort Hood MR	Bell, Coryell	Federal	4,514
Recovery Region 4			
Canyon of the Eagles	Burnet	LCRA	9–14
Colorado Bend SP	Lampasas, San Saba	State	35–40

Table 3.5. Number of GCWAs Occurring on Protected Lands by Recovery Region

Property[1]	County	Ownership	No. of Male GCWs[2]
Recovery Region 5			
Balcones Canyonlands NWR	Burnet, Travis, Williamson	Federal	800–1,000
Balcones Canyonlands Preserve	Travis	City of Austin, Travis County, The Nature Conservancy, LCRA,	100s
Hickory Pass Ranch Conservation Bank	Burnet	Private	?
Lake Georgetown	Williamson	Federal	37
Pedernales Falls SP	Blanco	State	40
Recovery Region 6			
Camp Bullis MR	Bexar	Federal	73–130
City of San Antonio Natural Areas	Bexar	City of San Antonio	10s?
Government Canyon SNA	Bexar	State	70
Guadalupe River SP / Honey Creek SNA	Comal	State	30
Indian Springs / Cibolo Canyon	Bexar	Private	16–17
Majestic Ranch	Bexar	Private	19
Morton Tract	Comal	Comal County	?
Recovery Region 7			
Kerr WMA	Kerr	State	?
South Llano River SP / Walter Buck WMA	Kimble	State	?
Recovery Region 8			
Garner SP	Uvalde	State	16
Hill Country SNA	Bandera	State	22
Kickapoo Cavern SP	Edwards, Kinney	State	15–20
Love Creek Preserve	Bandera	The Nature Conservancy	?
Lost Maples SNA	Bandera	State	115

[1] MR = Military Reservation; NWR = National Wildlife Refuge; SNA = State Natural Area; SP = State Park; WMA = Wildlife Management Area

[2] Sources: DLS Associates (1992), LCRA (2010c), Peak (2003), Kuhl (2007), Lockwood (2010), SWCA (2009, 2010), Service (2005)

3.7.4.2 BCVI

3.7.4.2.1 Seasonal Status, Distribution, and Habitat

The black-capped vireo (*Vireo atricapilla*, BCVI) was federally listed as endangered in 1987 (52 FR 37420). No critical habitat has been designated for this species. LCRA TSC is seeking incidental take coverage for this species during performance of its Covered Activities. See Section 2.4.1.2 of the FHCP for a more detailed description.

In Texas, the BCVI breeds primarily in the Cross Timbers, Edwards Plateau, and the Trans Pecos regions of the state. BCVIs also breed in a few localities in central Oklahoma, and in the states of Coahuila, Nuevo Leon, and Tamaulipas, Mexico (Service 1991, Grzybowski 1995, Farquhar and Gonzalez 2005). This species winters primarily on the Pacific slope of Mexico, mostly from southern Sonora south to Guerrero (Grzybowski 1995). Most BCVIs arrive on their breeding grounds in Texas in late March or early April.

Typical breeding habitat for the BCVI consists of mostly deciduous shrublands with woody vegetation of irregular height and distribution, with clusters of shrubs separated by narrow clearings (Grzybowski 1995). Larger trees may be present in areas occupied by BCVIs, although the canopy layer is typically open. Shrublands occupied by vireos usually, but not exclusively, develop on limestone substrates (Campbell 2003a). Across most of the range of the species, vegetation used by BCVIs is an early successional habitat that develops in response to disturbance, especially fire (Graber 1961, Grzybowski 1995, Campbell 2003a).

3.7.4.2.2 Threats

Primary threats to the BCVI include direct destruction of breeding habitat, loss or deterioration of breeding habitat through natural processes, low reproductive success, and indirect effects of land use on breeding grounds (Service 1991, Campbell 2003a). Low reproductive success has been attributed to high rates of nest parasitism by brown-headed cowbirds and nest predation by red imported fire ants, Texas rat snakes, and other species. Habitat loss occurs through clearing of land for ranching or other agricultural practices, browsing of low-level vegetation by goats and other domestic animals, and clearing for residential developments, road construction, placement of utilities, and other land use projects.

It is believed that BCVI habitat, at least in the eastern portion of the species' range, developed historically in response to wildfire. Suppression of wildfire likely causes potentially suitable BCVI habitat to develop at rates below those of historical times, and at rates that lag behind the rates at which habitat grows out of suitability for the species. Impacts to wintering habitat are thought to be relatively understudied (Grzybowski *et al*. 1994). A recent study by Powell and Slack (2006) found that clearing of brush for grazing and/or other agricultural purposes was common throughout the Mexico winter range, but did not conclude that such disturbance "could be considered a serious problem for the species." This study also indicated that the species is more of a habitat generalist on the wintering grounds than it is during the breeding season.

3.7.4.2.3 Population

The total BCVI population is unknown. Much of the range of the species in Texas and Mexico lies on privately held lands that have not been surveyed. BCVI habitat is difficult to identify from satellite imagery or aerial photography because the shrubs that make up their habitat are difficult to discern from that distance. However, the Service (2004) using Wilkins *et al*. (2006) and Maresh and Rowell (2000) estimate the total amount of potentially suitable BCVI habitat present in Texas to be 1,450,438 acres. Populations of the BCVI in Oklahoma and Texas appear to be increasing and the Mexican population may be greater and distributed more widely than was thought at the time of listing.

The BCVI Recovery Plan (Service 1991) estimated the total number of male BCVIs known to occur in Oklahoma and Texas was on the order of 1,000. By 1995, the number of male BCVIs known to occur in Oklahoma and Texas was around 1,800 (Service 1996b). The known population of male BCVIs rangewide was reported as 6,269 by Wilkins *et al*. (2006) in a population status report prepared for the Service, with 6,010 of those occurring in Texas and Oklahoma. This number was derived using 2003 BCVI population data from Fort Hood. Replacing the Fort Hood numbers provided in Wilkins *et al*. (2006) with an extrapolated 2010 population estimate of approximately 4,500 males from Fort Hood (Cimprich and Comolli 2010)

and approximately 6,000 males from Oklahoma (Grzybowski *et al*. 2010) yields a possible population of approximately 12,427 males.

The BCVI population in Mexico is poorly known and was considered limited to Coahuila as of 1995 (Service 1996b). Surveys by Farquhar and Gonzalez (2005) indicated presence of high densities of BCVIs in northern Coahuila. Studies from 2001 through 2005 confirmed presence of BCVIs in Nuevo Leon and Tamaulipas, and it was considered promising that the species was also in San Luis Potosi (Farquhar and Gonzalez 2005). Farquhar and Gonzalez (2005) also reported on the presence of BCVI in southwestern Tamaulipas. Based on that work, Wilkins *et al*. (2006) presented the known Mexican population of BCVI as 259 males.

Five BCVI breeding populations of 100 pairs or more receive some degree of protection. These include those vireos breeding at Wichita Mountains National Wildlife Refuge and the adjacent Fort Sill in southwest Oklahoma; and in Texas, those at Fort Hood Military Reservation in Coryell and Bell counties; those on the BCNWR; those at Kerr Wildlife Management Area, Kerr County; and those at Devils River State Natural Area and adjacent Dolan Falls Ranch Preserve of The Nature Conservancy in Val Verde County.

Also based on Wilkins *et al*. (2006), BCVI populations ranging from 10 to 100 pairs that receive some form of protection occur at Colorado Bend State Park in Lampasas and San Saba counties, the LCRA Canyon of the Eagles property in Burnet County, the BCP in Travis County, Camp Bullis Military Reservation and the City of San Antonio Rancho Diana property in Bexar County, Walter Buck Wildlife Management Area in Kimble County, Mason Mountain Wildlife Management Area in Mason County, Kickapoo Caverns State Park in Edwards and Kinney counties, and Big Bend National Park in Brewster County, as well as on some privately managed properties scattered across the Texas range of the species. Small numbers of BCVIs, perhaps less than 10 pairs each, also occur at Hill Country and Lost Maples State Natural Areas in Bandera County, and South Llano River State Park, Kimble County.

3.7.4.2.4 Recovery

The BCVI Recovery Plan divided the Texas breeding range of the vireo into six regions (Service 1991). All counties of the Permit Area lie within the breeding range of the BCVI, with most of the Permit Area falling into Recovery Region 3 and smaller portions of it lying in Recovery Regions 2 and 4.

Because of gaps in knowledge of the biology, ecology, and population status of the BCVI at the time of its preparation, the Recovery Plan does not identify criteria for delisting of the species. Instead, it states that the vireo will be considered for downlisting to threatened when: 1) all existing populations are protected and maintained; 2) at least one viable breeding population exists in Oklahoma, Mexico, and four of the six recovery regions delineated in Texas; 3) sufficient and sustainable area and habitat on the winter range exists to support the breeding populations; and 4) the previous three criteria have been maintained for at least five consecutive years and available data indicate that they will continue to be maintained.

"Viable population" is defined in the Recovery Plan as 500 to 1,000 breeding pairs of vireos (Service 1991). A population and habitat viability assessment performed for the vireo indicated

that the vireo has a very low probability of going extinct even in a population of 200 to 400 breeding pairs if fecundity of ≥1.25 female offspring per female is achieved, either naturally or through management (Service 1996b). As of 2010, viable populations of BCVIs, as defined by the Recovery Plan, were known to be present in Oklahoma and in Texas in Recovery Region 2 at Fort Hood (Cimprich 2005, Kostecke *et al*. 2010, Grzybowski *et al*. 2010).

A 5-year status review of the BCVI summarizing the work of Wilkins *et al*. (2006) was produced by the Service in 2007. Based on known increases in populations in Texas and Oklahoma, improved knowledge of the status of the species in Mexico, success of conservation measures, and changes in magnitude of threats to the species, the Service in this review recommended that the BCVI be downlisted to threatened (Service 2007a).

Table 3.6 provides the known male vireo population of each of the Texas recovery regions occurring in the LCRA TSC Permit Area as reported by the Service (2004), Wilkins *et al*. (2006), and Maresh (2005). The great difference between the numbers of BCVIs present in Recovery Region 2 as identified by the Service (2004) and Wilkins *et al*. (2006) and those as identified by Maresh (2005) results from the Service and Wilkins *et al*. having used 2003 population data from Fort Hood that were limited to the number of BCVIs actually counted during surveys, and Maresh having used a 2005 population estimate that was extrapolated up from known BCVI numbers based on a delineation of perceived available habitat.

Table 3.6. Known Male BCVI Population by Recovery Region

Recovery Region	Reported BCVI Population		
	Service (2004)	Wilkins *et al*. (2006)	Maresh (2005)
2	2,011	2,090	5,162
3	1,084	1,019	647*
4	31	148	27

*Maresh (2005) omitted the Kerr County population in his total for Recovery Region 3, which was reported as 435 by Service (2004) and 436 by Wilkins *et al*. (2006).

The large majority of vireos (1,847 of 2,090 or 88.4 percent) attributed by Wilkins *et al*. (2006) to Recovery Region 2 occurred on Fort Hood. A little over half (568 of 1,019 or 55.7 percent) of the vireos attributed by Wilkins *et al*. (2006) to Recovery Region 3 occur in counties of the Permit Area, although 559 of the 568 vireos (98.4 percent) occurred on state parks or wildlife management areas not anticipated to be crossed by either of the Priority Projects. Of the 148 male vireos attributed by Wilkins *et al*. (2006) to Recovery Region 4, 125 (84.5 percent) occurred outside the Permit Area in Taylor County. Six of the 148 occurred in Tom Green County, but are not known to occur along the Priority Projects.

3.7.4.2.5 Status in the Permit Area

The Service and the TPWD NDD have records of BCVI from the Permit Area. Most BCVI records occur in the general region that would be crossed by the Big Hill–Kendall transmission line. The Service and TPWD NDD have no vireo records from Schleicher County. However, based on information provided to LCRA TSC, it appears that a TPWD biologist recorded two BCVIs on a private property in southeastern Schleicher County in response to a landowner request for technical guidance (TPWD 2009c).

Table 3.7 provides the known male BCVI population for the counties encompassed by the Permit Area as reported by the Service (2004), Wilkins *et al*. (2006), and Maresh (2005), as well as the amount of potentially suitable vireo habitat identified by the Service (2004) as occurring in each of these counties. Service estimates of the extent of potential BCVI habitat present in each Texas county were based on extrapolation of data collected along public roadside transects and, for Dallas County only, review of aerial photography (Service 2004). The actual number of BCVIs occurring in many, if not all, of the counties of the Permit Area is likely greater, but private lands in Texas are rarely visited by people that would submit records of BCVI observations to the Service or TPWD.

Table 3.7. Known Male BCVI Population and Amount of Potentially Suitable Vireo Habitat by Permit Area County

County	Reported BCVI Population			Potentially Suitable Habitat (ac)[1]
	Service (2004)[2]	Wilkins *et al*. (2006)	Maresh (2005)[3]	
Recovery Region 3				
Gillespie	0	0	0	58,826
Kendall	0	0	0	4,945
Kerr	435	436	n/a[‡]	53,074
Kimble	35	35	35	36,001
Schleicher	0	0	0	1,397
Sutton	1	1	1	46,498
Recovery Region 4				
Tom Green	6	6	4	17,851

[1] Source: Service (2004)
[2] Service (2004) reported a population occurring at the BCNWR in Burnet, Travis, and Williamson counties as an undifferentiated "at least 100 pairs." It is assumed here that 57 of those pairs were in Burnet County based on that number of pairs being identified by Wilkins *et al*. (2006) and Maresh (2005) on the NWR in Burnet County based on a 2002 citation. Service (2004) also reported 23 pairs occurring at another Burnet County location.
[3] Maresh (2005) omitted the Kerr County population from his report.

3.7.5 Evaluation Species

"Evaluation Species" are federally listed, candidate, proposed, recently delisted, and petitioned species evaluated in the FHCP (Table 3.8). Some of these species are also listed as threatened or endangered by the State of Texas. As stated in its FHCP, LCRA TSC does not anticipate the need for incidental take coverage for any Evaluation Species at this time because Covered Activities are not anticipated to cause take of Evaluation Species. The status of the Evaluation Species is summarized in the following paragraphs.

Table 3.8. Evaluation Species in the FHCP

Common Name	Scientific Name	Status[1]	
		Federal	State
Birds			
Bald eagle	*Haliaeetus leucocephalus*	D	T
Least tern	*Sternula antillarum*	E	E
Sprague's pipit	*Anthus spragueii*	C	
Whooping crane	*Grus americana*	E	E
Mammals			
Ocelot	*Leopardus pardalis*	E	E
Reptiles			
Fishes			

Table 3.8. Evaluation Species in the FHCP

Common Name	Scientific Name	Status[1]	
		Federal	State
Freshwater Mussels			
False spike	*Quadrula mitchelli*	PL	T
Golden orb	*Quadrula aurea*	PL	T
Texas fatmucket	*Lampsilis bracteata*	PL	T
Texas fawnsfoot	*Truncilla macrodon*	PL	T
Texas pimpleback	*Quadrula petrina*	PL	T
Plants			
Tobusch fishhook cactus	*Sclerocactus brevihamatus* subsp. *tobuschii*	E	E

[1] C = Candidate for Federal listing; D = Delisted; E = endangered; PL = Petitioned for Federal listing;; T = threatened

3.7.5.1 Bald Eagle

The bald eagle was listed as endangered in 1967 (32 FR 4001) and downlisted to threatened in 1995 (60 FR 36001). Successful recovery efforts led to its removal from the Federal list of threatened and endangered species on 9 July 2007 (72 FR 37346). Although the bald eagle has been federally delisted, it is protected by the BGEPA and listed by the State of Texas as a threatened species. A distinction between Federal and state protections afforded listed species is that species listed by the State of Texas are not protected against incidental take. Also under state law, habitat modification is not a regulated activity.

Nesting bald eagles in Texas occur mostly in the eastern half of the state, where they typically occur along major rivers or the shores of reservoirs and nest in tall trees (Campbell 2003a). Some bald eagles on the coastal plain in south Texas have used large transmission line towers for nesting in lieu of trees (Ortego *et al*. 2009). Bald eagles have also been documented to use transmission line structures for nesting in Minnesota where tree nest sites were available (Bohm 1988).

For the past several years, pairs of bald eagles have been breeding in central Texas along rivers at scattered locations on the Edwards Plateau and in the Cross Timbers region. Central Texas counties in which bald eagles are nesting, or have nested, since 2002 include Bell, Burnet, Edwards, Kimble, Llano, Mason, and San Saba (Ortego *et al*. 2009, B. Ortego/TPWD pers. comm. to SWCA on 27 January 2010). Bald eagles are distributed in Texas more widely during migration and the winter months. While most do occur in association with aquatic habitats, at these times of year bald eagles will also occur in grassland habitats in the Trans Pecos and Panhandle regions of the state (Campbell 2003a).

Bald eagles are known to occasionally collide with, and be electrocuted by, overhead transmission lines (Manville 2005, Mojica *et al*. 2009). Potential for electrocutions to occur can be reduced greatly by designing transmission line structures in conformance with Avian Power Line Interaction Committee (APLIC) standards (APLIC 2006). With respect to 345kV transmission lines, such as the Priority Projects, the separation between conductors is greater than the wingspan of these species; thus, the possibility that bald eagles would be electrocuted by these lines is diminished significantly.

No bald eagle nests are known from Tom Green or Schleicher counties where the Twin Buttes–Big Hill transmission line route is located, and few nests are known to occur in the counties of the other Priority Project Permit Area (Ortego *et al*. 2009).

3.7.5.2 Least Tern

Least terns that bred inland along major rivers were described as a separate subspecies known as interior least tern (*Sternula antillarum athalassos*). Interior populations of least tern were listed as endangered in 1985, largely owing to concerns over loss of riverine breeding habitat to reservoir and channelization projects and disturbance to nesting habitat caused by recreational use of sand bars (50 FR 21784).

Least terns are known to breed in Texas at sites along the Canadian River, Red River, Prairie Dog Town Fork of the Red River, and the Rio Grande, various sites in north-central Texas in the Trinity River basin, and on the margins of reservoirs in the vicinity of the City of San Angelo, Tom Green County (Campbell 2003a, Lockwood and Freeman 2004, Kasner *et al*. 2005). On their breeding grounds, least terns typically forage comparatively near, and spend their nights at, their breeding colony (Thompson *et al*. 1997, Service 1990a).

Kasner *et al*. (2005) indicated that 10 pairs of terns bred at O.C. Fisher Reservoir in Tom Green County in 1999, and that the species was again observed during the breeding season in 2002 at that reservoir and at Twin Buttes Reservoir. The route selected for the Twin Buttes–Big Hill transmission line runs approximately 6 miles west of O.C. Fisher Reservoir and 2.75 miles west of Twin Buttes Reservoir.

Least terns are considered uncommon to rare migrants across the eastern two-thirds of Texas, becoming increasingly rare to the west (Lockwood and Freeman 2004). As indicated, it is known that least terns breed in Tom Green County (Kasner *et al*. (2005). The least terns that breed in Tom Green County may largely follow the Colorado River corridor when traveling to and from the Gulf Coast, although they could also partially follow the Guadalupe River corridor and travel overland in part to/from Tom Green County.

3.7.5.3 Sprague's Pipit

Sprague's pipit is an uncommon migrant and rare to local winter resident throughout central Texas (Lockwood and Freeman 2004). Migrant Sprague's pipits have potential to occur in appropriate habitat throughout the Permit Area. Tom Green, Schleicher, and Sutton counties, the western two-thirds of Menard County, and the northwestern part of Kimble County have been identified as within the wintering range of this species (Lockwood and Freeman 2004). Accordingly, Sprague's pipits may winter in grassland habitats along the length of the Twin Buttes–Big Hill transmission line route and in the western portion of the Big Hill–Kendall Permit Area.

3.7.5.4 Whooping Crane

The whooping crane was listed as endangered in 1970 with critical habitat designated in 1978, including in and adjacent to Aransas National Wildlife Refuge (ANWR) along the coast of Texas. Whooping cranes are the rarest of the 15 species of cranes in the world. One natural wild population of this species exists, with its members nesting within and directly adjacent to Wood

Buffalo National Park (WBNP) in the Northwest Territories and Alberta provinces of Canada, and wintering at ANWR along the central Texas coast in Aransas, Calhoun, and Refugio counties (Canadian Wildlife Service [CWS] and Service 2007).

The wild population of whooping cranes migrates both spring and fall through a relatively narrow corridor between ANWR and WBNP. The migration corridor follows a nearly straight line through the Great Plains, with the cranes usually traveling through Alberta, Saskatchewan, extreme eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas (CWS and Service 2007). The primary migration corridor is approximately 200 miles wide, although cranes can be pushed east or west of this corridor by unfavorable winds. The Permit Area is outside of this corridor.

Most of the whooping crane observations reviewed by Austin and Richert (2001) occurred less than 0.5 mile from human disturbance, with 32.5 percent of observations occurring less than 0.25 mile from such disturbance. Approximately 58.5 percent of whooping crane observations were recorded more than 2,640 feet away from utility lines. Approximately 22.4 percent of observations were recorded 1,320 to 2,640 feet from utility lines, 16.3 percent were recorded 300 to 1,320 feet away from utility lines, and 2.5 percent were recorded less than 300 feet from utility lines (Austin and Richert 2001).

Stehn and Wassenich (2008) provide the circumstances of each of the 45 known whooping crane/power line collisions. Of the 45 collisions, 9 (20 percent) were incurred within the wild population. The remaining 36 (80 percent) were incurred in a no longer extant Rocky Mountain flock (n = 13), a non-migratory Florida flock (n = 20), and an established flock that migrates between Wisconsin and Florida (n = 3). Seventeen of the 45 collisions (37.8 percent) were with overhead transmission lines, 23 (51.1 percent) were with distribution lines; and 5 (11.1 percent) were with lines of unrecorded type. Of the nine collisions involving birds from the wild population, one was with a transmission line and eight were with distribution lines (Stehn and Wassenich 2008). Three of the nine collisions occurred in Texas, including the collision involving the transmission line, which occurred in 1956 in Lampasas County, and did not result in death of the crane (Stehn and Wassenich 2008).

As of the spring of 2009, whooping cranes have been recorded on 25 occasions outside of the 200-mile wide migration corridor to the north or northwest of the Permit Area. Nearly all of the cranes represented by these 25 records were observed in extensively agricultural areas. All but one of the 25 records was obtained during the fall or winter months, with the one spring record from Gray County in the Panhandle.

Given the pattern of whooping crane records, it is considered possible that at some point in time, whooping cranes could occur almost anywhere within the Permit Area during migratory periods; however, this potential is considered to be very low. This potential is also considered to be much lower in spring than in fall, and to decrease from east to west as distance from the centerline of the migration corridor increases. Whooping cranes are also considered much more likely to occur in the Permit Area flying high overhead than they are to occur on the ground because the Permit Area largely contains rocky and hilly upland habitats, and cranes prefer margins of large reservoirs, any large stock tanks with marshy edges, any croplands occurring in floodplains of

large rivers, and any other extensive croplands or managed pastures, especially if containing or lying close to a stock pond or playa pond.

3.7.5.5 Ocelot

The Permit Area lies outside of what is considered to be the current or potential range of the ocelot, which extends from extreme southern Texas and southern Arizona (although recent documentation in Arizona is sparse) through the coastal lowlands of Mexico to Central America, Ecuador, and northern Argentina (Service 1990b, 2010a). Known occurrences of ocelots in Texas are currently limited to two breeding aggregations in the southern portion of the state in Cameron and Willacy counties (Laack 1991, Navarro-Lopez 1985, Shindle 1995, Tewes and Everett 1986) 240 miles or more from the Permit Area; therefore, this species is not expected to occur in the Permit Area.

3.7.5.8 Freshwater Mussels

Texas contains a diverse assemblage of freshwater mussels, although many of these species have become very rare and some may now have been extirpated from the state (Howells *et al.* 1996, TPWD 2009e). Five rare mussel species are considered Evaluation Species in the FHCP (Table 3.9). All five are known to occur in, are known to have formerly occurred in, or are considered by the Service or TPWD as having potential to occur in, one or more counties of the Permit Area. These five species are identified in Table 3.9 along with the counties of the Permit Area in which they occur, formerly occurred, or are considered to have potential to occur.

The five species were petitioned for Federal listing in June 2007. The Service issued a 90-day finding that the petition presented substantial scientific or commercial information that listing of these six species may be warranted (74 FR 66260). On October 6, 2011, the Service published a 12-month finding stating that listing is warranted; however, the listing is precluded by higher priority actions at this time (76 FR 62166).

All five species are also on the state list of threatened species. Two state-designated freshwater mussel sanctuaries occur within the Permit Area (31 TAC 57.157). One is a segment of Live Oak Creek in Gillespie County from the U.S. Highway 290 bridge downstream to the creek's

Table 3.9. Freshwater Mussels of the Permit Area by County of Known or Potential Occurrence

Common Name	Scientific Name	Federal Status*	Tom Green	Schleicher	Sutton	Kimble	Kerr	Kendall	Gillespie
False spike	*Quincuncina mitchelli*	PL	X			X	X	X	X
Golden orb	*Quadrula aurea*	PL					X	X	X
Texas fatmucket	*Lampsilis bracteata*	PL	X			X	X	X	X
Texas fawnsfoot	*Truncilla macrodon*	PL	X			X			
Texas pimpleback	*Quadrula petrina*	PL	X			X	X	X	X

confluence with the Pedernales River. The second is a segment of the Guadalupe River in Kerr County, from the Upper Guadalupe River Authority Dam downstream to Flat Rock Dam.

Freshwater mussels have a larval stage, during which most species are parasitic and attach themselves to various species of fish, with a few species also using amphibians as hosts or metamorphosing to adulthood without a host (Howells *et al.* 1996, NatureServe 2010). As adults, freshwater mussels live their entire lives in essentially the same spot into which they settled upon conclusion of their larval stage (NatureServe 2010). Primary threats to mussels are species specific but include reservoir construction, water quality degradation, drought and dewatering, flooding, and overharvesting for commercial purposes (76 FR 62166). Information on each of the seven species identified in Table 3.9 is briefly summarized below. A physical description of each mussel species can be found in Howells *et al.* (1996).

3.7.5.8.1 False Spike

False spike occurs, or historically occurred, in rivers in the southern half of Texas. Texas river systems from which this species has been recorded include the Brazos, Colorado, Guadalupe, and Rio Grande (Howells *et al.* 1996). Tributaries of the Colorado River from which the species has been found include the San Saba and Llano rivers (NatureServe 2010), either or both of which could be crossed by the Big Hill–Kendall transmission line. Currently, the species is only known in Texas from the lower San Marcos River, a tributary of the Guadalupe River that lies outside the Permit Area (76 FR 62166). The species has not been recorded in the Concho River or its tributaries (Howells *et al.* 1996, 76 FR 62166), so it seems unlikely that it would occur in creeks expected to be crossed by the Twin Buttes–Big Hill transmission line. It also appears unlikely that it would occur in the South Concho River, which could be crossed near the northern end of the Big Hill–Kendall transmission line in Schleicher County. While it is unlikely, it is considered possible that the species could occur in any medium or larger rivers crossed by the Big Hill–Kendall transmission line.

3.7.5.8.2 Golden Orb

The golden orb is endemic to Texas, where it is known to occur only in river systems of the central portion of the state (Howells *et al.* 1996). Historically, the species was known to occur in the Brazos, Colorado, Frio, Guadalupe, Nueces, and San Antonio River systems (Howells *et al.* 1996), but currently is known to occur only in the upper and central Guadalupe River, the lower San Marcos River (Guadalupe River system), and in Lake Corpus Christi in the Nueces River system (76 FR 62166).

Given the golden orb's currently known range, counties in the Permit Area that have the potential to contain this species are those traversed by the Guadalupe River; that is, Gillespie, Kendall, and Kerr counties. Given the species' historic range, it is prudent to also consider the species as having potential to occur in perennial streams throughout the Permit Area.

3.7.5.8.3 Texas Fatmucket

Texas fatmucket is endemic to the river systems of central Texas. This species occurs, or historically occurred, in the Colorado, Guadalupe, and San Antonio river systems. Within the Colorado system, the species at least historically occurred in the Concho, Llano, and San Saba rivers (Howells *et al.* 1996). The species is currently known to occur in the upper Guadalupe

River in Kerr County and in the Colorado River system in the upper San Saba River (Menard County), the Llano River, Live Oak Creek (Gillespie County), and, possibly, a tributary in Runnels County (76 FR 62166).

This species is also considered to have potential to occur in all perennial creeks and rivers that would be crossed by the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines.

3.7.5.8.4 Texas Fawnsfoot

Texas fawnsfoot is another mussel that is endemic to central Texas river systems. Historically the species occurred in the Brazos, Colorado, and Trinity River watersheds (Howells *et al.* 1996). NatureServe (2010) indicates the species is now known only from the Brazos River system; however, the Service in its 90-day finding indicated a population of approximately 3,000 individuals was recently discovered in the upper Colorado River (76 FR 62166).

No population of this species is known to occur in the Permit Area and it is not expected to occur in the creeks crossed by the approved route for the Priority Projects.

3.7.5.8.5 Texas Pimpleback

The Texas pimpleback is another mussel endemic to the rivers of central Texas. At least historically this species occurred in the Brazos, Colorado, and Guadalupe river systems, with reports from the Colorado system including the Concho, San Saba, and Pedernales rivers (Howells *et al.* 1996, Service 2009a). Currently the species is known from the lower Concho River (Concho County), the upper San Saba River (Menard County), and the upper San Marcos River (Howells *et al.* 1996, Service 2009a, NatureServe 2010).

Given the historic and currently known distribution of this species as well as its habitat preferences, it is possible the species could occur in Spring Creek and Dove Creek, which are crossed by the route selected for the Twin Buttes–Big Hill transmission line.

3.7.5.9 Tobusch Fishhook Cactus

The Tobusch fishhook cactus *(S. brevihamatus* subsp. *brevihamatus*) is a small, inconspicuous cactus of the western Edwards Plateau that was listed as endangered in 1979 (44 FR 64736). The range of this cactus is limited to the western Edwards Plateau of Texas, where it occurs in parts of Bandera, Edwards, Kerr, Kimble, Kinney, Real, Uvalde, and Val Verde counties (Poole *et al.* 2007). Known locations for this species lie relatively close to the Kerr/Gillespie and Kimble/Menard county lines (TPWD 2010c), so it is possible the range of this cactus extends into portions of the Permit Area and the species could occur within one or both of the transmission line corridors.

3.7.6 State Special Status Species

A total of 10 state threatened species and 46 Species of Concern have been identified by the TPWD as occurring in, having occurred in, or having potential to occur in the counties of the Permit Area (Table 3.10). Ten of these species, all Species of Concern, are not likely to occur in the Permit Area for various reasons. These ten species are noted in Table 3.10 (marked with an "X") but not further addressed in this EA. The status of each of the ten *threatened* species is dis-

cussed below. No additional information is provided in this chapter for any of the Species of Concern.

Table 3.10. Texas State Special Status Species for the Counties in the Permit Area

Common Name	Scientific Name	State Status[1]	Not Expected to Occur in Permit Area
Birds			
Baird's sparrow	*Ammodramus bairdii*	SOC	
Common black-hawk	*Buteogallus anthracinus*	T	
Ferruginous hawk	*Buteo regalis*	SOC	
Peregrine falcon	*Falco peregrinus*	T	
Snowy plover	*Charadrius alexandrinus*	SOC	
Western burrowing owl	*Athene cunicularia hypugaea*	SOC	
Zone-tailed hawk	*Buteo albonotatus*	T	
Mammals			
Black bear	*Ursus americanus*	T	
Black-tailed prairie dog	*Cynomys ludovicianus*	SOC	
Cave myotis	*Myotis velifer*	SOC	
Llano pocket gopher	*Geomys texensis*	SOC	
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	SOC	
Plains spotted skunk	*Spilogale putorius interrupta*	SOC	
Swift fox	*Vulpes velox*	SOC	X
White-nosed coati	*Nasua narica*	T	
Reptiles			
Cagle's map turtle	*Graptemys caglei*	T	
Spot-tailed earless lizard	*Holbrookia lacerata*	SOC	
Texas garter snake	*Thamnophis sirtalis annectens*	SOC	
Texas horned lizard	*Phrynosoma cornutum*	T	
Texas tortoise	*Gopherus berlandieri*	T	
Amphibians			
Blanco River Springs salamander	*Eurycea pterophila*	SOC	X
Cascade Caverns salamander	*Eurycea latitans* complex	T	
Comal blind salamander	*Eurycea tridentifera*	T	
Texas salamander	*Eurycea neotenes*	SOC	X
Valdina Farms Sinkhole salamander	*Eurycea troglodytes* complex	SOC	
Fishes			
Guadalupe bass	*Micropterus treculii*	SOC	
Guadalupe darter	*Percina sciera apristis*	SOC	X
Headwater catfish	*Ictalurus lupus*	SOC	X
Invertebrates			
Bifurcated cave amphipod	*Stygobromus bifurcatus*	SOC	
Cascade Cave amphipod	*Stygobromus dejectus*	SOC	
Clear Creek amphipod	*Hyalella texana*	SOC	
Creeper	*Strophitus undulates*	SOC	
Disjunct crawling water beetle	*Haliplus nitens*	SOC	X
Leonora's dancer	*Argia leonorae*	SOC	
Long-legged cave amphipod	*Stygobromus longipes*	SOC	
Mayfly, no common name	*Allenhyphes michaeli*	SOC	
Mayfly, no common name	*Baetodes alleni*	SOC	X
Rawson's metalmark	*Calephelis rawsoni*	SOC	

Table 3.10. Texas State Special Status Species for the Counties in the Permit Area

Common Name	Scientific Name	State Status[1]	Not Expected to Occur in Permit Area
Reddell's cave amphipod	*Stygobromus reddelli*	SOC	
Russell stygobromid	*Stygobromus russelli*	SOC	
Sage sphinx	*Sphinx eremitoides*	SOC	
Plants			
Basin bellflower	*Campanula reverchonii*	SOC	
Big red sage	*Salvia pentstemonoides*	SOC	
Broadpod rushpea	*Pomaria brachycarpa*	SOC	
Canyon mock-orange	*Philadelphus ernestii*	SOC	X
Canyon rattlesnake-root	*Prenanthes carrii*	SOC	
Edwards Plateau cornsalad	*Valerianella texana*	SOC	
Elmendorf's onion	*Allium elmendorfii*	SOC	X
Enquist's sandmint	*Brazoria enquistii*	SOC	
Granite spiderwort	*Tradescantia pedicellata*	SOC	
Hill Country wild-mercury	*Argythamnia aphoroides*	SOC	
Longstalk heimia	*Nactea longipes*	SOC	X
Rock quillwort	*Isoetes lithophilia*	SOC	
Small-headed pipewort	*Eriocaulon koernickianum*	SOC	
Texas mock-orange	*Philadelphus texensis*	SOC	
Warnock's coral root	*Hexalectris warnockii*	SOC	

[1] SOC = State Species of Concern; T = State Threatened

3.7.6.1 Common Black-Hawk

Common black-hawk occurs very locally in the desert southwest of the U.S., where it is migratory and typically occurs along cottonwood-lined perennial rivers and streams. Common black-hawks are a rare and local summer resident in the Davis Mountains in the Trans-Pecos, with a few birds also occurring along the Rio Grande in Big Bend National Park, along the Devils River in central Val Verde County, and Tom Green County (Lockwood 2001, Lockwood and Freeman 2004). Vagrant common black-hawks have also been reported at various locations across central and western Texas, including at Colorado Bend State Park in San Saba County, with a pair also unsuccessfully attempting to nest in Lubbock County in the early 1980s (Lockwood and Freeman 2004).

3.7.6.2 Peregrine Falcon

Arctic and American peregrine falcons were federally listed as threatened and endangered, respectively, in 1970 due to severe reductions in their population as a result of pesticide damage to egg shells and consequent low productivity rates. Arctic peregrine falcons were considered recovered in 1994 and removed at that time from the Federal list of threatened and endangered species (49 FR 10520). American peregrine falcons were considered recovered in 1999 and were delisted at that time (64 FR 46543). Both subspecies were also listed by the State of Texas, with Arctic peregrine falcon having since been delisted and American peregrine falcon currently listed as threatened. Peregrine falcons are not known nor expected to breed in the Permit Area.

Both subspecies migrate through Texas and make frequent stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands (TPWD 2010d). However, as they are opportunistic hunters, they can also be expected to occur in nearly any open habitat.

3.7.6.3 Zone-tailed Hawk

In Texas, zone-tailed hawks are uncommon and local summer residents in the mountains of Trans-Pecos to the southern portions of the Edwards Plateau (Lockwood and Freeman 2004). The zone-tailed hawk is also a rare winter resident on the Edwards Plateau and rare winter resident and irregular summer visitor to the Lower Rio Grande Valley. The species has been recorded in the Kerrville area three times over the past decade (National Audubon Society 2010). Relative to the Permit Area, Lockwood and Freeman (2004) delimit the breeding range of this species in Texas as including all of Kerr, Gillespie, and Llano counties, nearly all of Kendall County, southeastern Kimble County, southern and eastern Mason County, southern San Saba County, western and central Burnet County, and southwestern Lampasas County. A pair of zone-tailed hawks has also recently been discovered nesting in northern Tom Green County (T. Maxwell/Angelo State University pers. comm. to SWCA on 15 November 2010). The Tom Green County nest is located along Grape Creek close to the Coke County line more than 12 miles north of the Twin Buttes Substation and northern terminus of the selected route for the Twin Buttes–Big Hill transmission line. Oberholser (1974) mentions that a zone-tailed hawk nest was present along Grape Creek in the 1950s, so perhaps this is a traditional nesting location for this species.

3.7.6.4 Black Bear

Black bears do not occur regularly in the Permit Area. Small numbers of black bears occur in the mountains of the Trans-Pecos region, with these bears being part of a population that largely resides in mountainous regions of adjacent Mexico (Schmidly 2004). Black bears are on very rare occasion found on the Edwards Plateau, with these individuals believed to have dispersed from the Mexican/Trans-Pecos population. This species is not expected to occur in the Permit Area except on an extremely irregular and infrequent basis. Any black bears occurring in the Permit Area would be expected to be fully independent, mobile, and capable of successfully avoiding human activities.

3.7.6.5 White-nosed Coati

The primary range of the white-nosed coati is Mexico and Central America, although it has been recorded across southern Texas in Aransas, Brewster, Cameron, Hidalgo, Kerr, Maverick, Starr, Uvalde, and Webb counties (Schmidly 2004). It is unclear whether individuals found in Texas have wandered into the state from Mexico, or if the species occupies the southern portion of Texas in extremely low densities on a regular or irregular basis.

It is possible that the species could occur on occasion in the Permit Area, where individuals seem most likely to occur in Gillespie, Kerr, Kendall, and Kimble counties (Schmidly 2004). Like ocelots and black bears, it is expected that any white-nosed coatis occurring in the area would be fully mobile individuals capable of avoiding human activities.

3.7.6.6 Cagle's Map Turtle

The Service designated the turtle as a candidate species in 1991, indicating that listing of the species was warranted but precluded at that time because the Service lacked the resources to propose the species for listing (56 FR 58804). The Service announced on 12 September 2006, that, because of stable population size, increased protection, and no foreseeable threats from reservoir construction, the listing of Cagle's map turtle was no longer warranted and removed its

candidate designation (71 FR 53756). The State of Texas listed Cagle's map turtle as a state threatened species in 2000 (Texas Register, Title 31, Chapter 65).

The Guadalupe River flows through the southeastern portion of the Permit Area, although the final route for the Big Hill–Kendall transmission line would not cross the river. The Blanco and San Marcos rivers both lie outside of the Permit Area. As the Kendall Substation lies in the Guadalupe River watershed, at least the southern end of a Big Hill–Kendall transmission line would be constructed within the watershed that supports this species.

3.7.6.7 Texas Horned Lizard

Texas horned lizard lacks Federal status but is listed by the State of Texas as threatened. The species occurs or historically occurred across much of Texas, Oklahoma, and northeast and north-central Mexico, as well as portions of Arizona, Kansas, and New Mexico, and restricted portions of Arkansas, Colorado, and Missouri (Conant and Collins 1998).

Texas horned lizards have potential to occur throughout the Big Hill–Kendall portion of the Permit Area, although the species likely decreases in abundance from west to east. It is most likely to occur in the Permit Area in alluvial areas that support sparse ground cover, but the lizards may occur wherever open habitats are present. Texas horned lizards are not expected to occur in heavier woodlands such as those present in canyons on the east side of the Permit Area.

3.7.6.8 Texas Tortoise

Texas tortoise is a species of southern Texas and northeast Mexico (Conant and Collins 1998). The species typically occurs in open brush with a grassy understory and avoids areas of open grass and bare ground owing to a lack of shade (TPWD 2010d). Dixon (2000) depicts the Permit Area as lying completely north of the range of this species and questions a record from Sutton County, as well as several other records obtained from counties in north-central and eastern Texas. Texas tortoises can be easily transported from their home range and kept as pets, with exploitation by the pet trade among other factors having led to severe declines in the species (TPWD 2009d). Because pet tortoises can escape or be released, extra-limital records of the species must be viewed with caution. As the Edwards Plateau lies outside of the known range of this species, it is considered highly doubtful that Texas tortoise occurs naturally in the Permit Area.

3.7.6.9 Cascade Caverns Salamander

Salamanders attributed to *Eurycea latitans* have been reported from many sites in Bandera, Bexar, Comal, Kendall, and Kerr counties (Chippindale *et al*. 2000, TPWD 2010c). Salamanders of the *Eurycea latitans* complex occur in water-bearing caves, at springs, and in spring runs (AmphibiaWeb 2009). These salamanders have external gills and are obligate aquatic species. Where they occur at springs and in spring runs, Cascade Caverns salamanders usually are found under rocks and leaves, or in gravel substrate.

Within the Permit Area, springs with potential to support salamanders of the *Eurycea latitans* complex are expected to be limited in distribution to the Balcones Canyonlands ecoregion of Kendall and Kerr counties. The TPWD NDD has several records of this species from the Permit

Area, with all occurring south of the Guadalupe River in southern Kendall and southeastern Kerr counties (TPWD 2010c).

3.7.6.10 Comal Blind Salamander

Comal blind salamander is another species salamander with external gills that occurs in waters of caves and springs. It is known from several sites in central Texas, where their habitat is considered vulnerable to alteration of water quantity and quality. Comal blind salamanders are known to occur along the southeastern margin of the Edwards Plateau in the Cibolo Sinkhole Plain region of Comal, Bexar, and perhaps Kendall counties (Chippindale *et al.* 1994, 2000). The TPWD NDD has no records of this species from the Permit Area.

3.7.7 Invasive Species

Invasive species have been defined as "alien species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health" (Executive Order 13112, issued 1999). Typically, non-native species that are considered to be invasive are those that can reproduce rapidly, are able to out-compete and displace native species, and are difficult to eradicate. Agricultural and conservation agencies and entities are concerned about invasive species because of their ability to adversely alter the composition of floral and faunal communities, eliminate open waters, or cause damage to crops, grazing lands, and timber stands.

Many invasive species are known to be present in the counties of the Permit Area. One of the more invasive pasture grasses of Texas, King Ranch bluestem (*Bothriochloa ischaemum* var. *songarica*), was for years planted in highway ROW to stabilize soils following road construction projects. The NRCS through its Environmental Quality Incentives Program offers funding to control one of these invasive plants, salt cedar (*Tamarix* spp.), in the upper Colorado River watershed, including within Schleicher, Sutton, and Tom Green counties.

3.8. CULTURAL RESOURCES

3.8.1 Prehistory and History of the Permit Area

The Permit Area is situated on the western portion of the central Texas archaeological region, which is geographically defined by the Edwards Plateau. Comparative data from known cultural resources within the region indicate that the area has been occupied throughout most of the prehistoric and historic stages and phases recognized in the central Texas region. The prehistoric cultural sequences comprise three periods: Paleoindian, Archaic, and Late Prehistoric. The Historic period follows the Late Prehistoric, announcing the arrival of Europeans to central Texas.

3.8.1.1 Paleoindian Period

Human occupation of the central Texas archaeological region is thought to have begun approximately 11,000 to13,000 years ago (see Waters *et al.* 2011). This period correlates with the end of the late Pleistocene, the last ice age in North America. These early Texans are characterized by small but highly mobile bands of foragers who were specialized hunters of Pleistocene megafauna, although they probably also used a much wider array of resources (Bousman *et al.* 2002, 2004; Bever and Meltzer 2007; Dering 2007; Meltzer and Bever 1995). Surficial and deeply buried sites, rockshelter sites, and isolated artifacts represent Paleoindian

occupations in the central Texas region. Usually these sites are near permanent sources of water. Bison kill sites, open and protected campsites, and non-occupation lithic sites are known from this period in Texas. Intra-site features include hearths and isolated burials.

3.8.1.2 Archaic Period

The Archaic period for the central Texas archaeological region dates from ca. 8,800 to 1,300–1,200 B.P. (Collins 2004) and generally is believed to represent a shift toward hunting and gathering of a wider array of animal and plant resources and a decrease in group mobility (Willey and Phillips 1958). For central Texas, the Archaic period is typically considered an arbitrary chronological construct and projectile point style sequence. Overall, the Archaic period represents a hunting and gathering way of life that was successful and remained virtually unchanged for more than 7,500 years. This notion is based in part on fairly consistent artifact and tool assemblages through time and place and on resource patches that were used continually for several millennia. This pattern of generalized foraging, though marked by brief shifts to a heavy reliance on bison, continued almost unchanged into the succeeding Late Prehistoric period.

3.8.1.3 Late Prehistoric Period

Introduction of the bow and arrow and, later, ceramics into the central Texas region marks the Late Prehistoric period (1,250–350 B.P.). Population densities dropped considerably from their Late Archaic peak (Prewitt 1985). Subsistence strategies did not differ greatly from the preceding period, although bison again became an important economic resource during the latter part of the Late Prehistoric period (Prewitt 1981). Horticulture came into play very late in the region but was of seemingly minor importance to overall subsistence strategies (Collins 1995).

3.8.1.4 Historic Period

The Historic period (A.D. 1630 to present) in Texas roughly began when Spanish explorers and missionaries entered the region (Foster 1995). During the latter part of the seventeenth century, the Spanish began establishing missions in eastern and central Texas (Foster 1995). By 1800, European expansion in Texas and disease and intrusions by other Native American peoples had decimated many Native American groups; however, central Texas remained a Native American stronghold until the 1870s. After a short period under Mexican authority (1821–1836) and independence (1836–1845), Texas entered the United States in 1845 (Campbell 2003b). In the 1870s, several major cattle trails heading to markets passed through central Texas, and ranching became established in the region.

3.8.2 Methodology for Identifying Potentially Affected Cultural Resources

To identify cultural resources potentially affected by the Priority Projects, archaeologists conducted a thorough background cultural resources and environmental literature review of the Permit Area. Counties covered in the review included Tom Green, Schleicher, Sutton, Kimble, Kerr, Kendall, and Gillespie.

Sources of information for the review included USGS 7.5-minute topographic quadrangle maps and site files at the Texas Archeological Research Laboratory (TARL), and the THC Texas Archeological Sites Atlas (hereafter cited as “Atlas 2011”). These sources provided information on the nature and location of previously conducted archaeological surveys, previously recorded

cultural resource sites, locations of National Register of Historic Places (NRHP) properties, sites designated as State Archeological Landmarks (SALs), Official Texas Historical Markers, Registered Texas Historic Landmarks, cemeteries, and local neighborhood surveys.

To identify historic structures potentially affected, archaeologists analyzed TxDOT's Historic Overlay GIS database. This interactive GIS database is composed of a series of maps including soil maps, topographic maps, city survey maps that date to as early as the middle-to-late nineteenth century in some cases. These maps depict the locations of historic-age structures (i.e., older than 1960), or where historic-age structures once existed.

To determine whether any Native American resources could potentially be affected by the Priority Projects, the Service initiated consultation with those tribes known to have staked interests in the Permit Area. The Apache of Oklahoma, Tonkawa, Kiowa, Kickapoo, Comanche, Caddo, and Wichita & Affiliated tribes were contacted by the Service on behalf of LCRA in October of 2010 (Pers. Comm., Dr. David Siegel, Service Region 2). The tribes were asked if they have any concerns regarding culturally significant species, traditional cultural properties (TCPs), traditional use areas, ancestral sites, or sacred sites within the area that might be affected by the proposed ITP. To date, none of the contacted tribes have responded to the consultation efforts.

In the following sections, the "direct Area of Potential Effect (APE)" consists of all areas within which cultural resources have the potential to incur direct, physical impacts through construction of the Priority Projects. This includes the total disturbance area along the length of the route alignments. The "indirect APE" consists of all areas within which indirect impacts to cultural resources may occur. Indirect impacts are typically associated with the introduction of visual, atmospheric, or audible elements that diminish the historic integrity of a property as a whole. Historic resources (i.e., standing structures) and TCPs may be subject to indirect, as well as direct impacts. The "indirect APE" includes all areas within 0.5-mile on either side of the Priority Projects.

3.8.3 Cultural Resources Potentially Affected by the Twin Buttes–Big Hill Project

3.8.3.1 Archaeological Resources

One archaeological site is documented within the direct APE of the approved Twin Buttes–Big Hill transmission line route, and three archaeological sites are documented within 1,000 feet of the direct APE. The site within the direct APE (41TG278) was recorded in September of 1988 during a survey for the All American Pipeline (AAPL) Project, which intersects a small portion of the route alignment. The site, which consists of a surficial scatter of non-diagnostic lithic debitage and biface fragments, was recommended by its original recorders as ineligible for NRHP or SAL nomination.

Three recorded sites within 1,000 feet of the direct APE (41TB153, 41TG573, and 41TG623) are in alluvial settings near major waterways or in upland areas. Site 41TG634 is a prehistoric open campsite located on the banks of a creek. Site 41TG573 is a prehistoric campsite located on a broad upland landform. The site consists of a low density surficial lithic scatter and was

recommended as ineligible for the NRHP. No data were available on the THC's sites database or at TARL for site 41TG153.

The records search revealed that five area surveys and one linear survey have been conducted within or adjacent to the direct APE. Most of these surveys were related to road and pipeline construction and overlap a very small portion of the direct APE. The linear survey was conducted in September of 2003 for the Proposed Twin Buttes–Big Lake/SAPS transmission line, substation, and access route on behalf of LCRA. This survey coincided with approximately 3.0 miles of the northern portion of the direct APE. No cultural resource sites were recorded within the direct APE during this investigation (Atlas 2011).

3.8.3.2 Historic Resources

A review of the Texas Historic Overlay and topographic maps determined that approximately 85 above-ground historic-age resources are depicted within the indirect APE. None of these resources is depicted within the direct APE for cultural resources. While these structures are indicated on historic maps, none of the 85 structures has been formally documented, field verified, or evaluated for their NRHP eligibility.

3.8.3.3 Native American Resources

To date, no TCPs or other Native American resources have been publicly documented within the direct APE.

3.8.3.4 Other Resources

The Midway Cemetery is located within the 1,000-foot search radius. This cemetery contains approximately 60 graves that date from 1900 to the present and is located on the north side of FM 853 on the opposite side of (east of) an existing transmission line from the selected transmission line route.

3.8.4 Cultural Resources Potentially Affected by the Big Hill–Kendall Project

3.8.4.1 Archaeological Resources

The background review revealed that one linear and six area archaeological projects intersect the APE of the approved Big Hill–Kendall transmission line. Four cultural resource sites are located within or directly adjacent to the ROW. Site 41KR641 consists of a prehistoric burned rock midden located in an agricultural field. No diagnostic materials were located during the survey; however, the site contained fire cracked rock, lithic debris, charcoal, and rabdotus shell to a depth of 30 inches below ground surface. No recommendations were made regarding the significance of the site and no further work was recommended due to disturbances from previous farming activities (Atlas 2011). Site 41KE80 consists of a late Paleoindian lithic scatter on an upland terrace overlooking the Guadalupe River valley. One projectile point, chert flakes, cores and burned limestone were observed in a deflated upland setting. No recommendations were made regarding the significance of the site or recommendations for further work (Atlas 2011). Two additional sites, 41KM11 and 41KM14, intersect the APE and were recorded in 1971 during a survey along SH 290. Site 41KM11 consists of a ring burned rock midden located in a plowed field. Frio points were reported to have been previously found at the site location; however, only burned rock and lithic debris was observed during the site documentation. Site

41KM14 is also a ring midden with abundant lithic debris and scrapers. No information regarding site significance or recommendations for further work was reported for either of these midden sites (Atlas 2011). Forty-seven additional cultural resource sites are located within a half-mile on either side of the center line.

3.8.4.2 Historic Resources

No National Register properties, districts or historical markers intersect the APE; however, two National Register properties and 26 historical markers are located within a half-mile of the ROW centerline (Atlas 2011).

The TxDOT Historic Overlay review was to identify any historic-age structures or features that are within the APE and included maps dating from 1839 to 1964. Approximately 489 potentially historic-age structures were noted within the half-mile visual impact area, only 8 of which are within the 160-foot wide APE. Based upon the available maps, most of these structures date from the early- to mid-twentieth century and are likely related to agriculture and the expansion of rural populations during that time. To date, these structures have not been field verified and it remains unclear as to how many are still present within the APE.

In addition to structures, a variety of historic features were also identified on the historic maps within and adjacent to the project APE. Of particular note were several railroads and trails that pass through the APE. The arrival of the railroad in Texas during the latter half of the nineteenth century contributed to the establishment of many towns and communities throughout the state and created a period of economic expansion. The 1874 Railroad Map of Texas shows the Dallas-North and the Texas Pacific railroads both crossing the APE. In addition to historic railroads, historic maps also indicate trails associated with the earlier frontier period of the Hill Country. Many of these trails are associated with routes between frontier forts such as on the Fort Clark 1869 map, which crosses the alignment near Kerrville. Others, such as the 1839 Hunt and Randall Map of Texas and the 1864 Eastern and Central Texas map indicate an “Indian Road” or “Comanche Road” passing through the alignment in northeastern Sutton County. However, it is important to note that these historic trail and railroad maps are not of sufficient scale or accuracy to pinpoint exactly where these features may have crossed the alignment.

3.8.4.3 Native American Resources

To date, no TCPs or other Native American resources have been publicly documented within the direct APE.

3.8.4.4 Other Resources

The Copperas Creek Cemetery is located within 1,000 feet of the direct APE. The cemetery is located on the north side of Highway 291 approximately 0.9 mile east of FM 1674. No other information about this cemetery was available on Atlas (2011).

3.9 LAND USE

This section summarizes data gathered on land use for the area in the vicinity of each transmission line. Land within the seven-county Permit Area is overwhelmingly privately owned. Population density is low to very low and agricultural uses predominate, but the Permit Area also includes small towns (although not many) and two Metropolitan Statistical Areas: San

Angelo in Tom Green County and Kerrville in Kerr County. With a population of 88,439, San Angelo is by far the largest urban area in any of the seven counties in the Permit Area (U.S. Census Bureau 2000 data). Given the low population levels (see Section 10.3.2 in Socioeconomics), low population density, and low level of development across the Permit Area, it follows that the number of habitable structures in the region is low as well. Except for the few urban areas described below, these structures are typically found in the small communities; rural, large-lot subdivisions; and isolated farmsteads scattered throughout the region.

The following sections identify the principal communities within the Permit Area and provide information regarding predominate economic land uses, recreational areas, and land set aside for conservation purposes. This information was largely taken from the environmental assessment reports prepared for the Priority Projects by PBS&J (2010a, 2010b).

3.9.1 Twin Buttes–Big Hill

The Twin Buttes–Big Hill portion of the Permit Area covers parts of Tom Green and Schleicher counties. It includes the incorporated City of San Angelo and the unincorporated communities of Christoval and Knickerbocker in Tom Green County. As noted above, San Angelo, with a population of 88,439, is a fairly large city. All the other communities in the area are small, with populations under 1,000. Outside of the San Angelo metropolitan area, which dominates Tom Green County, population density is very low, averaging less than 2.5 individuals per square mile (U.S. Census Bureau 2000 data).

Land use within the Twin Buttes–Big Hill portion of the Permit Area is predominantly agricultural, specifically grazing land (see Section 3.9.2.1, below, for more information). The remaining land is mostly devoted to urban uses in and around San Angelo, rural transportation, and railways, although oil fields, gas well exploration, mining, and wind energy production play a role as well (USDA 2000). Oil exploration and production in the region have occurred since around 1918, and production continues to the present. Oil fields within the region include the Pulliam, Christoval, and Neva West oil fields (Texas State Historical Association 2009).

Numerous oil and gas transmission pipelines and wells exist within the area (Railroad Commission of Texas [RRC] 2009). In general, the production and exploration activities associated with the oil and gas industry do not significantly interfere with other uses of the same land (e.g., ranching). However, the pipeline easements, access roads, well pads, storage tanks, and processing plants do represent a significant land use across the area (PBS&J 2010b). Some stone, limestone, sand, gravel, and gypsum surface mines/quarries are also located throughout the area (RRC 2008, U.S. Department of Labor 2009). Currently under construction, the Langford Wind Farm will span three counties (Irion, Tom Green, and Schleicher) and include 100 turbines.

3.9.1.1 Agriculture

Agriculture use, which includes grazing land and cropland, dominates the landscape in Tom Green and Schleicher counties. Land use in the area is predominantly grazing land range (88 percent), with a small percentage dedicated to cultivated crops (8 percent) (PBS&J 2010b). According to the National Agricultural Statistics Service (NASS) 2007 Census of Agriculture, livestock sales in Tom Green County accounted for approximately 62 percent of the total value

for agricultural products, while crop sales accounted for approximately 38 percent (NASS 2009). In Schleicher County livestock sales accounted for approximately 76 percent of total value, while crop sales accounted for approximately 24 percent. Agriculture and associated services play an important role in each community, providing employment and economic stability. Sheep, cattle, and goats are the primary livestock raised in the region and account for over 75 percent of the total value for agricultural products, with cultivated crops such as cotton, wheat sorghum, pecans, and forage crop production not far behind.

3.9.1.2 Parks, Dispersed Recreation, and Conservation Areas

One state park, San Angelo State Park, is located on the shores of O.C. Fisher Reservoir, adjacent to the City of San Angelo in Tom Green County. Activities available at the park include camping, picnicking, hiking, mountain biking and horseback riding on multi-use trails, lake swimming and wading, fishing, boating, an orienteering course, bird and wildlife observation, and hunting for deer and turkey (TPWD 2010f). Additional camping and water-related activities are available in Tom Green County at Twin Buttes Reservoir and Lake Nasworthy. Also located in Tom Green County, the San Angelo Claybird Association offers various types of target shooting and is open to the public year-round.

Opportunities for dispersed recreation[7] within the area are somewhat limited because most of the land is privately owned, and access for recreational use on private land is typically prohibited. Hunting is a major exception to the limitations on dispersed recreation posed by private property. Owners of ranches and farms often allow hunters use of their land through commercial and private hunting leases.

No wildlife management areas or other conservation areas are located in the Twin Buttes–Big Hill portion of the Permit Area.

3.9.2 Big Hill–Kendall

The Big Hill–Kendall portion of the Permit Area covers all or portions of Schleicher, Sutton, Kimble, Kerr, Kendall, and Gillespie counties. The largest communities are Eldorado, Sonora, Junction, Fredericksburg, Kerrville, and Comfort. For the most part, these are small towns, with only Fredericksburg (8,911) and Kerrville (20,425) exceeding 3,000 (U.S. Census Bureau 2000 data). In addition to these towns, smaller communities and residential areas dot the landscape. Population density ranges from very low in western counties, averaging approximately 2.5 individuals per square mile, to substantially higher in eastern counties, approximately 35 individuals per square mile. To put this in perspective, Texas as a whole averages 79.6 individuals per square mile (U.S. Census Bureau 2000 data).

Land use within the area is dominated by agricultural activities, specifically grazing land (see Section 3.9.2.1, below). In addition to agriculture, oil fields, gas well exploration, and mining for various types of stone, are major contributors to the region's economy and have greatly influenced the area's land use. Oil exploration in the region has occurred since around 1918, and production continues to the present. Oil fields within the region include the Brooks, Atkinson, West Pulliam, Atrice, Toenail, Hulldale, Page, and F&H oil fields (Texas State Historical Association 2009). Numerous oil and gas transmission pipelines and wells exist within the area

[7] "Dispersed recreation" refers to recreational activities outside of established recreational facilities.

(RRC 2010). These land uses are generally compatible with ranching operations, as land leased for oil and gas is also used for surface grazing. Stone, sand, gravel, and gypsum surface mines/quarries are located throughout the area (RRC 2008, U.S. Department of Labor 2010, PBS&J 2010a).

3.9.2.1 Agriculture

Various agricultural pursuits account for approximately 96 percent of land use in this area. Grazing land accounts for 93 percent and cultivated crops, 3 percent (PBS&J 2010a). According to the 2007 Census of Agriculture, livestock sales in Schleicher County accounted for approximately 76 percent of the total value for agricultural products, while crop sales accounted for approximately 24 percent (NASS 2009). In Sutton County, livestock sales accounted for approximately 97 percent of the total value for agricultural products, while crop sales accounted for approximately 3 percent. In Kimble County livestock sales accounted for about 84 percent, while crop sales accounted for approximately 16 percent. In Gillespie County, where larger communities exist, such as Fredericksburg, 74 percent of the total value for agricultural products was in livestock and approximately 26 percent was in crop sales. In Kendall County, 87 percent of the total value for agriculture products was livestock, while only 13 percent was in crop sales.

Agriculture and associated services play an important role in each community in the area, providing employment and economic stability. Cattle, sheep, and goats are the primary livestock raised in the area and account for over 75 percent of the total value for agricultural products in each county. Cultivated crops such as cotton, wheat, oats, sorghum, pecans, peaches, and forage crop production account for most of the balance.

3.9.2.2 Parks, Dispersed Recreation, and Conservation Areas

One state park is located in the Big Hill–Kendall portion of the Permit Area. In Kimble County, South Llano River State Park offers facilities for camping, hiking, and picnicking (TPWD 2010f). Additional facilities for mountain biking, camping, and hunting are available at the privately owned Flat Rock Ranch in Kendall County. Throughout the area, many owners of ranches and farms allow hunters use of their land through commercial and private hunting leases.

Two Wildlife Management Areas (WMAs) are located within this area: the Walter Buck WMA, located in Kimble County, and the Old Tunnel WMA located in Kendall County. The Walter Buck WMA is bounded on the north side by the South Llano River State Park (see Section 3.12.4.1), and consists of approximately 2,155 acres of limestone hills covered by dense stands of juniper, live oak, and Spanish oak (TPWD 2010f). This area is managed by the TPWD to maintain healthy, native wildlife habitats and populations; hunting is permitted as part of the management program.

The Old Tunnel WMA features an abandoned railroad tunnel on 16.1 acres of land (TPWD 2009b). The tunnel is home to up to three million Brazilian free-tailed bats and 3,000 cave myotis bats. This area is managed by the TPWD to ensure the long-term stability of the bat colony, while providing for maximum public outreach opportunities. Bat-viewing opportunities are available every evening, May to October.

3.10 SOCIOECONOMICS

3.10.1 Introduction

According to NEPA regulations at 40 CFR 1508.8 and 1508.14, social and economic effects must be addressed if they are related to effects on the natural or physical environment. The socioeconomic baseline information provided here organizes and describes the social and economic conditions of the Permit Area. The information in this section is based on data from public sources, including the following:

- U.S. Census Bureau
- U.S. Department of Commerce, Bureau of Economic Analysis (BEA)
- U.S. Bureau of Labor Statistics
- State of Texas departments and agencies
- IMPLAN data (Minnesota IMPLAN Group)

Indicators used to assess potential impacts from the Priority Projects on socioeconomic factors include demographics (population size), housing availability, property values, and economic activity (industry employment and output). Baseline information for these indicators is provided below.

3.10.2 Demographics

Table 3.11 summarizes historical and projected population within the seven counties. Overall, population increased between 2000 and 2009 by 9.3 percent, from 203,700 in 2000 to 223,192 in 2009. Individually, all but one county grew between 2000 and 2009, ranging from a 1.4 percent increase in Tom Green County to a 40.4 percent increase in Kendall County. Schleicher County is the only county that experienced a decrease, and that was -0.5 percent.

Projections for the seven counties as a whole indicate an estimated 14.5 percent growth between 2010 and 2040 (see Table 3.11). However, as with past population trends, some individual counties are expected to continue to see a decrease in population.

Table 3.11. Historical and Projected Population for the Seven Counties in the Permit Area

	Population		Total % Change in Population	Projected Population				Total % Change in Population
Location	2000	2009	2000–2009	2010	2020	2030	2040	2010–2040
Gillespie County	20,814	24,279	16.6%	25,873	23,635	24,706	24,924	-3.7%
Kendall County	23,743	33,341	40.4%	35,351	37,307	44,411	50,744	43.5%
Kerr County	43,653	48,246	10.5%	46,829	48,743	50,410	50,981	8.9%
Kimble County	4,468	4,589	2.7%	4,784	4,572	4,411	4,261	-10.9%
Schleicher County	2,935	2,921	-0.5%	3,193	3,349	3,396	3,323	4.1%
Sutton County	4,077	4,339	6.4%	4,630	4,883	4,937	4,930	6.5%
Tom Green County	104,010	105,477	1.4%	103,750	117,729	121,484	123,394	18.9%
TOTAL	209,798	229,332	9.3%	224,410	240,218	253,755	262,557	14.5%

[*] Source: Census Bureau (2000).
[†] Source: Texas State Data Center and Office of the State Demographer (2010).

3.10.3 Property Values

The average value of agricultural properties in the seven counties, and the average value per acre are shown in Table 3.12. Agricultural property values per acre tend to be lowest in the more western counties (e.g., $796/acre in Sutton County) and highest in the more developed and populous eastern counties (e.g., $2,718/acre in Kendall County). The average size of ranches and farms tend to be much larger in the western counties (e.g., 3,823 acres in Sutton County) than in eastern counties (e.g., 294 acres in Kendall County). As a result, the average value per property tends to be higher in those counties compared to the smaller properties in the eastern counties. Tom Green County is an exception to these patterns. While this county is located in the far western portion of the Permit Area, it is more developed than its neighbors due to the presence of San Angelo, a relatively large metropolitan area. As a result, ranches and farms are smaller and per-acre property values somewhat higher than in neighboring counties.

Table 3.12. Average Size and Value of Agricultural Properties in the Seven Counties in the Priority Project Permit Area, 2007 Data

County	Average Size in Acres	Average Value / Property	Average Value / Acre
Gillespie County	352	$916,819	$2,602
Kendall County	294	$799,738	$2,718
Kerr County	500	$892,896	$1,784
Kimble County	970	$1,447,847	$1,492
Schleicher County	2,411	$2,180,436	$904
Sutton County	3,823	$3,044,106	$796
Tom Green County	783	$844,202	$1,079
All seven counties	1,304	$1,446,577	$1,625

Source: NASS 2009

3.10.4 Employment

Industry employment is based on the Bureau of Labor Statistics Covered Employment and Wages, as reported by IMPLAN (IMPLAN 2008). Generally these data include jobs for people who worked during, or received pay for, the reporting period, with a few exceptions. Excluded from employment data are self-employed, proprietors, domestic workers, and unpaid family workers. The agricultural jobs listed in Table 3.13 are wage earners who work for ranch and farm owners.

Table 3.13 details employment by industry for each of the seven counties; shaded cells indicate the top five employment sectors for each county. While state and local government education jobs rank in the top five for all seven counties, representing 5.4 percent of employment across all counties combined, state and local government non-education and food services jobs rank the highest at 6.6 and 6.7 percent, respectively.

3.10.5 Industry Output

Industry output is the value of industry production. As defined for IMPLAN data, output is the annual production estimate for the year of the data set, in terms of producer prices. Economic output in Table 3.14 is presented in constant 2008 dollar terms, rounded to the nearest thousand. The top five sectors for each county are shaded in gray.

Table 3.13. Employment by County and Industry (Number of Jobs) in the Seven Counties in the Priority Project Permit Area. Shaded Cells Indicate the Top Five Employment Sectors for Each County.

Sector	County						
	Gillespie	Kendall	Kerr	Kimble	Schleicher	Sutton	Tom Green
Total full and part-time employment	13,606	14,323	24,633	2,461	1,467	3,584	57,816
State & local government– education	585	739	878	143	109	216	3,659
State & local government– non-education	585	1,014	1,848	180	127	210	3,817
Food services and drinking places	980	849	1,643	219	13	153	4,077
Cattle ranching and farming	1,005	359	254	298	199	182	255
Construction–new nonresidential, commercial, health care structures	520	478	866	71	54	90	976
Real estate establishments	264	348	1,021	6	24	10	415
Wholesale Trade Business	281	540	361	33	31	439	1,603
Private hospitals	599	23	821	21	35	0	2,296
Nursing and residential care facilities	327	453	932	13	0	5	1,318
Support activities for oil and gas operations	3	4	2	0	113	526	255
Drilling oil and gas wells	0	0	0	6	0	65	813
Extraction of oil and gas	8	14	57	1	15	281	242
Retail Stores - Motor vehicle and parts	131	632	484	25	2	23	925
Animal production, except cattle and poultry and eggs	237	188	299	137	56	92	79
Hotels and motels, including casino hotels	169	107	274	36	1	14	254
Home health care services	5	14	373	33	17	26	1,454
Retail stores, Food and beverage	335	352	534	80	11	53	1,114
State and local government passenger transit	4	10	16	1	0	4	39
Grant-making, giving, and social advocacy organization	30	29	43	0	0	0	8
Cotton farming	0	0	0	0	102	0	664
Federal government, military	52	76	109	11	6	13	3,284

Source: IMPLAN 2008
Note: Shaded sectors rank in the top five for the county.

Table 3.14. Industry Output by County and Industry Sector in the Seven Counties in the Priority Project Permit Area (2008 dollars). Shaded Cells Indicate the Top Five Sectors for Each County.

Sector	County						
	Gillespie	Kendall	Kerr	Kimble	Schleicher	Sutton	Tom Green
County Total	1,411,861,034	1,813,725,758	2,877,025,504	328,367,479	166,659,963	791,736,817	7,671,988,379
Imputed rental activity for owner-occupied dwellings	89,195,640	154,476,208	192,815,776	11,825,507	8,106,254	23,171,090	349,160,416
Construction of new nonresidential commercial and health care structures	69,648,120	70,885,848	114,605,272	9,215,924	7,683,208	14,055,513	134,144,392
Plastics and resin manufacturing	0	0	0	0	0	0	0
Real estate establishments	43,986,988	92,725,624	147,610,176	599,888	2,559,713	2,843,099	77,258,232
Wholesale trade businesses	29,874,860	93,421,368	56,908,724	2,515,504	3,687,552	113,743,680	226,273,344
Private hospitals	62,088,088	2,264,103	83,697,392	2,039,235	3,017,207	0	248,281,424
Food services and drinking places	55,369,492	45,432,720	91,129,872	10,757,767	663,475	6,974,641	202,832,784
Aircraft manufacturing	51,180,376	0	206,375,392	0	0	0	0
Drilling oil and gas wells	0	0	0	14,215,285	0	41,773,592	690,114,624
Extraction of oil and natural gas	11,179,850	15,864,463	79,668,960	2,789,864	11,269,852	199,535,680	293,366,816
Petroleum refineries	0	0	0	0	0	21,236,480	0
Support activities for oil and gas operations	1,311,464	1,461,114	472,930	0	27,619,920	183,647,632	85,287,856
Pharmaceutical preparation manufacturing	0	159,527,072	0	0	0	0	0
Other basic organic chemical manufacturing	0	0	0	91,051,344	0	0	0
Electric power generation, transmission, and distribution	12,341,705	10,383,847	20,293,952	14,943,934	24,270,948	5,805,836	68,604,536
Reconstituted wood product manufacturing	0	0	0	14,728,969	0	0	0
Toilet preparation manufacturing	0	0	0	14,294,250	0	0	0
Animal (except poultry) slaughtering, rendering, and processing	266,007	0	2,216,346	3,360,859	0	0	397,943,392
Audio and video equipment manufacturing	0	0	0	0	0	0	0
State & local government, non-education	19,950,030	51,894,784	88,356,872	7,251,260	4,171,997	9,069,757	159,955,408
Cattle ranching and farming	43,590,548	8,236,058	11,980,247	6,697,314	9,554,463	5,555,132	23,005,520
Monetary authorities and depository credit intermediation activities	35,508,568	34,122,808	62,796,272	5,692,882	3,497,363	5,040,154	168,781,552
Automotive equipment rental and leasing	0	4,570,543	1,198,846	0	0	0	13,074,082
Transport by pipeline	18,462,086	4,938,943	0	10,357,821	0	14,142,635	16,715,515
Securities, commodity contracts, investments, and related activities	6,509,806	5,264,968	13,146,805	1,179,180	430,789	215,423	15,122,017
State & local government, education	29,724,318	41,914,140	50,018,588	7,021,763	5,319,139	10,737,876	190,335,664
Mineral wool manufacturing	0	0	0	0	10,267,019	0	0
Telecommunications	15,111,250	6,078,985	48,829,176	548,920	973,538	324,882	533,623,104
Federal government, military	2,770,911	4,447,089	6,582,325	647,798	374,594	654,516	383,350,592

Industry output in the Permit Area totaled over $15 billion in 2008. Top sectors for industry output in the overall seven-county area include rental income (5.5 percent), drilling of oil and natural gas wells, while not present in all counties, was the second highest output sector (4.9 percent), and extraction of oil and natural gas (4.1 percent).

3.11 ENVIRONMENTAL JUSTICE

3.11.1 Regulatory Framework and Definitions

Executive Order (EO) 12898 (11 February 1994) and its accompanying memorandum have the primary purpose of ensuring that "each Federal agency shall 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." To meet this goal, EO 12898 specified that each agency develop an agency-wide environmental justice strategy.

The Presidential Memorandum that accompanied EO 12898 calls for a variety of actions. Four specific actions were directed at NEPA-related activities, including the following.

- Each Federal agency must analyze environmental effects (i.e., human health, economic and social effects) of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by NEPA.
- Mitigation measures outlined or analyzed in environmental assessments, environmental impact statements, or Records of Decision, whenever feasible, should address significant and adverse environmental effects of proposed Federal actions on minority communities and low-income communities.
- Each Federal agency must provide opportunities for community input in the NEPA process, including identifying potential effects and mitigation measures in consultation with affected communities and improving accessibility of public meetings, official documents, and notices to affected communities.
- In reviewing other agencies' proposed actions under Section 309 of the Clean Air Act, the EPA must ensure that the agencies have fully analyzed environmental effects on minority communities and low-income communities, including human health, social, and economic effects.

3.11.1.1 Minority Communities

Minority communities addressed in the scope of NEPA analysis are generally considered as follows:

- Minority: Individual(s) classified by Office of Management and Budget OMB Directive No. 15 as Black/African American, Asian and Pacific Islander, American Indian, Eskimo, Aleut, other non-white persons, or Hispanic.
- Minority Population: Minority populations should be identified where either:
  - the minority population of the affected area exceeds 50 percent; or
  - the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds.

3.11.1.2 Low-Income Population

"Low-income" is equated in this EA to "below poverty level" as defined by the U.S. Census Bureau. Families and persons are classified by the U.S. Census Bureau as "below poverty level" if their total family income or unrelated individual income was less than the poverty threshold specified for the applicable family size, age of householder, and number of related children under 18 that are present. A community is considered an environmental justice community if the total number of individuals living below poverty level is equal to or exceeding the state's percentage.

3.11.1.3 Disproportionately High and Adverse Human Health Effects

According to EO 12898, when determining whether human health effects are disproportionately high and adverse on minority or low-income populations, agencies are to consider the following three factors to the extent practicable:

- whether the health effects, which may be measured in risks and rates, are significant, unacceptable, or above generally accepted norms (adverse health effects may include bodily impairment, infirmity, illness, or death);
- whether the risk or rate of hazard exposure by a minority population or low-income population to an environmental hazard is significant and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and
- whether health effects occur in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

3.11.2 Minority Populations in the Permit Area

The potentially affected area units for this analysis are the seven counties within the Permit Area (Table 3.15), and the principal municipality within each county (Table 3.16). The geographic unit against which these local populations are being measured is the State of Texas. The counties and communities with a minority representation greater than the Texas state-wide average are considered to meet the criterion for having a minority population percentage greater than that of the general population. According to data recorded by the U.S. Census Bureau in 2000, two counties (Schleicher and Sutton) met this criterion (see Table 3.15). In that year, the population of Texas was 32.0 percent Hispanic, while the populations of Schleicher and Sutton counties were 43.5 and 51.7 percent Hispanic, respectively. Of the principal communities in the seven counties, Comfort (Kendall County), Eldorado (Schleicher County), Sonora (Sutton County), and San Angelo (Tom Green County) all had Hispanic populations that exceeded the state's percentage of 32.0 percent (see Table 3.16).

Table 3.15. Race and Ethnicity of Populations in the Seven Counties in the Permit Area, 2000 Data (Minority Population Percentages Exceeding that of Texas are Shaded)

County	Race and Ethnicity							
	White (non-Hispanic)	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino
Texas	52.4%	11.3%	0.3%	2.7%	0.1%	0.1%	1.1%	32.0%
Gillespie County	82.8%	0.1%	0.3%	0.2%	0.0%	0.0%	0.7%	15.9%
Kendall County	80.5%	0.3%	0.3%	0.2%	0.0%	0.1%	0.7%	17.9%
Kerr County	77.4%	1.7%	0.4%	0.5%	0.0%	0.0%	0.8%	19.1%
Kimble County	77.9%	0.1%	0.2%	0.4%	0.0%	0.1%	0.5%	20.7%
Schleicher County	54.3%	1.1%	0.0%	0.2%	0.0%	0.2%	0.5%	43.5%
Sutton County	47.4%	0.2%	0.3%	0.2%	0.0%	0.0%	0.3%	51.7%
Tom Green County	63.0%	4.0%	0.4%	0.8%	0.1%	0.1%	1.0%	30.7%

Source: U.S. Census Bureau 2000

Table 3.16. Race and Ethnicity of Populations in the Principal Community in Each County in the Permit Area, 2000 Data (Minority Population Percentages Exceeding that of Texas are Shaded)

Community	Race and Ethnicity							
	White (non-Hispanic)	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino
Texas	52.4%	11.3%	0.3%	2.7%	0.1%	0.1%	1.1%	32.0%
Fredericksburg (Gillespie County)	81.7%	0.2%	0.2%	0.2%	0.0%	0.1%	0.5%	17.0%
Comfort (Kendall County)	53.6%	0.2%	0.7%	0.1%	0.0%	0.0%	0.5%	45.0%
Kerrville (Kerr County)	72.7%	2.8%	0.3%	0.6%	0.0%	0.0%	0.8%	22.7%
Junction (Kimble County)	69.5%	0.0%	0.2%	0.7%	0.0%	0.2%	0.5%	29.0%
Eldorado (Schleicher County)	43.6%	1.5%	0.1%	0.3%	0.1%	0.1%	0.5%	53.9%
Sonora (Sutton County)	45.6%	0.2%	0.3%	0.2%	0.0%	0.0%	0.3%	53.4%
San Angelo (Tom Green County)	59.9%	4.5%	0.3%	0.9%	0.1%	0.1%	1.0%	33.2%

Source: U.S. Census Bureau 2000.

3.11.3 Low-Income Populations in the Permit Area

Table 3.17 identifies the number and percentage of individuals and families below the poverty level in the seven counties, and provides a comparison of those figures with those for the state as a whole. A county is considered an environmental justice unit if the total number of individuals living below the poverty level is equal to or exceeding the state's percentage (15.4 percent).

According to U.S. Census Bureau data for 2000, four counties in the Permit Area had poverty levels that exceeded that of the state as a whole (see Table 3.17). Those counties include Kimble (18.8 percent), Schleicher (21.5 percent), and Sutton (18.0 percent).

Principal communities in the Permit Area that had higher rates of poverty in 2000 than the state include Comfort, Kerrville, Junction, Eldorado, Sonora, and San Angelo (see Table 3.17).

Table 3.17. Individuals Below the Poverty Level in the Priority Project Permit Area and Their Principal Communities, 2000 Data (Below-Poverty-Level Percentages Which Exceeded that of Texas are Shaded)

County	Individuals / Percent Below Poverty Level	Principal Community	Individuals / Percent Below Poverty Level
Texas	3,117,609 / 15.4%	Texas	3,117,609 / 15.4%
Gillespie County	2,067 / 10.2%	Fredericksburg	994 / 11.9%
Kendall County	148 / 8.4%	Comfort	659 / 29.0%
Kerr County	6,074 / 14.5%	Kerrville	3,007 / 15.6%
Kimble County	828 / 18.8%	Junction	567 / 21.7%
Schleicher County	621 / 21.5%	Eldorado	504 / 26.1%
Sutton County	726 / 18.0%	Sonora	492 / 16.7%
Tom Green County	15,193 / 15.2%	San Angelo	13,275 / 15.7%

Source: U.S. Census Bureau 2000

3.11.4 Disproportionately High and Adverse Human Health Effects

Although there are counties and communities that meet the criteria for environmental justice, no prior and existing development in the Permit Area is known to have had disproportionately high and adverse human health effects on residences in these areas.

3.12 ROADS AND AVIATION FACILITIES

3.12.1 Roads

Portions of Federal highways (US), state highways (SH), and farm-to-market (FM) and ranch-to-market (RM) rural roads are located within each of the Permit Area as listed below:

Twin Buttes–Big Hill	Big Hill–Kendall
US 87	Interstate Highway 10
US 67	US 87
US 277	US 277
SH Loop 306	US 190
FM 2288	US 83
RM 853	US 377
RM 584	US 290
RM 2166	SH 29
FM 2335	SH 173
RM 2084	SH 27

3.12.2 Aviation Facilities within the Permit Area

The following information regarding airports, airstrips, and heliports in or adjacent to the Permit Area was taken from environmental assessments prepared by PBS&J (2010a, 2010b).

No Military Operations Areas associated with military aircraft are located within the boundaries of the Permit Area (FAA 2008). According to information gathered by PBS&J (2010b), eight Federal Aviation Administration (FAA)-registered[8] airports and over 70 private airports/airstrips and are located within the seven-county Permit Area. San Angelo Regional Airport-Mathis Field, the largest of the regional airports, is located in the northern portion of the Permit Area just southwest of the City of San Angelo along Knickerbocker Road. The airport services commercial, private, and some military aviation (FAA 2009, City of San Angelo 2009).

The other regional airports are Eldorado, Sonora, Gillespie County, Kerrville Municipal Airport/Louis Schreiner Field, and Kimble County Airports (Table 3.18). The overriding majority of the private airports/airstrips scattered throughout the Permit Area are mostly associated with large ranch headquarters and hunting leases (AirNav 2010).

Five heliports provide medical flight services for hospitals in the Permit Area. A heliport at Angelo Community Hospital is used to provide medical flight services. It is located in the northwestern portion of the Permit Area on the southeast side of the City of San Angelo (AirNav 2010). The Kimble Hospital Heliport is located in the central portion of the Permit Area in the

[8] An FAA-registered airport is one listed in the FAA's Airport/Facility Directory, online at: http://www.naco.faa.gov/afd.asp?cycle=afd_18NOV2010&eff=11-18-2010&end=01-13-2011#searchoptions

central part of the town of Junction, and the Peterson Regional Medical Center Heliport and the Veterans Affairs Medical Center Heliport are located in the southeastern portion of the Permit Area in the central part of the City of Kerrville (AirNav 2010). A fifth heliport, associated with the Tierra Linda Ranch residential area, is located approximately 4.6 miles north of the City of Kerrville. In addition, numerous rural medical evacuation sites and private helipads are located throughout the Permit Area (AirNav 2010).

Table 3.18. FAA-Registered Airports within the Permit Area

Airport Name	Location
San Angelo Regional Airport-Mathis Field	San Angelo
Eldorado Airport	Eldorado
Sonora Municipal Airport	Sonora
Kimble County Airport	Just north of the town of Junction
Kerrville Municipal Airport / Louis Schreiner Field	Kerrville
Gillespie County Airport	Southwest of Fredericksburg

3.13 HUMAN HEALTH AND SAFETY

During the public comment process associated with the PUC process for the Priority Projects and, again, during the NEPA scoping period, some responders raised concerns regarding potential health and safety issues specifically related to transmission lines. Currently, high-voltage transmission lines carry electrical power to communities in every county in the Permit Area, although the existing lines carry lower voltages (69 kV or 138 kV) than the proposed Priority Projects (345 kV). As discussed in greater detail below, in areas that now have electrical transmission lines, people in close proximity to the lines may be exposed to extremely low frequency electric and magnetic fields (ELF-EMF) as well as a small but increased potential for electric shock. Other safety issues related to transmission lines include an increased potential for wildfires, and a small but increased potential for injury due to collapsing support structures. These issues are addressed below.

3.13.1 Extremely Low Frequency Electric and Magnetic Fields (ELF-EMF)

For at least the last 30 years, there has been some level of public concern about the possible health effects of ELF-EMF generated by overhead electrical transmission lines. Electric fields and magnetic fields are both created by electrical energy, but they differ. Magnetic fields, the component of ELF-EMF of primary health concern, are generated by electrons *moving* in a conductor, such as a transmission wire (Public Service Commission of Wisconsin 2010). The number of electric charges (electrons) moving through a conductor at any given time is called the current (measured in amperes, or amps). Electric fields, in contrast, are created by the mere *presence* of electric charges and are measured in volts per meter (V/m). The current flowing in a line, not the voltage, creates the magnetic field. This fact notwithstanding, a higher voltage transmission line has the capacity to carry more current than a lower voltage line and, as a result, generally produces a greater magnetic field. Table 3.19 provides typical examples of the correlation between the size of a transmission line and the magnetic field it might generate, as measured in Milligauss (mG). Note how rapidly the strength of the magnetic field decreases with distance from the line.

Table 3.19. Typical Magnetic Field Strengths Generated by Different Sized Transmission Lines

Transmission Lines[1]	At Center Line	At 40 Feet from Center Line
69 kV (167 amps)	23.0 mG	7.0 mG
138 kV (300 amps)	39.0 mG	17.0 mG
345 kV (628 amps)	95.8 mG	56.4 mG

Source: Public Service Commission of Wisconsin 2010

[1] Current, as measured in amps, varies with demand. The values shown here are typical for each line.

The amperages shown for each size line is typical for that line, but the amount of current a line carries can vary a great deal, depending upon the demand. For example, the Big Hill–Kendall double-circuit 345-kV transmission line can be expected to have loads during different times of the year resulting in lower EMG (34 mG at the centerline, 13 mG at 50 feet from centerline, and 5mG at 80 feet from centerline) or higher EMG (192 mG at centerline, 71 mG at 50 feet, and 31 mG at 80 feet).

ELF-EMF are a direct consequence of the generation, transmission, and use of any type of electrically producing material, including common household appliances. The ELF-EMF strengths for some appliances are shown in Table 3.20.

Table 3.20. ELF-EMF Strengths for Some Common Household Appliances

Appliance	Specification	Electric Field	Magnetic Field
Electric blanket	Surface	2.00 kV/m	10–30 mG
Hairdryer	1 foot distance	0.04 kV/m	1–70 mG
Iron	1 foot distance	0.06 kV/m	12–30 mG

Source: Elliott and Wadley 2002

As shown in Table 3.20, levels of exposure to magnetic fields generated by high-voltage power lines are comparable to those of other, very common, sources.

Because of the ubiquitous presence of electrical devices everyone in the United States is routinely exposed to ELF-EMF (National Institute of Environmental Health Sciences [NIEHS] 1999). The consequences of exposure to ELF-EMF, including the electromagnetic fields generated by transmission lines, on human health are unknown. Results of the many scientific studies regarding the health effects of ELF-EMF exposure are mixed and inconclusive. While some types of epidemiological studies (i.e., field studies) have shown a weak relationship between proximity to transmission lines and childhood leukemia, others have shown no such link (NIEHS 1999). The NIEHS reports that numerous laboratory experiments have failed to show a cause-and-effect relationship between exposure to ELF-EMF at environmental levels and disease. Given this contradiction, NIEHS reports that it is possible that some other factor or common source of error could explain epidemiological findings of a correlation between proximity to transmission lines and childhood leukemia (NIEHS 1999).

3.13.2 Electric Shock

Potential safety considerations attributed to an electric transmission line include the potential for electric shock. The electric field created by a high-voltage transmission extends from the conductors to other conducting objects nearby such as vehicles, persons, and vegetation. These effects can include induced currents, steady-state shocks, and spark discharge shocks (U.S. Department of Energy 2003).

- Induced Currents: Electric currents can be induced by electric and magnetic fields in conductive objects near transmission lines. For magnetic fields, the concern is for very long objects parallel and close to the line. The level of the induced current varies by the strength of the electrical field strength and size and shape of the object. Generally, facilities including those paralleling the transmission line—such as fences—are grounded when their lengths exceed a maximum length, which is calculated to reduce this impact.
- Spark-Discharge Shock: Induced voltages appear on objects such as vehicles when there is an inadequate ground. If the voltage is sufficiently high, a spark-discharge shock will occur as contact is made with the ground. Spark-discharge shocks that create a nuisance occur in instances of carrying or handling conducting objects, such as irrigation pipe, under transmission lines.
- Steady-State Shock: Steady-state currents are those that flow continuously after a person contacts an object, such as a vehicle, and provides a path to ground for the induced current. The effects of these shocks range from involuntary movement in a person to direct physiological harm. Steady-state current shocks occur in instances of direct or indirect human contact with an energized transmission line.

3.13.3 Risk of Fire and Collapsing Support Structures

The primary fire threats associated with high-voltage transmission lines are indirect, often consisting of human-caused accidents during construction and maintenance activities and as a result of increased access to areas inaccessible prior to development of utility corridors (California Public Utilities Commission 2008). Construction and maintenance activities that may ignite fires include blasting, the use of equipment such as chainsaws, and the presence of personnel who may inadvertently ignite fires while smoking. The introduction of transmission line access roads can provide increased access to wildlands by members of the public, which may increase ignitions from smoking, campfires, and arson.

Fires caused by components of electrical lines are most often associated with smaller-voltage distribution lines, which have shorter support structures than is generally the case with high-voltage transmission lines (California Public Utilities Commission 2008). Fire risks increase with proximity to vegetation. Failure to trim or remove trees located very close to transmission line conductors (wires) can result in wildfire ignitions when trees or branches are blown onto conductors. Inclement weather can also be a factor in fire threats associated with electrical lines. For example, fires can be started when wind-blown debris comes in contact with conductors, and when conductors come into contact with each other during high winds. Distribution line support structure failures are infrequent, but due to their placement in relatively narrow corridors in close proximity to trees and other tall vegetation, they may be pushed down in storms by wind-blown trees. Assisted by high winds, distribution line ignitions are known to have caused large fires (measured by acreage burned) (California Department of Forestry and Fire Protection 2006). Wildfires related to power lines can also be ignited by wildlife, the main culprit being large birds. Bird-caused flashovers are possible on low-voltage distribution and transmission lines where conductors are closely spaced. Birds perched on power poles or flying between poles can simultaneously contact two conductors, causing an electrical flashover. This electrocutes the bird and occasionally causes the feathers to catch fire. The bird may fall to the ground and ignite nearby vegetation.

Severe weather, including high winds, ice and snow storms, and tornados, can cause support structures to collapse and create safety hazards within the fall distance of overhead transmission lines and support structures. Both distribution and transmission systems are designed to withstand weather conditions normally experienced in their area of installation.

No data are currently available on the frequency of wildfires related to overhead distribution or transmission lines or on the frequency of support structure failures within the Priority Project Permit Area.

3.14 NOISE

Noise has generally been defined as an unpleasant, unexpected, or undesired sound that disrupts or interferes with the activity of balance of human or animal life. The principal human response to noise is annoyance. An individual's response to noise is influenced by the type of noise, perceived importance of the noise, appropriateness in the setting, time of day, type of activity during which the noise occurs and the sensitivity of the individual.

Intensity of sound is commonly measured in units of decibels and is expressed as "dB." In 1974, the EPA provided information to help protect public health and welfare (EPA 1974). According to that document, typical day-night (Ldn) average outdoor sound levels extend from 20–30 dB in wilderness areas, to upwards of 80–90 dB for urban areas (Figure 3.1). These sound levels are often referred to as the "ambient," or background, sound of a particular environment. An area's ambient sound is generally a composite of sounds from many sources, near and far, with no particular sound being dominant (EPA 1974).

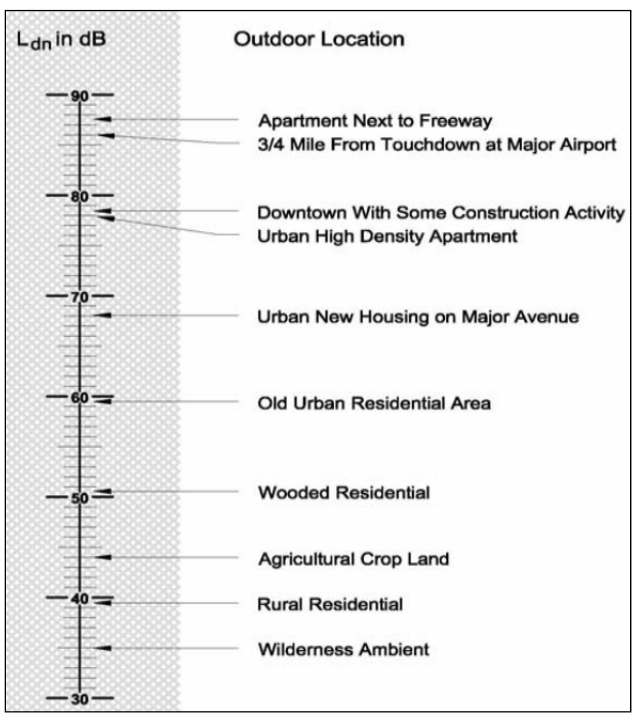

Figure 3.1. Examples of outdoor day-night average sound levels in dB measured at various locations (from EPA 1974).

Certain types of facilities and land uses are considered to be more sensitive to noise levels than others, due to the amount of noise exposure and the types of activities typically involved with

these land uses. Facilities such as schools, hospitals, residences, parks and outdoor recreation areas are generally quieter and more sensitive to noise than are commercial and industrial land uses. Rural areas are quieter than urban areas, and are therefore more sensitive to noise.

3.14.1 Sound Environment in the Permit Area

The Permit Area is predominantly rural; land uses are mostly agricultural, with sparse residential areas and a scattering of recreational facilities. Due to the rural environment, ambient sound levels are generally low. People living in rural areas are estimated to have outdoor day-night average sound levels ranging between 35 and 50 dB (see Figure 3.1).

This is not to say that rural residents do not experience sporadic noise. The primary sources for potential noise impacts include agricultural activity (e.g., using farm equipment), vehicles traveling on low-traffic county roads, some small aircraft, hunting and recreational shooting, and barking dogs. Noisy farm equipment includes tractors, combines, grain dryers, and power tools such as chain saws. Noise from chain saws typically reach 110 dB; tractors under load, 100 dB; and grain dryers, 70–90 dB (Toombs 1996).

3.14.2 Transmission Line Noise

Generally speaking, in areas where transmission lines occur (see Section 3.14, above), residents may hear sounds emanating from the transmission wires and towers, from activities associated with routine inspection and maintenance of the line, and from substation facilities. Transmission line noise includes corona, insulator, and wind noise (Aspen Environmental Group undated). Of the three, corona noise is the most common. It is heard as a crackling or hissing sound caused by the breakdown of air into charged particles by the electrical field at the surface of wires. Corona noise varies with both weather and voltage of the line, and occurs most often during wet conditions (heavy rain and high humidity). During relatively dry conditions, corona noise typically results in lower noise levels in close proximity to the transmission line (i.e., near the edge of the ROW). In rural locations, this sound level is similar to ambient conditions and may not be perceived. During rainy or foggy weather, corona noise levels typically increase and may be temporarily perceived near the transmission line. The corona effect (that is, the electrical field at the surface of wires) can also cause interference with amplitude-modulated (AM) broadcast radio. Such interference typically occurs immediately below a transmission line and dissipates quickly with distance from the line.

Insulator noise is caused by dirty or damaged insulators, and is primarily associated with older ceramic or glass insulators (Aspen Environmental Group undated). It is similar to corona noise, but it is not dependent on weather conditions. This type of noise is minimized by the use of new polymer insulators. Noise produced by the wind blowing through the wires and/or structures is usually infrequent and depends on wind velocity and direction. Wind that is blowing steadily and perpendicular to the wires may produce an aeolian vibration, which can resonate and create sound if the frequency of the vibration matches the natural frequency of the wire. Dampeners can be attached to the lines to minimize aeolian noise.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

The following three alternatives have been evaluated for their potential impacts on the resources described in Chapter 3.

Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)
Alternative B – Maximum Take Avoidance
Alternative C – No Action

For each resource, impacts are identified as being direct or indirect, beneficial or adverse. These terms are defined in this document as follows:

Direct Impact: An effect that is caused by an action and occurs in the same time and place.
Indirect Impact: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
Beneficial Impact: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
Adverse Impact: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Significance of impact as used in NEPA requires considerations of both context and intensity (40 CFR 1508.27). The context of the assessment is provided in the narrative for each resource. The level of intensity of an impact (impact threshold) is expressed as negligible, minor, moderate, or major. Because definitions of level of intensity vary by impact topic, these definitions are provided separately for each topic near the beginning of the corresponding subsections.

4.2 VISUAL AND AESTHETIC QUALITIES

The intensity of potential adverse impacts to visual and aesthetic qualities of the landscape is defined as follows:

- Negligible: Landscape character would remain intact, with only minute, if any, deviations. Any change to the existing viewshed would generally be overlooked by an observer.
- Minor: Landscape character would appear slightly altered. Deviations would be noticeable but remain visually subordinate to the existing visual characteristics of the landscape.
- Moderate: Landscape character would be noticeably altered and the changes would compete with the existing visual characteristics for the viewer's attention.
- Major: Landscape character would be substantially altered. The change to the existing viewshed would demand the attention of the observer or dominate the view such that it becomes the primary focus of the observer.

4.2.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would minimize and mitigate the potential impacts of the authorized take on the Covered Species as

described in the FHCP. Construction of the Priority Projects, to the extent considered connected to the issuance of the ITP, will result in both temporary and permanent impacts to the visual landscape in the Permit Area. Temporary impacts could include views of clearing and cleanup activities in the ROW, assembly and erection of the support structures (towers), and stringing of the wires. Where wooded areas are cleared, piles of brush and wood debris could have a temporary negative impact on the local visual environment. Permanent impacts from the projects would be views of the cleared ROWs, multiple 120- to 180-feet-tall support structures, and the transmission wires themselves.

The analysis of potential impacts on visual and aesthetic qualities of the landscape in the Permit Area presented in the following sections was largely taken from environmental assessment reports prepared for the Priority Projects by PBS&J (2010a, 2010b). To evaluate visual impacts to areas most used by the public, PBS&J estimated the length of each primary alternative route for each of the transmission lines that would fall within the foreground visual zone (FVZ) of a major highway, recreational area, or other site of public importance. The FVZ is defined as that part of the transmission line ROW within 0.5 mile of, and visible to, an observer (i.e., not obstructed by terrain, trees, etc.). The determination of the visibility of the transmission line from various points was calculated from USGS topographic maps and aerial photography.

Mitigation of the visual impact of high-voltage transmission lines usually involves selection by the PUC of alignments that avoid, to the extent practicable, places of high scenic quality. Visual impacts are taken into account by the PUC in selecting routes for transmission lines in Texas (LCRA TSC 2009). To some viewers, some types of support structures (e.g., monopoles) are less visually intrusive than others (e.g., lattice towers); however, numerous other criteria, including engineering and budgetary constraints, must be also taken into account when choosing the type of support structure used in any given circumstance. The visual impact of the ROW itself can be mitigated to some extent by revegetating disturbed areas not needed for long-term maintenance, inspection, and repair access to reduce the visual contrast with the surrounding landscape.

The Preferred Alternative includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered Species. These areas (the location of which is currently unknown) would be protected from development and thus retain visual and aesthetic values that might otherwise be lost.

4.2.1.1 Twin Buttes–Big Hill Transmission Line

The PUC-approved route for the Twin Buttes–Big Hill transmission line passes through rolling to hilly open range and more gently sloped farmland. Because of this relatively open landscape, many of the transmission line support structures generally would be visible from a considerable distance, and the landscape character along much of the route would be substantially altered (except for the northern 6.8 miles of the route, which follows an existing overhead transmission line corridor). Within the 0.5 mile FVZ, the change to the existing viewshed would demand the attention of the observer and could dominate the view such that it becomes the primary focus of the observer. With increasing distance from the line, the perceived degree of contrast with prevailing landscape features would be moderate. For viewers, including those who reside, work, visit, or travel within sight of the transmission line, the long-term adverse impacts to the

visual and aesthetic characteristics of the landscape would be minor to major, depending on the viewer's distance from the line and how conditioned they are to the appearance of transmission lines.

Approximately 2.2 miles of the selected route for this transmission line lie within the FVZ of one major highway, US 67, and approximately 2.1 miles of the highway lie within 0.5 mile of the transmission line route. Given the geometry of the transmission line route at the US 67 crossing, a west-bound person traveling at 55 mph on the highway would have the transmission line in the FVZ in a forward-facing or side view for approximately 94 seconds, while an east-bound person traveling the highway at the same speed would have the transmission line in the FVZ in a forward-facing or side view for approximately 105 seconds.

A total of approximately 1.4 miles of the ROW for the selected route would be located within the FVZ of one recreational area: the San Angelo Claybird Association in Tom Green County. The visual impacts to some of the affected properties along the Twin Buttes–Big Hill alignment would be mitigated with the use of monopoles rather than lattice towers as stipulated in PUC's Order of 9 July 2010.

4.2.1.2 Big Hill–Kendall Transmission Line

The landscape crossed by this transmission line is largely level to rolling fields and hilly rangeland in the western reaches with increasing topographic relief (hills and canyons) and woodlands in the eastern reaches. From the Big Hill Substation in Schleicher County to eastern Kimble County, because of the open landscape, construction of the transmission line with its 120- to 180-feet-tall support structures would result in visual impacts similar to those described for the Twin Buttes–Big Hill transmission line, above. Most of this section of the selected route crosses over private lands away from public roads; therefore, most of the this portion of this transmission line would not be in a FVZ available to the general public, but would be in the FVZ to those people that live and work on the lands crossed by the transmission line. The cleared ROW would not be particularly obvious where the transmission line crosses open range lands, but would appear as an anomalous cleared swath where the line crosses shrublands and woodlands.

After entering Kimble County, the alignment crosses into a hillier, wooded landscape. This section of the route closely follows R.R. 1674 and I-10 until reaching the Kendall Substation. The transmission line and its structures would be in the FVZ of all people traveling these roads in addition to those people living and working on lands crossed by the transmission line. The hilly topography would obstruct views of more distant structures. R.R. 1674 is a two-lane, somewhat curvy road that passes through a rural landscape. Along this road, the cleared ROW would appear in most areas as an anomalous swath cut through wooded vegetation, and the transmission line structures would stand in contrast to the mostly undeveloped landscape. While the section of I-10 followed by the selected route also largely passes through a rural landscape (with the exception of where the route passes the cities of Kerrville and Junction), for travelers of this highway, the FVZ already includes a very broad cleared swath that contains at least four paved travel lanes, gravel shoulders, and grassy ROW, as well as, in many segments, frontage roads, all which stand in contrast to woodlands and rangelands present on either side of the highway. Construction of the transmission line would increase the width of the cleared

swaths and add the presence of transmission line structures. Along some sections of the alignment that follow I-10, the ROW would not be visible to, or not likely to be seen by, travelers of the highway because the cleared ground would be well above eye-level and its view would be blocked by hillsides, or because the challenges posed by traveling on an interstate highway would at times require drivers to keep their eyes on the road.

The transmission line would pass a rest area approximately 10 miles west of the City of Comfort that was recognized as one of the best in Texas by TxDOT (1998). This rest area is located on the top of a hill, with the transmission line alignment passing below the hill to the north. The transmission line would be clearly visible as people entered and left the rest area, but would be less evident from most of the rest area proper because of trees that screen much of the view to the north. It is expected that people standing in certain locations would be able to see sections of transmission line, and maybe one somewhat distant structure, from gaps between trees. The impact that construction of the transmission line would have on the aesthetic quality of the rest area is considered to be minor because of the trees and terrain that would minimize visibility of the transmission line, and the trees, buildings, and vehicles that would dominate foreground views, for a person stopped at the rest area.

This transmission line alignment crosses the Texas Forts Trail in two locations in Schleicher County, crosses the Texas Hill Country Trail in Kerr County, and follows a portion of the Texas Pecos Trail in Kimble County. People following the Texas Forts and Texas Hill Country trails would only see this transmission line for a brief period of time because they should be traveling at relatively high speeds along U.S. Highway 277 and U.S. Highway 190 in Schleicher County, or State Highway 16 in Kerr County, and the transmission line crosses each of these roads at only one location and at nearly right angles. People following the Texas Pecos Trail in Kimble County would be able to view the transmission line along an approximately 14-mile long stretch of I-10 between the City of Junction and RR 1674. All three of these trails pass through towns and cities and follow roads that provide views of human infrastructure such as houses, businesses, quarries, cellular phone and other communication towers, distribution lines, billboards, cars, trucks, and the roads themselves. The transmission line would add one more human element to the landscape seen by people traveling these trails, but because of existing levels of disturbance and how the alignment crosses U.S. Highway 277, U.S. Highway 190, and State Highway 16, the impact of construction of the transmission line on the visual and aesthetic qualities of the Texas Forts Trail and Texas Hill Country Trail is considered to be minor. Impact to the visual and aesthetic quality of the Texas Pecos Trail, which is followed by the Big Hill-Kendall alignment for a distance of approximately 14 miles, is considered to be minor to moderate, with the relative level of impact expected to be registered on an individual basis depending on the person's tolerance of, and familiarity with, the appearance of transmission lines.

The Service recognizes that the Hill Country landscape of the Permit Area is among the most scenic in Texas and is highly valued for its aesthetic qualities by residents and visitors alike. In sum, for much of this transmission line, the long-term adverse impacts to the visual and aesthetic characteristics of the landscape would be minor to major, depending on the viewer's distance from the line, the degree to which the view of the transmission line was obstructed, proximity of the line to previously developed or highly disturbed areas, and how conditioned the viewer was

to the appearance of transmission lines. Based on concerns raised by the citizens of Kerr County, the Service understands that the PUC required LCRA TSC to meet with affected landowners and the City of Kerrville to discuss structure types for the portion of the line traversing Kerrville and Kerr County along I-10. Those meetings were to help ensure that the people and entities directly affected by the line have input on the type of structures actually constructed along the path of the line through Kerr County.

The total length of the approved Big Hill–Kendall transmission line that would be within the FVZ of U.S. and state highways would be approximately 86.24 miles (SOAH 2010). Approximately 8.12 miles would be within the FVZ of parks and recreational areas. The visual impacts to some of the affected properties along the Big Hill-Kendall alignment would be mitigated with the use of monopoles rather than lattice towers as stipulated in PUC's Order of 24 January 2011.

4.2.2 Alternative B – Maximum Take Avoidance

Impacts to visual and aesthetic qualities under Alternative B would be similar to those under the Preferred Alternative, except under Alternative B less woodland and shrubland vegetation would likely be cleared (approximately 608 acres) from the ROW. See Sections 4.7.1.2, 4.7.3.1.2, and 4.7.3.2.2, below, for a discussion of the amount of vegetation and Covered Species habitat potentially removed under Alternative B. In the uncleared areas, the ROW would present little visual contrast to the surrounding landscape. The visual impacts of support structures and transmission lines would be expected to be similar to those of the Preferred Alternative. Similar to the Preferred Alternative, Alternative B includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered Species, although less offsite mitigation would occur. These preserved areas (the location of which is currently unknown) would be protected from development and thus retain visual and aesthetic values that might otherwise be lost.

4.2.3 Alternative C – No Action

Under No Action, LCRA TSC would not request and the Service would not issue an ITP. It is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using similar impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Therefore, the impacts to visual and aesthetic qualities along the transmission lines are expected to be similar to those under Alternative B. However, differences may occur offsite. The woodland and shrubland habitats preserved as mitigation for Covered Species impacts under Alternative B will likely not be protected over the long term from the visual impacts of development under Alternative C.

4.2.4 Summary of Impacts

Under all three alternatives, impacts to the visual and aesthetic characteristics of the landscape through which the proposed transmission lines would pass would be minor to major, adverse, and both short term and long term. The intensity of the impact would vary depending on the aesthetic qualities of the landscape in the immediate area, the degree to which the view of the transmission line was unobstructed, the viewer's distance from the line, and how conditioned the viewer was to the sight of transmission lines.

4.3 CLIMATE AND CLIMATE CHANGE

The impact assessment in this section discusses the potential for construction, operation, and maintenance activities related to the Priority Projects to emit greenhouse gas emissions and, thereby, potentially contribute to global warming in light of the combined emissions of other broad-scale causes of climate change. The potential for climate change to affect the Priority Projects is also addressed. Because it is not currently feasible to quantify the effects of individual projects on global climate change (IPCC 2007, U.S. Forest Service 2007), the impact intensity ratings of "negligible" to "major" have no meaning in this context and are not defined or used in this section.

4.3.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. Sources of potential impacts to climate and climate change would not differ between the two Priority Projects; thus, this section is not broken down by project.

Installing the Priority Projects would generate some level of greenhouse gas emissions, particularly during the construction phase. All three of the major greenhouse gases; carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O); are produced by the burning of fossil fuels for heavy equipment, heavy and light trucks, and passenger cars, which all typically use fossil-based fuels to operate. Therefore, it is inevitable that some level of greenhouse gases would be emitted through the operation of construction-related equipment onsite and the operation of worker and builder supply vehicles traveling to and from the construction area. In addition to vehicle exhaust emissions, CH_4 would be emitted during onsite fueling of heavy equipment. During long-term operations and maintenance, the transmission lines would require the sporadic use of greenhouse-emitting vehicles. Project emissions may contribute to the cumulative effect of all greenhouse gas emissions on global climate change (see Section 5.2.2); however, as noted above it is not currently feasible to quantify the effects of individual projects on climate change (IPCC 2007, U.S. Forest Service 2007).

Future climate change may indirectly affect the Priority Projects under this alternative. The EPA (1997) predicts that over the next century, climate in Texas is likely to become warmer, with wider extremes in both temperature and precipitation. If the hotter- and drier-than-normal conditions seen in central Texas in 2011 become more typical in the future, the threat of wildfire damage to facilities, including the Priority Projects, would increase. A measure of protection from the threat posed by wildfires is provided by local, state, and national firefighting agencies; however, their effectiveness is constrained by the individual circumstances of each fire. Future climate change may also affect the habitat preserves that provide mitigation for project impacts to Covered Species. However, management of those preserves is governed by legal agreements other than the FHCP and beyond the scope of this analysis.

The Priority Projects are expected to primarily transmit electricity produced in the CREZ by renewable energy generation projects as needed to meet current and expected future energy demands in Texas. Wind-generated electricity transmitted on these Priority Projects would displace thermal (i.e., coal and older gas) generation electricity when the wind is blowing. Some lower levels of existing thermal generation will be kept on spinning reserve to account for the

intermittent nature of wind generation. However, when wind generation is available and being transmitted on the Priority Projects, less coal and gas generation will be necessary, thereby resulting in decreased amounts of greenhouse gas production. Consequently, future incremental increases in the amount of greenhouse gases released as a result of energy production in Texas could be less under Alternative A if the Priority Projects carry electricity produced by those renewable energy generation projects than they might if the transmission lines carried electricity produced from traditional non-renewable resources.

4.3.2 Alternative B – Maximum Take Avoidance

The potential impacts of this alternative on climate and climate change would be substantially the same as for the Preferred Alternative. The potential effects of climate change on the Priority Projects under this alternative would be similar to those under the Preferred Alternative, with the following exception. Should the climate of central Texas become hotter and drier in the future, the threat posed by wildfire to the transmission lines would be somewhat greater under Alternative B because woody vegetation (potential fuels) would not be cleared from portions of the ROW.

4.3.3 Alternative C – No Action

For the reasons described in Section 4.1.1, it is anticipated that the impacts of the No Action alternative on climate and climate change would be similar to those of Alternative B.

4.3.4 Summary of Impacts

Under all three alternatives, project emissions may contribute to the cumulative effect of all global greenhouse gas emissions on climate change (see Section 5.2.2); however, it is not currently feasible to quantify the effects of individual projects on climate change (IPCC 2007, U.S. Forest Service 2007). Under all three alternatives, if the hotter- and drier-than-normal conditions become more typical in the future, the threat of wildfire damage to facilities, including the Priority Projects, would increase, but less so under the Preferred Alternative because more woody vegetation (potential fuels) would be removed from the ROW.

4.4 AIR QUALITY

The intensity of potential impacts to air quality is defined as follows:

- Negligible: Changes in air quality would be below or at the level of detection and, if detected, the effects would be considered slight.
- Minor: Changes in air quality would be measurable, although the changes would be small and local. No air quality mitigating measures would be necessary.
- Moderate: Changes in air quality would be measurable and would have appreciable consequences, although the effect would be relatively local. Air quality mitigating measures would be necessary, and they probably would be successful.
- Major: Changes in air quality would be measurable, would have substantial consequences, and would be noticed regionally. Air quality mitigating measures would be necessary, and their success would be uncertain.

4.4.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. Sources of potential impacts to air quality would not differ between the two Priority Projects; thus, this section is not broken down by project.

During construction of the Priority Projects, there would be a short-term impact on local air quality during periods of site preparation and installation. The primary construction-related emissions would be particulate matter (PM), or fugitive dust, which would be produced by excavation and earth moving and cement and aggregate handling. Any effects from fugitive dust would be temporary and would vary in scale depending on local weather conditions, the degree of construction activity, and the nature of the construction activity. During construction, this effect would be minimized by LCRA TSC's commitment to requiring the contractor to adhere strictly to dust control measures, such as wetting newly cleared ROWs and access roads or mulching and reseeding disturbed areas as quickly as possible after clearing.

Construction-related equipment would produce air pollutants associated with diesel and gasoline combustion (nitrogen oxides, carbon and sulfur oxides, hydrocarbons, and PM). These emissions would be confined to the daytime hours and would be generated only during active construction periods. Due to the linear nature of the project, construction-related activities would not last long at any one place. As a result, the National Ambient Air Quality Standards (NAAQS) for the criteria pollutants (CO, Pb, NO_2, PM_{10}, $PM_{2.5}$, O_3, and SO_2) in any given area would not be exceeded (see Section 3.4.1). It is not anticipated that emissions from construction of the Priority Projects would have more than short-term, negligible adverse impacts on air quality in the Permit Area.

Vehicle and equipment emissions would also occur during the repair and maintenance phases of the projects whenever the ROWs were driven and vegetation was trimmed from the ROWs. However, these activities would occur infrequently and be of short duration. Therefore, adverse impacts on air quality are expected to be negligible.

4.4.2 Alternative B – Maximum Take Avoidance

Potential impacts to air quality under Alternative B are expected to be similar to those under the Preferred Alternative. Pollutants emitted by the extensive use of helicopters to string transmission wire are expected to be offset by the reduced use of construction vehicles and vegetation clearing equipment. Trees and shrubs provide some air-filtering capability, and more trees and shrubs would be retained on the landscape under this alternative than under Alternative A. The difference in loss of natural air-filtering capability between Alternatives A and B would not likely extend to a noticeable or even measurable difference in air quality in the Permit Area.

4.4.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same air quality impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Therefore, this alternative would result in similar impacts to air quality as would Alternative B.

4.4.4 Summary of Impacts

Under all three alternatives, emissions from construction of the Priority Projects would not have more than negligible, adverse, short-term impacts to air quality in the Permit Area. Negligible amounts of vehicle and equipment emissions would also occur during the repair and maintenance phases of the projects. NAAQS for the criteria pollutants (CO, Pb, NO_2, PM_{10}, $PM_{2.5}$, O_3, and SO_2) would not be exceeded.

4.5 SOILS AND GEOLOGY

The intensity of potential impacts to soils and geological resources is defined as follows:

- Negligible: The impact on soils and geological resources would not be measurable.
- Minor: An action would change a soil's color and/or texture in a relatively small area, but it would not increase the potential for erosion of additional soil. For geological resources, impacts would be slightly detectable, but would not be expected to have an overall effect.
- Moderate: An action would result in a change in quantity or alteration of the topsoil or the potential for erosion to remove small quantities of additional soil. For geological resources, impacts would be clearly detectable and could have an appreciable effect on resources.
- Major: An action would result in a change in the potential for erosion to remove large quantities of additional soil or cause alterations to topsoil in a relatively large area. For geological resources, impacts would be substantial, with highly noticeable influences on the resources.

4.5.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.5.1.1 Soils

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. Sources of potential impacts to soils and other geological resources would not appreciably differ between the two projects; thus, this section is not broken down by project.

The major potential impact from construction of the two proposed transmission lines to soil would be disturbance of soil by construction of support structures, soil compaction, and an increased potential for erosion. The potential for erosion and compaction would be greatest at support structure sites where heavy equipment would be used to erect the support structures, in areas where new access roads would be created, and in project staging areas. In parts of the ROW where vegetation would be completely removed, the potential for erosion would be increased until ground cover anchoring the soil was restored. In areas where vegetation would be mowed back, no impacts to soil would occur. Use of heavy equipment, such as large trucks and cranes, may compact the soil in areas of greatest vehicle use.

Use of grading would be unnecessary or minimized. Where soils must be disturbed, several measures would be implemented to minimize the severity and duration of impacts. As a general practice, the timing and method of ROW preparation would take into account soil stability and the potential for erosion. No vegetation would be removed until a Storm Water Pollution

Prevention Plan (SWPPP) had been prepared and a notice of intent submitted to TCEQ. In accordance with the SWPPP, erosion-control devices would be constructed where necessary to prevent soil erosion in the ROW and new access roads. Erosion-control devices would be maintained and inspections conducted until the site was sufficiently revegetated, as required by the SWPPP. Natural succession is expected to revegetate the majority of the ROW; however, if natural revegetation would not provide adequate ground cover in a reasonable length of time (or invasive species are a threat), seeding, sprigging, or hydroseeding of restored areas would be used to encourage growth of ecologically desirable vegetation. Where site factors make it unusually difficult to establish a protective vegetative cover, other materials, such as gravel, rocks, or concrete, may be used to prevent erosion.

Topography could create moderate slope stability problems in some areas. To reduce potential impact to slopes and to protect slope stability in these areas, LCRA TSC could modify construction activities during periods of increased precipitation. Slopes would be returned to preconstruction conditions or graded parallel to landscape contours in a manner that conforms to natural topography, except to the extent necessary to establish appropriate ROW, structure sites, and access for the transmission line.

With the implementation of the aforementioned mitigation measures, the Priority Projects are expected to result in temporary, minor adverse impacts to soils in the Permit Area due to erosion and compaction.

The Preferred Alternative includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered Species. These areas (the locations of which are currently unknown) would be protected from development and thus potential adverse effects on soils may be avoided. Over the long term, the potential benefit to soil resources on preserves would offset, to some degree, short-term potential adverse impacts to soil resources at the project site.

4.5.1.1.1 Prime Farmland Soils

Prime farmland soils are those soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops (7 USC 4201(c)(1)(A)). The Priority Projects are not expected to significantly impact areas of prime farmland soils or other agricultural uses. Identification of the preliminary alternative transmission line routes and selection of the final routes took prime farmland into consideration. To the extent practicable, routes were chosen that follow existing roadways, property lines, fence lines, or other existing ROW, thus minimizing potential impacts to prime farmland.

Other than the potential for construction-related soil erosion and compaction in the ROW, the only potential impact of the Priority Projects on prime farmland soils would be the physical occupation of relatively small areas by the base of the support structures (up to 900 ft^2) per tower). Prime farmland would be avoided to the maximum extent practicable when constructing new access roads and staging areas. Overall, the Priority Projects would only slightly reduce the potential in the Permit Area for agricultural production and farming operations to continue within the ROW much as before installation of the line. The projects, therefore, are expected to have a negligible adverse impact on prime farmland soils.

4.5.1.2 Geological Resources

In some locations, erection of the support structures for the priority Projects would require the removal and/or minor disturbance of small amounts of near-surface rock, but this would have no meaningful impact on geological resources or features. Some risk does exist of penetrating solution cavities at structure locations on the Edwards Limestone Formation. To minimize this risk, when preparing the environmental assessments for the Priority Projects, PBS&J contacted the Texas Speleological Society (TSS) to request information from their database (TSS 2009) on the location of known caves, sinkholes, and cavities within the Permit Area. This information, in the form of geographic information system (GIS) files, was then overlaid on preliminary route maps to see whether any of these sensitive features might be potentially impacted. The result was that no known caves, sinkholes, or cavities are located in the vicinity of any of the preliminary alternative routes or the final PUC-approved routes.

While LCRA TSC would place no support structure over a cave, sinkhole, or cavity listed in the TSS database, it is possible that, in the process of laying the foundation for support structures, drilling may penetrate a previously unknown cavity. How such instances would be handled would depend on several variables, including the nature of the cavity, engineering constraints, and options for avoiding the cavity. It is not likely that a cavity large enough for human entry would happen to occur at a structure site (caves are not that common in the region), but if such a feature were discovered, adjustments would be made to avoid the cavity. Small voids would likely be filled with concrete. Because no portion of the Permit Area lies within the Edwards Aquifer recharge zone, provisions of the Edwards Aquifer Rules pertaining to significant recharge features would not apply. It is also worth noting here that no federally listed karst species are known to occur within the Permit Area.

Any adverse impacts to geological resources in the Permit Area resulting from the installation of the Priority Projects are expected to be minor because, while small karst features (cavities) are likely to be encountered and destroyed, such features are ubiquitous in the regional topography, and the loss or disturbance of a few is expected to have little or no serious ecological consequences. Large karst features are unlikely to be encountered, and if they are, they would be avoided.

4.5.2 Alternative B – Maximum Take Avoidance

Compared to the Preferred Alternative, potential impacts to soils under Alternative B would be reduced. Because woodland and shrubland habitat for Covered Species would not be cleared in transmission line ROW except at support structure locations, more vegetation would be left intact to anchor soil. As a result, the potential for soil erosion on the project site would be reduced. Offsite, less Covered Species habitat would be preserved as mitigation; therefore, the potential for protecting offsite soil resources from the effects of development would be reduced. Impacts to geological resources under Alternative B would be very similar to those expected under the Preferred Alternative. The number of support structures erected would be comparable; therefore, the amounts of excavation work and associated geological impacts are expected to be similar.

4.5.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using similar impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Impacts to soils and other geological resources on the project site under No Action would be very similar to those under Alternative B for the reasons described above in Section 4.5.2. Land will likely not be preserved as mitigation for impacts to Covered Species, and, as a result, offsite soil resources will likely not be protected from the effects of development.

4.5.4 Summary of Impacts

The magnitude of potential adverse impacts to soils would be somewhat less under Alternative B or Alternative C than under Alternative A (the Preferred Alternative), with Alternative B likely to result in the lowest level of adverse impacts to soils. The difference among the alternatives would be small, however, and all three alternatives are expected to result in minor, adverse, short-term impacts to soils, including prime farmland soils, due to erosion and compaction. Negligible impacts to soils are expected over the long term. Adverse impacts to geological resources are likely to be negligible under all three alternatives.

4.6 WATER RESOURCES

The intensity of potential impacts to water resources is defined as follows:

- Negligible: Impacts would not be detectable. Water quality parameters would not change, and availability of surface water and groundwater would be within the range of historical ambient and variability conditions.
- Minor: Impacts would be detectable, but small in magnitude, and would not cause water quality parameters to fall below the water quality standards for the designated use. While change would be measurable, water availability would be within the range of historical ambient and variability conditions.
- Moderate: Changes to water quality and availability would be readily apparent, but would not cause water quality parameters to fall below all water quality standards for the designated use. Water availability would drop below the range of historical ambient and variability conditions by a small amount.
- Major: Changes to water quality and availability would be readily apparent, and some water quality parameters periodically would be approached, equaled, or exceeded. Water availability would drop below the range of historical ambient and variability conditions, and could include a complete loss of water in some areas.

4.6.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. Sources of potential impacts to water resources would not appreciably differ between the two projects; thus, this section is not broken down by project.

4.6.1.1 Surface Water

4.6.1.1.1 General Impacts and Mitigation

The main potential impacts on surface waters are siltation resulting from erosion and pollution in the unlikely event of an accidental spillage of petroleum products (e.g., fuel, lubricants, solvents) or other chemicals. Removal of vegetation during ROW clearing and creation of access roads could result in increased erosion potential of the affected areas, leading to the delivery of slightly higher-than-normal sediment loads to nearby surface waters during heavy rainfall events. These short-term adverse impacts, however, are expected to be negligible to minor because the methods used by LCRA TSC for vegetation clearing are devised to take into account soil stability, prevention of silt deposition in water courses, and practical measures for the protection of natural vegetation and adjacent resources. For example, LCRA TSC plans to use flail mowers to clear the ROW in many locations (see Section 4.7.4.6.1.3). In addition, the construction activities, including those related to creating new access roads, require a SWPPP, which would include implementation and monitoring of various TCEQ BMPs such as the installation of silt fences, mulch logs, side drainage ditches, culverts, and potentially other TCEQ-approved mechanisms.

Both proposed transmission lines would span surface waters. If permanent or relatively permanent streamflow is present in any surface water, construction crews would transport machinery and equipment around these areas via existing roads to avoid direct crossings. If construction crews must cross streams, some bank and streambed alterations may be necessary to facilitate the crossing. Construction contractors would conduct such activities according to the Clean Water Act and applicable regulations and the SWPPP. If clearing of vegetation would be necessary at surface water crossings, LCRA TSC would employ selective clearing (i.e., use of chainsaws instead of heavy machinery), to minimize erosion problems.

To prevent accidental spill of petroleum products and properly remediate any spills that should occur, LCRA TSC would employ BMPs during construction for proper control and handling of any petroleum or other chemical products (see LCRA's 2010 BMPs; LCRA 2010d). These BMPs are consistent with the TCEQ Spill Prevention and Control regulations (30 TAC Chapter 327) and are adequate to offset any impacts from such a spill. Because of these measures, it is highly unlikely that more than a minor spill would occur, and it is even less likely that pollutants from a spill would be allowed to enter any body of water.

Given the implementation of the mitigation measures described in the preceding paragraphs, potential adverse impacts of the Priority Projects to surface waters would be minor in the short term and negligible over the long term.

The Preferred Alternative includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered species. These areas (the locations of which are currently unknown) would be protected from development and thus potential adverse effects on surface water resources are likely to be avoided. Furthermore, LCRA TSC's use of sediment and erosion controls during construction and the use of existing vegetated buffers would reduce the likelihood of adverse effects from access road and ROW runoff to surface water resources. Over the long term, the potential benefit to water resources on preserves would offset, to some degree, short-term potential adverse impacts to water resources at the project site.

4.6.1.1.2 Hydrographic Features Potentially Affected by the Priority Projects

The following sections provide information on the number of hydrographic features (i.e., surface water features such as springs, streams, ponds, and lakes) crossed by the Priority Project approved routes and potentially affected by project construction.

Twin Buttes–Big Hill Transmission Line

According to the *National Hydrography Dataset* (NHD) (USGS 2010a), the alignment selected by PUC (2010) for the Twin Buttes–Big Hill transmission line crosses 49 hydrographic features (Table 4.1), of which four have names (Table 4.2). Field reconnaissance performed by SWCA and review of aerial photography indicates the majority of features are ephemeral to intermittent waterways, which are dry part of the time or over part of their course. No feature appears too wide to span; that is, none should require placement of support structures in or directly adjacent to the feature. The widest feature, at about 80 to 100 feet, is Rust Reservoir, a long, narrow impoundment of Spring Creek, which TPWD considers an ecologically significant stream segment at this location (see Section 3.6.1.1 in Chapter 3).

No impaired waters intersect the Twin Buttes–Big Hill alignment; however, three sections of the Concho River system in Tom Green County have been identified as impaired waters (see Section 3.6.1.1). These impaired waters will not be further impacted by the approved transmission line.

Table 4.1. NHD Hydrographic Features Crossed by the Twin Buttes–Big Hill Alignment

NHD Hydrographic Feature	Total Crossings
Artificial path	4
Stream/River, Intermittent	35
Stream/River, Perennial	4
Lake/Pond, Intermittent (upland constructed stock tank)	1
Lake/Pond, Perennial (small impoundments on intermittent tributaries)	5
Total	**49**

Table 4.2. Named Hydrographic Features Crossed by the Twin Buttes–Big Hill Alignment

Name of Hydrographic Feature	Total Crossings
Burks Creek	1
Dove Creek	1
Middle Concho River	1
Rust Reservoir / Spring Creek	1
Total	4

Big Hill–Kendall Transmission Line

According to the NHD (USGS 2010a), the alignment selected by PUC (2011) for the Big Hill–Kendall transmission line crosses 174 hydrographic features (Table 4.3); of which 27 have names (Table 4.4). Field reconnaissance performed by SWCA and review of aerial photography indicates the majority of features are ephemeral-to-intermittent waterways, which are dry part of the time or over part of their course. No feature appears too wide to span; that is, none should require placement of support structures in or directly adjacent to the feature.

Table 4.3. NHD Hydrographic Features Crossed by the Big Hill–Kendall Alignment

NHD Hydrographic Feature	Total Crossings
Stream/River, Intermittent	158
Stream/River, Perennial	10
Lake/Pond, Intermittent (upland constructed stock tank)	1
Lake/Pond, Perennial (small impoundments on intermittent tributaries)	5
Total	**174**

Table 4.4. Named Hydrographic Features Crossed by the Big Hill–Kendall Alignment

Name of Hydrographic Feature	Crossings		Name of Hydrographic Feature	Crossings
Bear Creek	1		Middle Copperas Creek	1
Cedar Hollow Creek	1		Middle Valley Prong	1
Copperas Creek	1		North Creek (Kerr County)	2
Cypress Creek	3		North Creek (Kimble County)	1
Dry Branch	2		North Fork Cypress Creek	1
East Town Creek	1		North Llano River	2
Elm Slough	3		North Valley Prong	1
Fall Branch	1		Quinlan Creek	1
Fessenden Branch	1		South Concho River	1
Goat Creek	1		Stark Creek	1
Hasenwinkel Creek	3		Sycamore Creek	1
Johnson Fork	1		Town Creek	1
Joy Creek	1		West Copperas Creek	3
Llano River	1		West Dry Branch	1
Total Crossings: 39				

No impaired waters are intersected by the approved Big Hill–Kendall alignment, but two impaired waters occur within the Big Hill–Kendall portion of the Permit Area: the upper 9 miles of Camp Meeting Creek in Kerr County and Upper Cibolo Creek in Kendall County (see Section 3.6.1.2). These impaired waters will not be further impacted by the approved transmission line.

4.6.1.1.3 Wetlands and Other Jurisdictional Waters of the U.S.

Most wetlands within the Permit Area are expected to occur in upland stock tanks and ponds, which the U.S. Army Corps of Engineers generally defines as isolated, non-jurisdictional Waters of the U.S. The greatest potential for the occurrence of jurisdictional wetland habitat would be within floodplains and along the margins of permanent waterways or impoundments. LCRA TSC is conducting delineations for all potential Waters of the U.S., including potential jurisdictional wetlands, along the alignments to determine whether any jurisdictional Waters of the U.S. exist in the ROWs. If any Waters of the U.S. do occur in a ROW, it is likely that the aerial transmission line would easily span those features. While LCRA TSC would attempt to avoid placement of structures in Waters of the U.S., if such placement proves necessary, LCRA TSC would comply with the Clean Water Act and applicable regulations and, where appropriate, obtain authorization from the U.S. Army Corps of Engineers. Additionally, LCRA TSC (2010) would utilize the BMPs during vegetation removal and land disturbance activities near Waters of the U.S., as these activities have potential to cause erosion and sedimentation. As part of these BMPs, LCRA TSC proposes to place erosion control devices downstream of areas disturbed by construction activities to detain and filter the flow of runoff toward Waters of the U.S. As a

result of these measures, the potential for either short-term or long-term adverse impacts to jurisdictional waters is minimized.

The Preferred Alternative includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered species. These areas would be protected from development and thus potential adverse effects on wetlands and other jurisdictional waters (should they occur in these areas) are likely to be avoided.

4.6.1.1.4 Floodplains

The Priority Project routes cross 100-year floodplains and may require the placement of some structures within the 100-year floodplain, particularly at wide river crossings with broad, low floodplains. Construction activities within the floodplains have the potential to result in erosion and sedimentation, to restrict transport of organic and inorganic materials, to divert streamflow, and to constrain natural channel migration, especially if flooding were to occur during construction. These factors can result in alteration or degradation of stream habitats, as well as physical damage to the landscape as a whole. Because the location of physical attributes of drainage channels is dynamic, appropriate placement of roads and other structures must account for movement of geomorphic (e.g., surface) features in the floodplain. If it becomes necessary to locate support structures, access roads, or temporary staging areas in floodplains, the design and construction would be such to not impede the flow of any waterway or create hazards during a flood event. The support structures and access roads within the floodplain would be located so that they would not significantly affect flooding. Some scour could occur around structures if flood-flow depths and velocities became great enough. Careful site placement of structures should eliminate the possibility of significant scour. LCRA TSC would also use information regarding site-specific conditions where roads would approach floodplains during the design and construction of these roads in order to ensure that the design best protects the integrity of channel and floodplain dynamics. In addition, LCRA TSC would have a SWPPP in place prior to beginning construction and would consult with local floodplain administrators where applicable. The Preferred Alternative includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered species. These areas would be protected from development and thus potential adverse effects on floodplains (should they occur in these areas) are likely to be avoided.

4.6.1.2 Groundwater Resources

In the karstic topography typical of some of the Permit Area, surface hydrographic features often contribute water to groundwater aquifers through fissures in the limestone bedrock. Notably, the extreme southeast portion of the Permit Area lies in the contributing zone of the Edwards Aquifer, an essential source of drinking water for the populous San Antonio–Austin corridor. As described in the preceding sections, the Priority Projects have a small potential to impact surface water in the form of increased sedimentation from construction sites, and a negligible potential for any spills to reach surface water. A local, short-term, minor increase in sedimentation in a surface water feature is unlikely to translate into any impact upon the quality of the underlying groundwater. Thus, the Priority Projects are not expected to affect the quality groundwater beyond a negligible level. No groundwater pumping is required to support the projects. LCRA TSC would purchase any water necessary for construction activities from local water supply

corporations or municipalities. Water requirements for the projects would be modest (e.g., mixing concrete and sprinkling exposed earth during dry conditions to control dust).

The Preferred Alternative includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered species. These areas would be protected from development and thus potential adverse effects on groundwater are likely to be avoided.

4.6.2 Alternative B – Maximum Take Avoidance

Impacts to surface water and groundwater resources under Alternative B are expected to be similar to those under the Preferred Alternative, except the potential for siltation would be reduced because the potential for soil erosion would be reduced (see Section 4.5.2 for a discussion of soil erosion impacts). Fewer surface water features would be crossed compared to the Preferred Alternative because those features passing through Covered Species habitat would be avoided to the extent practicable. The same BMPs would be used to minimize the potential for sedimentation and contamination in both surface water and groundwater resources.

Similar to the Preferred Alternative, Alternative B includes offsite mitigation in the form of preserved woodland and shrubland habitat for the Covered Species, although less offsite mitigation would occur. These preserved areas (the location of which is currently unknown) would be protected from development and thus potential adverse effects on water resources are likely to be avoided.

4.6.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Impacts to water resources on the project site under No Action would be very similar to those under Alternative B for the reasons described immediately above in Section 4.6.2. Covered Species habitat may not be preserved as mitigation, and, as a result, offsite water resources may not be protected from the effects of development.

4.6.4 Summary of Impacts

The magnitude of potential adverse impacts to surface waters would be somewhat less under Alternative B and Alternative C than under Alternative A (the Preferred Alternative). The difference would be small, however, and all three alternatives have the potential to result in short-term, minor adverse impacts to surface waters, wetlands, and floodplains. Over the long term, adverse impacts to these resources would be negligible. Impacts to groundwater resources in the Permit Area would also be negligible under all three alternatives.

4.7 BIOLOGICAL RESOURCES

4.7.1 Vegetation

The intensity of potential impacts to vegetation is defined as follows:

- Negligible: Individual native plants may occasionally be affected, but measurable or perceptible changes in plant community size, integrity, or continuity would not occur.

- Minor: Effects to native plants would be measurable or perceptible, but would be localized within a small area. The viability of the plant community would not be affected and the community, if left alone, would recover.
- Moderate: A change would occur over a relatively large area in the native plant community that would be readily measurable in terms of abundance, distribution, quantity, or quality. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
- Major: Effects to native plant communities would be readily apparent, and would substantially change vegetation community types over a large area in and out of the Permit Area. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

4.7.1.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects. Potential adverse impacts to vegetation as a result of the construction of the proposed transmission lines would be moderate in intensity, both direct and indirect, and both temporary and permanent. Potential impacts include loss or disturbance to native plant communities and the associated effects of fragmentation of vegetation communities within which the transmission alignments occur. Both temporary and permanent loss or disturbance to native plant communities would result from clearing of vegetation in the ROW, construction of facilities (support structures, access roads, and staging areas), and line maintenance. Short-term disturbances of previously undisturbed vegetation communities from the construction of the transmission lines could cause long-term reductions in the biological productivity of the area. These long-term effects tend to be more pronounced in arid and semi-arid areas such as portions of the Priority Projects where biological communities recover very slowly from disturbances.

Indirect adverse impacts may occur due to the spread of oak wilt. LCRA TSC will perform vegetation clearing activities in adherence to guidelines of the LCRA Corporate Oak Wilt Policy (LCRA 2006)to prevent the spread of oak wilt (see Section 4.7.1.1.3). The LCRA Corporate Oak Wilt Policy is essentially identical to the Texas Forest Service (2010) guidelines regarding the spread of oak wilt, which suggest that all clearing and pruning of oak trees occur outside the period of 1 February–1 July. If the clearing activities can be completed outside that period, then oak-wilt related impacts to oak trees and woodlands resulting from the Preferred Alternative are expected to be negligible. Should LCRA TSC be required, due to expected compressed construction schedules, to conduct some clearing of ROW during the period of 1 February–1 July, oak wilt could be spread; however, it is anticipated that implementation of the LCRA Corporate Oak Wilt Policy will reduce that potential.

The potential for establishment of invasive nonnative species within the ROW is also a potential indirect threat to the integrity of the native vegetation communities and is addressed in Section 4.7.6, Invasive Species.

Quantitative estimates of the potential magnitude of impacts resulting from the construction of each of the Priority Projects are provided below. Under the Preferred Alternative the potential exists for all vegetation to be cleared in a 160-foot-wide ROW over 38 miles of the Twin Buttes–Big Hill line and 140 miles of the Big Hill–Kendall line. The total footprint of the Priority

Projects is approximately 737 acres for the Twin Buttes–Big Hill route and 2,715 acres for the Big Hill–Kendall route, for a total footprint of 3,452 acres. For this analysis, the maximum width of 160 feet for each transmission line is used to arrive at a "worst case" estimate. The analysis also assumes that access roads would be within the ROW, which is unlikely for all access roads; however, it is assumed that the estimate for maximum impacts for the ROW would be more than enough to account for additional vegetation disturbed by construction of any new access roads that are not within the ROW. The potential impact to vegetation within each of the two Priority Project transmission line corridors is summarized below.

The potential impacts of the Priority Projects on two Federal endangered species of plants and state plant Species of Concern are discussed in Section 4.7.4, Evaluation Species, and in Section 4.7.5, State Species of Concern, respectively.

4.7.1.1.1 Twin Buttes–Big Hill Transmission Line

Table 3.2 summarizes the approximate number of acres that would be potentially impacted in each land cover type with construction of the two transmission lines. The number of acres of each cover type likely to be influenced or adversely impacted by the transmission line would be a function of the distribution of vegetation within each cover type and the final ROW width. For example, Table 3.2 indicates that 66 acres and 10 acres of cropland would be traversed by the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines, respectively. The actual impact of the lines on the croplands would be limited to only those areas where transmission towers are erected and access roads are constructed, the details of which are not currently available.
The Twin Buttes–Big Hill transmission line would traverse 201,954 linear feet (approximately 38 miles of land cover types and have a potential ROW and footprint of approximately 737 acres. Approximately 62 percent (457 acres) of the land cover types that would be crossed by the transmission line are primarily grassland/scrubland. Upland woodlands account for approximately 28 percent (206 acres). Riparian habitats are rare in the area and constitute less than 1 percent (8 acres) of land cover types that would be crossed by the transmission line.

4.7.1.1.2 Big Hill–Kendall Transmission Line

Table 3.2 provides an estimate of the total number of linear feet and the approximate number of acres that could potentially be impacted by construction of the Big Hill–Kendall transmission line in each land cover type. The Big Hill–Kendall transmission line would traverse 739,200 linear feet (approximately 140 miles) of land cover types and have a potential ROW and footprint of approximately 2,715 acres. Approximately 73 percent (1,982 acres) of the land cover types that would be crossed by the transmission line are primarily grassland/scrubland. Upland woodlands account for approximately 26 percent (706 acres). Riparian habitats are rare in the area and constitute less than 1 percent (17 acres) of land cover types that would be crossed by the transmission line.

4.7.1.1.3 Minimization Measures and Mitigation Measures

During construction LCRA TSC would clear the ROW of trees and brush only to the extent needed to provide access and ensure safe operation of the line. A flail mower or similar equipment may be used to clear ROWs instead of bulldozers with dirt blades, where such use would preserve the cover crop of grass, low-growing brush, and similar vegetation. After construction, revegetation would be performed at structure construction sites, and any other

places where soil is disturbed within the ROW or along access roads constructed by LCRA TSC, within 300 feet of the channels of perennial streams. If natural revegetation is considered incapable of providing ground cover in a reasonable length of time, seeding, sprigging, or hydro-seeding may be used in restored areas to encourage growth of ecologically desirable grasses and other vegetation. To meet state water quality regulations, the PUC final order instructs LCRA TSC to revegetate disturbed areas using native seed mixes; however, the PUC also allows the option of the individual landowners specifying preferences in seed mix or species used in revegetation, provided those choices are not cost prohibitive and will not compromise the safety or reliability of the transmission line. Thus, LCRA TSC shall revegetate using native species, but will consider landowner preferences in doing so. If site-specific factors make it unusually difficult to establish a protective vegetative cover, other restoration procedures, such as the use of gravel, rocks, or concrete, may be used to prevent erosion.

During routine maintenance activities, impacts to vegetation would be limited to the removal of trees and other woody vegetation that pose a potential danger to conductor wires or structures, or prohibit access. Native vegetation that does not impair access or endanger the safe operation and maintenance of a transmission line would be allowed to grow in the ROW. Herbicides are not typically used for vegetation maintenance purposes. However, if used, only EPA-approved herbicides would be used, and they would be applied carefully to minimize effects on desirable indigenous plant life.

To minimize the spread of oak wilt, LCRA TSC will implement its Corporate Oak Wilt Policy (LCRA 2006), which is based in its entirety on oak wilt management as practiced by the City of Austin and the Balcones Canyonlands Preserve (City of Austin 2007) and is consistent with Texas Forest Service recommendations (Texas Oak Wilt Information Partnership 2011). Among other things, the policy requires that, prior to conducting clearing activities, environmental staff will analyze LCRA and Texas Forest Service mapping data of known oak wilt centers, as well as data gathered during site visits, to identify any documented oak wilt centers within the project area. Regardless of whether documented oak wilt centers are identified, LCRA TSC workers and contractors working on this project shall have attended training on the LCRA Corporate Oak Wilt Policy before construction begins and shall complete the Oak Wilt Prevention Reports for the project, as necessary for the project. LCRA Corporate Oak Wilt Policy requires that all pruning cuts or other wounds to oak trees, including freshly cut stumps and damaged surface roots, be immediately treated with an asphalt or latex-based tree paint (year round). After pruning or cutting oak trees, all tools will be sterilized between each individual tree, with either Lysol aerosol disinfectant or a 10 percent bleach solution.

Potential impacts to woodland and shrubland communities would be mitigated as a result of the FHCP-required mitigation for impacts to the Covered Species (see Section 4.7.3, Covered Species). To accommodate and offset both direct and indirect impacts to listed species habitats, it is expected that up to approximately 3,611 acres of preserves (1,026.7 acres of GCWA and 2,584.3 acres of BCVI habitat) would be acquired and protected in perpetuity. No future development or land use conversions would be allowed in the preserves except where utilities have pre-existing easements, and strict management guidelines would be applied to maintain or improve, in perpetuity, the native vegetation communities in the preserves.

4.7.1.2 Alternative B – Maximum Take Avoidance

Impacts to vegetation under Alternative B would be similar to those under the Proposed Action, and include loss or disturbance to native plant communities and the associated effects of fragmentation of vegetation communities, except approximately 218 acres less GCWA woodland habitat and approximately 390 acres less BCVI shrubland habitat would potentially be cleared from the ROW. Thus, for the entire ROW, under Alternative B a total of approximately 608 acres (17.6 percent) less vegetation would be cleared compared to Alternative A. Alternative B would also have approximately 48 percent less preserve habitat established (1,872 vs. 3,902 conservation credits) as an offset for impacts to Covered Species habitat compared to Alternative A. See Sections 4.7.3.1.2 and 4.7.3.2.2, below, for a discussion of the amount of Covered Species habitat removed under Alternative B.

4.7.1.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). The impacts to vegetation along the transmission lines would be similar to those under Alternative B, except under the No Action, unlike Alternatives A and B, woodland and grasslands/shrubland habitats will likely not be preserved as mitigation for Covered Species.

4.7.1.4 Summary of Impacts

The magnitude of potential adverse impacts to vegetation would be somewhat less under Alternative B and Alternative C than under Alternative A (the Preferred Alternative). The difference would be small however (approximately 16 percent less ROW would be potentially cleared with Alternatives B and C). All three alternatives have the potential to result in short-term, minor adverse impacts to woodlands, shrublands, croplands, and some riparian habitat (< 1 percent of the total). Over the long term, adverse impacts to these resources would be negligible. The potential for adverse impact to woodlands and shrublands would be offset and reduced to some degree under Alternatives A and B by the mitigation proposed for the Covered Species stipulated in the FHCP (see Section 4.7.3, Covered Species). No mitigation would occur under Alternative C.

4.7.2 General Wildlife

The intensity of potential impacts to wildlife is defined as follows:

- Negligible: Wildlife would not be affected or the effects would be at or below the level of detection and would be so slight that they would not be of any measurable or perceptible consequence to wildlife populations.
- Minor: Effects to wildlife would be measurable or perceptible, but would be localized within a small area. While the mortality of individual animals might occur, the viability of wildlife populations would not be affected and the community, if left alone, would recover.
- Moderate: A change to wildlife would occur over a relatively large area. The change would be readily measurable in terms of abundance, distribution, quantity, or quality of populations. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.

- Major: Effects to wildlife would be readily apparent, and would substantially change wildlife populations over a large area in and out of the county. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

4.7.2.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. Potential adverse impacts on wildlife are primarily associated with the alteration and removal of vegetation associated with the clearing and maintenance of the Priority Project ROWs described under the Preferred Alternative. As previously discussed in the preceding section on vegetation impacts, the proposed transmission lines would result in the potential removal and fragmentation of up to approximately 3,452 acres, over a 178-mile distance, of wildlife habitat within the ROW of the two transmission lines by the winter of 2013. This vegetation and its substrate, as stated above, currently provides shelter, breeding, and foraging habitat for a host of woodland, grassland, shrubland and riparian species. Some areas in the ROW would be cleared entirely of trees and shrubs to facilitate construction; in other areas, vegetation could be crushed, but left onsite; and in other areas, relatively minimal or no disturbance would occur. At the conclusion of construction, temporary access roads would be closed and revegetated in accordance with LCRA's Best Management Practices (LCRA 2010d). Additionally, other impacts on wildlife associated with the Priority Project include project-induced temporary increases in human activity (e.g., increased noise and movement during construction) that can cause some species of wildlife to leave the vicinity of the activity, avoid the area, or otherwise alter behavior patterns (e.g., stay underground more than they would normally) for the duration of the activity. It is likely, however, that such effects would be short-term, and wildlife species would return to the area and resume normal behaviors once the human activity ceases. The Priority Projects could also affect wildlife through the increased potential for wildfires as a result of sparks from vehicles and electrical transmission facilities and collisions of bats and birds with transmission lines. The potential for establishment of nonnative species within the ROW is also a potential threat to wildlife and is addressed in Section 4.7.6, Invasive Species.

Impacts to wildlife as a result of construction would include mortality of smaller-bodied species, including rodents, reptiles and amphibians, but these mortalities would not likely result in any significant changes in overall populations. The populations of larger-bodied and more mobile species, for example, gray foxes, bobcats, raccoons, skunks, opossums, armadillos, etc., are also not likely to experience any significant declines in numbers. Additional impacts to wildlife include the loss of food, sheltering and breeding sites; however, overall, the construction of up to a 160-foot ROW over almost 178 miles is not likely to result in substantial reductions in wildlife populations in the region because of the relatively small amount of habitat affected in any particular area over this great distance.

The construction of the transmission lines and new access roads would also marginally increase public access into new areas which may also lead to an increase in human disturbances to wildlife and their habitats. Construction of the line is unlikely to lead to disrupting the movements of the wildlife because a 160-foot ROW would not constitute an impediment to movements or any kind of major barrier. Where the transmission lines would be constructed away from road ROW and through woodlands—and to a lesser extent, grasslands and

shrublands—a new habitat edge would be created. Increasing the amount of edge in habitats can increase exposure of the habitat to sun and wind, and increase the accessibility of woodland habitat to species that usually occur in more open habitats. The introduction of habitat edge can have both positive and negative consequences to wildlife, depending upon the species and the pre-existing level of tree or shrub cover within the affected vegetation community. For example, for some species, including the endangered GCWA, the creation of new edge habitats can result in declines in the quality of a woodland habitat for that species. However, the same creation of new edge in the same woodland can increase the quality of the habitat for another endangered species, the BCVI (see Section 4.7.3, Covered Species) by allowing the growth of shrubby vegetation in formerly shaded areas. The clearing of the ROW is not expected to create any unusual habitat conditions where it occurs. Most vegetation communities crossed by the alignments for the Priority Projects are open or semi-open, and so the clearing of a ROW would not newly expose those communities to sun and wind or increase their accessibility to species that currently do not occur in those habitats. Natural openings similar to those that would be created by the ROW are not unusual in the denser woodlands and shrublands of the Permit Area.

Additional impacts would include the potential for mortality of birds and bats resulting from collisions with the lines. Significant bat mortalities are not expected to occur. In a 3-year study of avian collision mortality along a 5-mile-long portion of a 115-kV transmission line in the San Francisco Bay area of California, only one bat mortality was recorded over the study period. The study concluded that local bat populations were extremely unlikely to be adversely affected by collision mortality with transmission lines (Hartman *et al.* 1992). Hartman *et al.* (1992) did not compare the single bat mortality finding against the local bat population. However, monitoring of bats in the San Francisco Bay area performed by the National Park Service indicates that bats occur widely and commonly in the region (National Park Service 2009). The potential for the corona effect (noise made by power lines) to cause a disruptive effect on the ability of bats to echolocate and find food appears to be un-studied in the scientific literature. Any such effect would be highly localized.

Local movements of birds and the potential for collision mortalities with towers and transmission lines are difficult to predict, although some collision mortality is considered unavoidable. Mortality levels are not expected to result in long-term losses of population viability of any species within the Permit Area. Recent summaries of avian and bat mortalities at electrical energy generation and transmission facilities document various levels of impact, but population level declines have not been recorded for any species (Sovacool 2009).

Electrocution is not expected to be a substantial hazard within the Permit Area because the lines would be spaced wider than the wing span of the largest raptors that are known to occasionally occur in the area (golden and bald eagles).

To the extent that clearing for the Priority Project ROW creates new open habitat or edge habitat in woodland or shrubland, this habitat creation could benefit those species of wildlife that utilize such habitats. Other potential beneficial impacts associated with implementation of the FHCP on wildlife include perpetual preservation and management of up to 3,611 acres of conservation land in one or more blocks containing habitat suitable for the GCWA and BCVI (see Section 4.7.3, Covered Species). Some species of wildlife, such as white-tailed deer, may not benefit

from the establishment and management of these protected areas if their habitat requirements conflict with those of the endangered species. In addition, the benefits of the establishment of the conservation lands may not be within the Permit Area, but within established conservation banks nearby within the Edwards Plateau and Cross Timbers Region of central and north-central Texas.

4.7.2.2 Alternative B – Maximum Take Avoidance

Impacts to wildlife under Alternative B would be similar to those under the Preferred Alternative, with the exception that approximately 17.6 percent less clearing of the ROW would be authorized and approximately 48 percent less preserve land would be established as mitigation for potential impacts to Covered Species. As a result, potential adverse impacts to wildlife occupying Covered Species habitat in the ROW and potential benefits to wildlife from the preservation of mitigation acreage would both be reduced.

4.7.2.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Impacts to wildlife under this alternative would be similar to those under Alternative B, with the exception that woodland and grasslands/scrubland habitats will likely not be preserved as mitigation for the Covered Species.

4.7.2.4 Summary of Impacts

Due to the loss or alteration of wildlife habitat and the increased risk of collisions with transmission lines by avian species, the potential impacts of all three alternatives on wildlife are considered to be moderate, both direct and indirect, and both short term and long term. The amount of wildlife habitat potentially lost or altered under each alternative represents a relatively small percentage of the vegetation communities supporting wildlife habitat compared to the overall amount present within the Permit Area. And, while modifying habitat in the ROW may disadvantage some wildlife species, other species would continue to use the area. Under all three alternatives, the risk of collision (potential direct impacts) is relatively low, and the frequency of avian and bat mortalities are expected to be low and not result in any population level impacts.

The Preferred Alternative would result in the greatest amount of potential adverse impact to wildlife habitat on the project site, but would provide the greatest amount of preserved wildlife habitat offsite. Alternatives B and C would result in less adverse impact to wildlife habitat on the project site, but Alternative B would provide less offsite mitigation, and Alternative C (No Action) would provide no offsite mitigation at all.

4.7.3 Covered Species

Two federally listed species, the GCWA and the BCVI, would be covered by the ITP. Definitions of impact intensity are similar for both Covered Species and are as follows:

- Negligible: Listed species would not be affected or the change would be so small as to not be of any measurable or perceptible consequence to the population.

- Minor: There would be a measurable effect on one or more listed species or their habitats, but the change would be small and relatively localized. Mitigation would be needed to offset adverse effects.
- Moderate: A noticeable effect with moderate consequences to a population of a listed species. The effect would be of consequence to populations or habitats. Mitigation would be needed to offset adverse effects.
- Major: Effects would be readily apparent, and would substantially change populations over a large area in and out of the County. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

4.7.3.1 GCWA

4.7.3.1.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. The FHCP identifies a habitat-based approach to identification of potential impacts to the Covered Species.

The GCWA breeding range does not include lands crossed by the Twin Buttes–Big Hill transmission line, but does include some portions of lands crossed by the Big Hill–Kendall line transmission line. Potential exists for construction of Big Hill–Kendall transmission line to result in the removal of GCWA habitat as part of ROW and access road clearing. The potential for GCWAs to be adversely affected by construction, maintenance, and repair of the Big Hill–Kendall transmission line is discussed below.

4.7.3.1.1.1 Direct Impacts to GCWAs

Direct impacts, including death and injury to GCWAs, are not expected during the construction phase of the Big Hill–Kendall project, since clearing of all known and potential GCWA habitat would be conducted outside of the breeding season (1 September through end of February). However, conditions beyond LCRA TSC's control could alter those intentions; therefore, changed circumstances (see Section 2.2.1.3 in this EA and Section 5.6.5.1 in the FHCP) address this possibility and actions that will be taken. Should this occur, LCRA TSC would coordinate any clearing activity and minimization measures with the Service as described in Section 2.2.1.3 in this EA and Section 5.6.5.1 in the FHCP.

Clearing of woody vegetation in or within 300 feet of known or potential GCWA habitat as part of routine ROW and access road maintenance activities would also be scheduled to occur during the period of 1 September through the end of February, and such clearing is considered a Covered Activity. If an emergency situation were to demand removal of woody vegetation within known or potential GCWA habitat during the period of breeding (1 March through 31 August), LCRA TSC would not remove that vegetation without first having a qualified biologist search for, and verify absence of, active GCWA nests in that vegetation, unless the severity of the emergency did not permit such a search to be conducted (e.g., an outage at the top of a structure could create need for immediate removal of tree limbs to allow an emergency repair crew to travel the ROW and reach the structure). In general, the transmission line ROW and access roads are expected to be maintained in an accessible condition so it is not expected that any emergency clearing of woody vegetation would ever result in direct loss of GCWAs.

The stringing of conductor and shield wires could potentially harm or destroy GCWA nests if that stringing was performed during the GCWA nesting season and in areas where occupied habitat was present along the centerline of a ROW. During a stringing operation, slack conductor or shield wire can sag down into the tops of trees. If a warbler nest were present beneath a sagging line, it could be knocked from the tree or have its contents crushed. The likelihood of such an event occurring seems to be extremely low both because most warbler habitat is expected to be cleared from beneath the centerlines of the ROW and because it appears highly improbable that an active warbler nest would happen to be present at the exact point where a line sags into a tree.

LCRA TSC would seek to avoid altogether the potential for such direct loss to occur by stringing conductor and shield wire across any uncleared warbler habitat during the time of year in which warblers are not expected to be on their breeding grounds (1 September through the end of February). However, depending on the timing of permitting, weather, etc., construction schedules may not allow for all stringing of conductor and shield wire across warbler habitat to occur outside of the breeding period (1 March–31 August). If stringing of line must occur during that period and across known or potential GCWA habitat, LCRA TSC would inform its work crews of the danger that the stringing operation could pose to GCWAs and require the crews to take all steps possible to avoid having line sag into the tops of trees. This would include keeping lines taut between structures through use of a tensioning system or by stringing the line with a helicopter. In addition, where stringing of the line must occur during the GCWA breeding season and across known or potential warbler habitat, to the extent practicable, LCRA TSC would employ the use of a biological monitor in the field who would coordinate with the Service in order to minimize the likelihood of direct impacts to active nests.

Collision Risk. Transmission lines pose a collision risk for many avian species (Faanes 1987, Manville 2005). Hence, completion of the Priority Projects would create the risk of post-construction direct loss of GCWAs through collision with the transmission lines, although the magnitude of that risk is likely small. The Priority Projects would represent a very small percentage increase in the number of collision risks on the landscape within the Permit Area. Existing collision risks include not only high-voltage transmission lines, but distribution lines, guyed and unguyed radio and television towers, cellular phone towers, and windows in homes and other buildings (Brown and Drewien 1995, Janss and Ferrer 1998).

There is no documentation of GCWAs colliding with transmission lines. Additionally, GCWAs regularly occur directly adjacent to transmission line ROW and routinely cross cleared ROW. Therefore, is areas where these transmission lines cross patches of GCWA habitat, it is expected that GCWAs would continue to occur in woodlands adjacent to the cleared ROW following construction and, thus, in immediate proximity to the overhead transmission lines.

The risk posed by the transmission lines to GCWAs crossing canyons and to GCWAs as they first arrive from, and depart for, their wintering grounds, appears to be of comparatively low magnitude. Brown and Drewien (1995) conducted a study of the effectiveness of different types of power line markers on reducing avian collision mortality. The study was conducted over three spring and three fall migration periods and involved both transmission and distribution lines. A total of 597 mortalities were found along the study sections of power lines (marked and

unmarked) during the study, with approximately 84 percent of those mortalities attributable to collision (the other 16 percent were attributable to other causes such as collision with fences, predation, lead poisoning, shooting, etc.). Of the 597 mortalities, 39 (6.5 percent) were identified as passerine birds. The bulk (89.9 percent) of the mortality was composed of larger birds such as ducks, geese, sandhill cranes, American coots (*Fulica americana*), raptors, owls, and gamebirds. Brown and Drewien's study area was relatively flat and primarily contained agricultural fields, so it is not a particularly good surrogate for the Priority Project Permit Area. However, the results of the study match those of other studies (e.g., Janss and Ferrer 1998), which generally suggest that larger, less mobile birds are at greater risk of collision with transmission lines than are smaller, more agile birds.

4.7.3.1.1.2 Direct and Indirect Habitat Impacts

As demonstrated in Section 3.7.4.1.1, potential habitat for the GCWA is expected to be impossible to avoid completely for a transmission line of this length located within the range of the species. As indicated in Section 3.7.2.4.1, it is not expected that LCRA TSC would conduct presence/absence surveys for the GCWA. Construction of the Big Hill–Kendall project is likely to directly and indirectly impact potential habitat. Given the uncertainties of exact line and tower placement relative to suitable GCWA habitat, it has been assumed for this analysis that all suitable habitat within the entire 160-foot-wide, 140-mile-long transmission line corridor would be removed. Final locations of these facilities will be determined and their impact to suitable habitat will be assessed immediately prior to construction.

Indirect impacts refer to a reduction of habitat suitability in habitat adjacent (up to 300 feet) to the area of direct impacts. The clearing of GCWA habitat in the ROW (direct impact) will reduce the suitability of adjacent habitat, and hence indirectly impact that habitat by 1) reducing in size, or eliminating completely, patches of woodland occupied by the species; 2) by increasing susceptibility of the species to predation and nest parasitism by brown-headed cowbirds; and 3) by altering microclimatic conditions within habitat patches by opening them up to sun and wind, thereby potentially altering woodland species composition or prey availability. .

Direct and indirect habitat impact numbers were derived using habitat delineations performed according to the initial GCWA habitat delineation methodology described in Campbell (2003a). Based on analysis of aerial photography, habitat modeling by PBS&J (2010a), and field surveys, GCWA habitat was determined within the Big Hill–Kendall ROW (direct impact) and 300 feet each side of the ROW (indirect impact). The results of that analysis are reported in Table 4.5. To provide for any additional impacts to GCWA habitat that may be associated with the clearing of access roads and unanticipated construction and maintenance emergencies during the breeding season, a contingency factor of 10 percent was added to both the measured direct and indirect impact assessment. The results of those calculations are also reported in Table 4.5.

Estimates of the maximum amount of suitable habitat along the Big Hill–Kendall project habitat that could be directly and indirectly impacted is 298.0 and 848.0 acres, respectively, for a total of 1,146.0 acres (Table 4.5). This number of acres represents approximately 0.13 percent of the potential GCWA habitat identified by Diamond (2007) in the GCWA recovery regions that encompass the Permit Area (862,404 acres in Recovery Regions 4, 6 and 7). It also represents approximately 0.03 percent of the potential GCWA habitat (4,148,138 acres) identified

rangewide by Morrison *et al.* (2010). It is worth noting that 848.0 of the 1,146.0 acres (74 percent) of affected habitat would not be removed, but would remain on the landscape and available for use by GCWAs.

Table 4.5. Golden-cheeked Warbler Habitat Impacts under Alternative A (Preferred Alternative)

Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in acres
Direct Habitat Impact in acres	Direct Plus Contingency Factor (10%)[1]	Indirect Habitat Impact in acres	Indirect Plus Contingency Factor (10%)	
270.9	**298.0**	**770.9**	**848.0**	**1,146.0**

1 To cover the potential impacts to GCWA that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

4.7.3.1.1.3 Minimization Measures and Mitigation Measures

The FHCP identifies several general and species-specific measures intended to minimize and/or avoid impacts of the proposed taking on the GCWA associated with the Covered Activities. The minimization measures that would be incorporated into the Priority Projects for the benefit of the GCWA are as follows:

- All clearing of woodland identified as known or potential GCWA habitat would occur during the non-breeding season (1 September through the end of February) in order to avoid the potential of felling a tree containing an active warbler nest or harassing adult, nesting, or free-flying juvenile birds. Exceptions to this prohibition would be made only in cases where the minimization measures described in the Changed Circumstances section of the FHCP (Section 5.6.5.1) are implemented. Localized construction activities (as opposed to clearing) within 300 feet of GCWA habitat may be conducted during the GCWA breeding season (1 March through 31 August), as long as those activities promptly follow permitted clearing and were initiated before 1 March, therefore being a continuous activity that began before initiation of the breeding season. See Section 2.2.4 (Construction Methodologies) and Section 2.2.5 (Construction Schedules) for a details on sequencing and duration of construction activities.
- LCRA TSC would minimize the clearing of woodland identified as known or potential GCWA habitat to that necessary for the construction and safe and reliable operation of the proposed transmission lines.
- If stringing of transmission line (conductor and shield wires) must occur during the period of 1 March through 31 August in an area where woodland identified as known or potential GCWA habitat was not cleared from the ROW, a tensioning system would be used to keep lines from sagging into treetops and potentially harming GCWA nests.
- All non-emergency maintenance activities, including clearing of vegetation from any ROW, planned to be performed within 300 feet of areas identified as known or potential GCWA habitat would be performed during the period of 1 September through the end of February to avoid potential to disturb GCWAs. This prohibition does not apply to simply driving a ROW or to any activities that do not involve disturbance to woody vegetation or creation of loud noise.
- If an emergency requires removal of woody vegetation from an area identified as known or potential GCWA habitat during the period of 1 March through 31 August, LCRA TSC

would coordinate with the Service regarding the need to perform the vegetation removal. LCRA TSC would not remove any woody vegetation from the ROW during the breeding season in an emergency situation without first having a qualified biologist search for, and verify absence of, active GCWA nests in the vegetation needing removal, unless the severity of the emergency does not allow for such a search to be conducted. In the unlikely event that an emergency demands removal of woody vegetation from a ROW before coordination with the Service can be performed (e.g., a line is severed by an aircraft on a weekend and clearing is required to reach the site), LCRA TSC would submit a written or verbal report to the Service describing the location and magnitude of the clearing activity and nature of the emergency within 48 hours of completion of the activity. An emergency requiring the clearing from a ROW of Covered Species habitat not previously identified and authorized for removal would be considered a Changed Circumstance as described in Section 5.6.5.1 of the FHCP.

In addition to the implementation of avoidance and minimization measures in the FHCP, LCRA TSC proposes to mitigate for impacts to GCWA habitat to the maximum extent practicable by concentrating mitigation efforts into the funding of preservation and perpetual management of one or more large blocks of GCWA habitat. LCRA TSC would mitigate for expected impacts to GCWA habitat by either purchasing conservation credits from a Service-approved GCWA conservation bank, providing funding to an entity or conservation program for conservation of the species, or a combination thereof. If mitigation is provided through the provision of funds to The Nature Conservancy of Texas, University of Texas Ladybird Johnson Wildflower Center, or some other appropriate conservation entity, LCRA TSC also would be providing for the preservation and third-party management in perpetuity of GCWA habitat (see Section 2.2.1.2). In such a case, LCRA TSC would not itself own or incur direct management responsibility of GCWA habitat.

LCRA TSC will seek to minimize habitat impacts by reducing clearing ROW widths where practicable, and avoiding the need to clear the ROW altogether if allowed by especially steep topography. Once the project engineers are able to inspect the ground to view topographic and vegetative conditions and construction plans for a transmission line are finalized, the actual number of acres of known and potential GCWA habitat expected to be directly and indirectly impacted by each Priority Project will be determined using the final habitat delineation methodology described above. These numbers will then be submitted to the Service for its concurrence.

Table 4.6 presents a summary of impacts and calculated conservation credit requirements that may be required for the GCWA under the Preferred Alternative. The maximum amount of conservation credits that would be purchased would be 1,318.0.

Table 4.6. Golden-cheeked Warbler Habitat Impacts and Mitigation Credit Requirements under the Proposed Alternative.

Priority Project	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			Total Credits to be Acquired
	Direct Habitat Impacts Plus Contingency Factor (10%)[1] in Acres (ha)	Mitigation Ratio	Credits to be Acquired	Indirect Habitat Impacts Plus Contingency Factor (10%) in Acres (ha)	Mitigation Ratio	Credits to be Acquired	
Big Hill – Kendall	**298.0 (120.6)**	**3:1**	**894.0**	**848.0 (343.2)**	**0.5:1**	**424.0**	**1,318.0**

[1] To cover the potential impacts to golden-cheeked warbler that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10 %.

4.7.3.1.2 Alternative B – Maximum Take Avoidance

As with the Preferred Alternative, direct impact to GCWAs through collisions with power lines and individual mortalities occurring during construction and maintenance activities are not expected to occur, and in that regard the alternatives are similar. However, direct and indirect impacts to habitat, while similar in effect, are less in scale under Alternative B than they are under the Preferred Alternative. For example, instead of assuming the full 160-foot by 140-mile ROW is fully cleared of vegetation during the construction of the two approved transmission lines as is assumed for the Preferred Alternative, under Alternative B, GCWA habitat would be cleared only in the immediate area of the structures and access roads. This results in less overall habitat being directly impacted, less habitat within 300 feet of the transmission line corridor being indirectly impacted, and less mitigation required to compensate for that impact.

Direct and indirect habitat impact numbers were derived using habitat delineations performed according to the initial GCWA habitat delineation methodology described in Campbell (2003a), but only for the area around the number of transmission line support structures and access roads estimated to occur within and adjacent to suitable GCWA habitat. To provide for any additional impacts to GCWA habitat that may be associated with the clearing of access roads and unanticipated construction and maintenance emergencies during the breeding season, a contingency factor of 10 percent was added to both the measured direct and indirect impact assessment. Direct and indirect impacts of Alternative B are presented Table 4.7.

Table 4.7. Direct and Indirect Habitat Impacts to GCWAs

Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in acres
Direct Habitat Impact in acres	Direct Plus Contingency Factor (10%)[1]	Indirect Habitat Impact in acres	Indirect Plus Contingency Factor (10%)	
72.9	**80.3**	**728.1**	**800.9**	**881.2**

[1] To cover the potential impacts to GCWA that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

The total amount of golden-cheeked habitat impacted under Alternative B (881.2 acres) represents approximately 0.10 percent of the potential GCWA habitat identified by Diamond (2007) in the GCWA recovery regions that encompass the Permit Area (862,404 acres in Recovery Regions 4, 6 and 7). It also represents approximately 0.02 percent of the potential GCWA habitat (4,148,138 acres) identified rangewide by Morrison *et al.* (2010). It is worth noting that 800.9 of the 881.2 acres of affected habitat would not be removed, but would remain on the landscape and be available for use by GCWAs.

Table 4.8 presents a summary of impacts and calculated conservation credit requirements that may be required for the GCWA under Alternative B. The maximum amount of conservation credits that would be purchased would be 641.4.

Table 4.8. Golden-cheeked Warbler Habitat Conservation Credit Requirements under Alternative B (Maximum Take Avoidance Alternative)

	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			
Priority Project	Direct Habitat Impacts Plus Contingency Factor (10%)[1] in acres (ha)	Mitigation Ratio	Credits Required	Indirect Habitat Impacts Plus Contingency Factor (10%) in acres (ha)	Mitigation Ratio	Credits Required	Total Credits Required
Big Hill–Kendall	**80.3 (32.4)**	**3:1**	**240.9**	**800.9 (324.0)**	**0.5:1**	**400.5**	**641.4**

[1] To cover the potential impacts to golden-cheeked warbler that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

4.7.3.1.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Therefore, direct and indirect impacts to GCWA habitat under Alternative C would be similar to those under Alternative B. The transmission lines would be constructed outside the breeding season for GCWAs and impacts would be largely avoided. Unlike Alternative B, there would be no mitigation provided.

4.7.3.1.4 Summary of Impacts

All three alternatives are unlikely to result in more than minor, mostly indirect, adverse impacts on the GCWA. The loss or impairment of potential GCWA habitat under each of the alternatives represents 0.1 percent or less of the total known available habitat for the species in GCWA Recovery Regions 4, 6, and 7, a very small percentage. As such, the estimated adverse impacts are not likely to affect recovery of the species.

Of the three alternatives, the Preferred Alternative could affect the largest amount of potential GCWA habitat (up to approximately 1,146 acres) but would provide for the largest amount of mitigation (up to 1,318.0 credits). Alternatives B and C could result in up to approximately 881.2 acres of potential habitat affected, a 23 percent reduction compared with the Preferred Alternative. Alternative B would include mitigation to partially offset impacts with

approximately 641.3 conservation credits being required, a 48 percent reduction in conservation credits between Alternatives A and B. There would be no mitigation requirements under Alternative C.

4.7.3.2 BCVI

4.7.3.2.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.3.2.1.1 Direct Impacts to BCVIs

Direct impacts, including death and injury to BCVIs, are not expected during the construction and maintenance phases of the Priority Projects. The clearing of all known and potential BCVI habitat is intended to be conducted during the times of year when they are not present on their breeding grounds (1 October through end of February). This would avoid the potential for clearing activities to destroy occupied nests or harm recently fledged, but still relatively immobile young. In the event that clearing cannot practicably be avoided during the breeding season due to changed circumstances, LCRA TSC would coordinate any clearing activity and minimization measures with the Service (see Section 2.2.1.3 in Chapter 2, and Section 5.6.5.1 of the FHCP) .

Similar to the minimization measures discussed for the GCWA in the previous section, during stringing of conductor and shield wires all minimization measures, biological monitoring and reporting to the Service would also be conducted for the BCVI. All non-routine, non-emergency clearing of vegetation would only be performed within LCRA TSC ROW or access road alignments. This clearing would be considered to be one of the Covered Activities authorized by the ITP.

Collision Risk. Construction of the Priority Projects within the breeding range of the BCVI may create a collision risk for the species, although the magnitude of that risk is likely small. The Priority Projects would represent a very small percentage increase in the number of collision risks on the landscape in the Permit Area. Existing collision risks include transmission lines, distribution lines, guyed and unguyed radio and television towers, cellular phone towers, and windows in homes and other buildings.

There are no documented records of BCVIs having collided with transmission lines. However, there are documented records of BCVIs regularly occurring within and directly adjacent to transmission line ROWs. Therefore, it is expected that BCVIs would continue to occur in shrublands within and adjacent to the ROW following construction and, thus, in immediate proximity to the overhead transmission lines.

Based on observations of BCVIs and published descriptions of their behavior (e.g., Grzybowski 1995), the birds typically fly below or only slightly above the tops of trees and shrubs when moving through their territories. Trees and shrubs in habitats used by BCVIs are usually less than 10 feet tall (Campbell 2003a). As discussed for the GCWA, in most areas the transmission lines would be a minimum of 35 feet above ground. Thus, the transmission lines would be well above the height at which BCVIs typically fly when in their habitat and so, in general, the transmission lines are not expected to pose a significant collision risk for the species.

Ultimately, whether or not BCVIs would ever collide with the proposed transmission lines is unknown. While construction of the Priority Projects would create a collision risk for BCVIs that would not exist in absence of the projects, that risk is considered to be very low given that the lines would be placed at heights well above those at which BCVIs typically occur and their exposure to the elevation zone of those lines is likely limited to no more than a matter of seconds each year. Consequently, while the possibility cannot be ruled out conclusively that BCVI collisions could occur, collision mortality is not expected to result from any of the Covered Activities.

4.7.3.2.1.2 Direct and Indirect Habitat Impacts

Based on a habitat assessment performed through review of aerial photography and field assessments, and the conservative assumption that all ROW would be cleared to a width of 160 feet for its full length, LCRA TSC estimated the amount of BCVI habitat that would be directly and indirectly impacted by construction of the Priority Projects. These data are presented in Table 4.9.

Table 4.9. BCVI Habitat Impacts under Alternative A (Preferred Alternative)

Priority Project	Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in acres
	Direct Habitat Impact in acres	Direct Plus Contingency Factor (10%)[1]	Indirect Habitat Impact in acres	Indirect Plus Contingency Factor (10%)	
Twin Buttes–Big Hill	27.5	30.3	143.9	158.3	188.6
Big Hill–Kendall	467.4	514.1	1,585.3	1,743.8	2,257.9
Total	**494.9**	**544.4**	**1,729.2**	**1,902.1**	**2,446.5**

[1] To cover the potential impacts to BCVI that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

The data in Table 4.9 indicate that 188.6 acres of direct and indirect impact to BCVI habitat could occur along the Twin Buttes–Big Hill route, and 2,257.9 acres of direct and indirect impacts could occur along the Big Hill–Kendall route. This is a "worst case" estimate that assumes, based on field assessments and review of aerial photography for properties not seen in the field, any area of mixed shrubland has the potential to be occupied by the species. The number of acres estimated to be affected (including a 10 percent contingency factor) likely overestimates the actual amount of BCVI habitat that would be directly and indirectly affected along these routes. This deliberate overestimate of habitat impacts is made to cover potential impacts resulting from construction of access roads, major and minor adjustments to the ROW, and unforeseen emergency construction and maintenance activities.

LCRA TSC will seek to minimize impacts to BCVI habitat by reducing clearing ROW widths where practicable, and avoiding the need to clear the ROW altogether if allowed by especially steep topography. Once the project engineers are able to inspect the ground to view topographic and vegetative conditions and construction plans for a transmission line are finalized, the actual number of acres of known and potential BCVI habitat expected to be directly and indirectly impacted by each Priority Project will be determined using the final habitat delineation methodology described above. These numbers will then be submitted to the Service for concurrence.

Similar to GCWA, indirect affects to BCVI habitat are out to a distance of 300 feet from the cleared edge on either side of the transmission line ROW. For both Priority Projects, under a "worst case" scenario, the potential exists for up to 544.4 acres of direct impacts and up to 1,902.1 acres of indirect impacts to occur. For habitat impact assessment/mitigation purposes then, the Priority Projects could impact up to a total of 2,446.5 acres of BCVI habitat. It is worth noting that almost 78 percent (1,902.1/2,446.5 = 0.777) of the habitat identified as impacted would remain on the landscape and be available for use by BCVIs.

The 2,446.5 acres of direct and indirect impacts represents approximately 0.8 percent of the potential BCVI habitat identified within the seven-county Permit Area (308,763 acres) and approximately 0.17 percent of the potential BCVI habitat in Texas(1,450,438 acres) (Service 2004; Morrison *et al*. 2010).

4.7.3.2.1.3 Minimization and Mitigation Measures

In addition to the implementation of avoidance and minimization measures similar to those provided for the GCWA (see Section 4.7.3.1.1.3), in the FHCP, LCRA TSC proposes to mitigate for impacts to BCVI habitat to the maximum extent practicable by concentrating mitigation efforts into the funding of preservation and perpetual management of one or more large blocks of BCVI habitat. LCRA TSC would mitigate for expected impacts to BCVI by either purchasing conservation credits from a Service-approved BCVI habitat conservation bank, or providing funding to an entity or conservation program for conservation of the species that would be used prior to any impacts from Covered Activities, or a combination thereof. A specific method for providing mitigation has not yet been identified; however, the selected option(s) would be approved by the Service and would be reasonably expected to be sufficient to fund the preservation of BCVI habitat in perpetuity in an amount equal to that attributed to being impacted by the Covered Activities. Possible methods of providing mitigation are similar to those described for the GCWA in Section 4.7.3.1.1.3.

It is anticipated that the ITP permit would be issued to LCRA TSC under the condition that Covered Activities would not be authorized until mitigation is provided to compensate for the expected impacts to endangered species. If available to LCRA TSC at the time that mitigation is needed to be provided, LCRA TSC would purchase from a BCVI habitat conservation bank conservation credits based on the following mitigation-to-impacts: 3:1 for direct impacts and 0.5:1 for indirect impacts.

Table 4.10 presents a summary of impacts and calculated conservation credit requirements that may be required for the BCVI under the Preferred Alternative. The maximum amount of conservation credits that would be purchased would be 2,584.3.

Table 4.10. BCVI Habitat Impacts and Conservation Credit Requirements under Alternative A (Preferred Alternative)

Priority Project	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			Total Credits Required
	Direct Habitat Impacts Plus Contingency Factor (10%)[1] in acres	Mitigation Ratio	Credits Required	Indirect Habitat Impacts Plus Contingency Factor (10%) in acres	Mitigation Ratio	Credits Required	
Twin Buttes–Big Hill	30.3	3:1	90.9	158.3	0.5:1	79.2	170.1
Big Hill–Kendall	514.1	3:1	1542.3	1,743.8	0.5:1	871.9	2,414.2
Total	**544.4**		**1,633.2**	**1,902.1**		**951.1**	**2,584.3**

[1] To cover the potential impacts to BCVI that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

4.7.3.2.2 Alternative B – Maximum Take Avoidance

As with the Preferred Alternative, direct impact to BCVIs through collisions with power lines and individual mortalities occurring during construction and maintenance activities are not expected to occur, and in that regard the alternatives are similar. However, direct and indirect impacts to habitat, while similar in effect, are less in scale under Alternative B than they are under the Preferred Alternative. For example, instead of assuming the full 160-foot-wide by 178-mile-long ROW is fully cleared of vegetation during the construction of the two approved transmission lines as is assumed for the Preferred Alternative, under Alternative B, BCVI habitat is only cleared in the immediate area of the towers and access roads. This results in less overall habitat being directly impacted, less habitat within 300 feet of the transmission line corridor being indirectly impacted, and less mitigation required to compensate for that impact.

Direct and indirect habitat impact numbers were derived using habitat delineations performed according to the initial BCVIs habitat delineation methodology described in Campbell (2003a), but only for the area around the estimated number of transmission line support structures and access roads that are estimated to occur within and adjacent to BCVI suitable habitat. As with the Preferred Alternative, SWCA identified potential BCVI habitat within the Twin Buttes–Big Hill and Big Hill–Kendall routes based on analysis of aerial photography, habitat modeling by PBS&J (2010a), and field surveys. To provide for any additional impacts to BCVI habitat that may be associated with the clearing of access roads and unanticipated construction and maintenance emergencies during the breeding season, a contingency factor of 10 percent was added to both the measured direct and indirect impact assessment. Direct and indirect impacts of Alternative B are presented Table 4.11.

Table 4.11. BCVI Habitat Impacts under Alternative B (Maximum Take Avoidance)

Priority Project	Direct Habitat Impacts		Indirect Habitat Impacts		Total Habitat Impacts in acres
	Direct Habitat Impact in acres	Direct Plus Contingency Factor (10%)[1]	Indirect Habitat Impact in acres	Indirect Plus Contingency Factor (10%)	
Twin Buttes–Big Hill	8.1	8.9	111.7	122.9	131.8
Big Hill–Kendall	132.4	145.6	1,432.2	1,575.4	1,774.3
Total	**140.5**	**154.5**	**1,543.9**	**1,698.3**	**1,852.8**

[1] To cover the potential impacts to BCVI that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

Estimates of the maximum amount of suitable habitat that could be directly and indirectly impacted with Alternative B are 154.5 and 1,698.3 acres, respectively, for a total of 1,852.8 acres (Table 4.11). The amount of direct and indirect impacts on BCVI habitat under Alternative B is approximately 24 percent less than it would be under the Preferred Alternative (2,446.5 –1,852.8 / 2,446.5 x 100 = 24%). This number of acres of BCVI habitat impacted under Alternative B also represents approximately 0.60 percent of the potential BCVI habitat identified by the Service (Service 2004) within the seven-county Permit Area (308,763 acres). Almost 92 percent of this habitat (1,698.3/1,852.8 = 0.917) would remain on the landscape and be available for use by BCVIs.

Table 4.12 presents a summary of impacts and calculated conservation credit requirements that may be required for the BCVI under Alternative B. The maximum amount of conservation credits that would be purchased would be 1,312.7.

Table 4.12. BCVI Habitat Impacts and Conservation Credit Requirements under Alternative B (Maximum Take Avoidance)

Priority Project	Direct Habitat Impacts and Mitigation			Indirect Habitat Impacts and Mitigation			Total Credits Required
	Direct Habitat Impacts Plus Contingency Factor (10%)[1] in acres	Mitigation Ratio	Credits Required	Indirect Habitat Impacts Plus Contingency Factor (10%) in acres	Mitigation Ratio	Credits Required	
Twin Buttes–Big Hill	8.9	3:1	26.7	122.9	0.5:1	61.5	88.2
Big Hill–Kendall	145.6	3:1	436.8	1,575.4	0.5:1	787.7	1,224.5
Total	**154.5**		**463.5**	**1,698.3**		**849.2**	**1,312.7**

[1] To cover the potential impacts to BCVI that cannot be quantified at this time (e.g., potential habitat impacts resulting from access road construction outside of the ROW and potential direct impacts resulting from emergency activities conducted within breeding season), estimates of habitat impacts based on aerial photography and field surveys have been increased by a contingency factor of 10%.

4.7.3.2.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using similar impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Therefore, direct and indirect impacts to BCVI habitat under Alternative C would be similar to those under

Alternative B. The transmission lines would be constructed outside the breeding season for BCVIs and impacts would be largely avoided. Unlike Alternative B, there would be no mitigation provided.

4.7.3.2.4 Summary of Impacts

All three alternatives are unlikely to result in more than minor, mostly indirect, adverse impacts on the BCVI. The loss or impairment of potential BCVI habitat under each of the alternatives would represent 0.17 percent or less of the total known available habitat for the species in BCVI Recovery Regions 2, 3, and 4.

Of the three alternatives, the Preferred Alternative could affect the largest amount of potential BCVI habitat (up to approximately 2,446.5 acres) but would provide for the largest amount of mitigation (2,584 credits). Alternatives B and C could result in up to approximately 1,852.8 acres of potential habitat affected, a 24 percent reduction compared with the Preferred Alternative. Alternative B would include mitigation to offset impacts with approximately 559.7 conservation credits being required. There would be no mitigation provided under Alternative C.

4.7.4 Evaluation Species

Several of the Evaluation Species are either so unlikely to occur in the Permit Area or so unlikely to be affected by the alternatives under consideration that they need not be carried forward for detailed effects analysis. These species are as follows:

- Ocelot
- False spike
- Golden orb
- Texas fatmucket
- Texas fawnsfoot
- Texas pimpleback

Ocelot is not carried forward because known Texas populations occur 240 miles or more from the Permit Area and the Permit Area lies outside of the potential range of the species as mapped by the Service (1990b). The remaining five species not carried forward are all freshwater mussels. Many comments were received during the public scoping period requesting that the NEPA analysis examine the potential effects of transmission line construction on the Texas fatmucket because any route for the now eliminated Kendall–Gillespie transmission line project was expected to cross Live Oak Creek, where this species is known to occur. The Texas fatmucket is not known to occur in any of the creeks crossed by the routes for the Priority Projects examined in this EA. Regardless, some potential exists, however small, that individuals of this species, or any of the five mussel species identified above, occur in creeks that would be crossed by the Priority Projects. The transmission lines would span all perennial streams, and project vehicles would cross such streams on existing bridges. LCRA TSC may install at-grade or culverted vehicular crossings at ephemeral or intermittent streams; however, these streams are unlikely to support mussel populations because of their water regimes. Indirect effects to any potential downstream mussel habitat would be minimized by constructing the crossings consistent with U.S. Army Corps of Engineers regulations and any state water quality requirements. Because of these measures, and others identified in sections of this EA that will be

implemented by LCRA TSC to avoid and minimize impacts to water quality and, concomitantly, freshwater mussels, it is extremely unlikely that construction of the Priority Projects under any of the alternatives under consideration in this EA would result in adverse effects to freshwater mussels. These measures are identified in the FHCP, but would be implemented even under the No Action Alternative (e.g., no ITP, no HCP) to meet the requirements of a TCEQ SWPPP. The balance of the Evaluation Species are carried forward for more detailed analysis in this chapter. The expected impacts of the Preferred Alternative, Maximum Take Avoidance, and No Action alternatives on each of the remaining seven species are described in this section.

Definitions of impact intensity are similar for all Evaluation Species and are as follows:

- Negligible: Species would not be affected or the change would be so small as to not be of any measurable or perceptible consequence to the population.
- Minor: There would be a measurable effect on one or more species or their habitats, but the change would be small and relatively localized.
- Moderate: There would be a noticeable effect with moderate consequences to a population of a species. The effect would be of consequence to populations or habitats.
- Major: Changes to the existing primary threats to the Evaluation Species, their habitats, or the natural processes sustaining them would be readily detectable over most of the range of that species within the Permit Area, and would be outside the range of natural variability for long periods of time or be permanent. Direct impacts or habitat alterations could substantially affect the distribution and abundance of the species in the Permit Area.

4.7.4.1 Bald Eagle

4.7.4.1.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.4.1.1.1 Direct Impacts to Bald Eagles

As described in its FHCP, LCRA TSC would coordinate with TPWD to determine whether any bald eagles are known to nest within 1.3 miles of the Priority Project routes. Because the possibility exists that some pairs of bald eagles could be nesting in the proximity of the approved routes unbeknownst to TPWD, LCRA TSC would also search for bald eagle nests within its easements for these Priority Projects within 1.3 miles of any habitat that has the potential to support nesting eagles. ROW clearing activities are likely to be performed during the first half of October through February, which coincides with the bald eagle nesting season in Texas, because of the need to perform these activities outside of the GCWA and BCVI nesting seasons. Coordination with TPWD and the search for eagle nests would be performed to ensure that ROW clearing activities do not result in the removal of active or inactive bald eagle nests. Consequently, no direct impacts to bald eagles are expected to result from clearing of the transmission line ROW.

It is very unlikely that any portion of a Priority Project route would end up passing close to an eagle nest site. However, the chance of this occurring is not zero, and it is also remotely possible that a pair of bald eagles could establish a new nest site in the area. In either case, ROW clearing and/or transmission line construction activities might need to be performed in proximity to an

eagle nest while that nest was being used by the birds. To the extent allowed by construction schedules and presence/absence of habitat for GCWAs and BCVIs, LCRA TSC indicated in its FHCP that it would endeavor to perform any Covered Activities slated to occur within 660 feet of any active or presumed active bald eagle nests during the time of year in which bald eagles are not expected to be nesting (August and September), or at any other time when the nests are inactive if the status of nesting activity is able to be determined from the LCRA TSC easement.[9]

As the non-nesting period for bald eagles is potentially very limited, it seems highly probable that if a transmission line alignment happens to lie within 660 feet of an active bald eagle nest, some ROW clearing activities and/or transmission line construction activities would need to occur while eagles were nesting. The performance of such activities would create potential for disturbance to nesting bald eagles. However, this potential appears to be extremely limited because very few bald eagle nests are known to occur in the Permit Area.

The Covered Activities are not expected to result in harassment of any non-nesting bald eagles that may occur in areas where those activities are performed. Non-nesting eagles, because they are fully mobile and not tied to any fixed point like a nest, should be fully capable of avoiding any activities they perceive as potentially disturbing. Because of the measures proposed to be taken by LCRA TSC to verify the status of nesting bald eagles in the vicinity of the alignments selected for the Priority Projects and the very small number of bald eagles known to nest in the Permit Area, ROW clearing and other transmission line construction activities are expected to have a negligible adverse direct impact on bald eagles.

Construction and operation of transmission lines can create potential for bald eagles and other birds to suffer death from electrocution. Electrocutions usually result when a bird completes a circuit by simultaneously touching conductor and shield wires, or by touching a conductor while still in contact with a grounded structure. Both Priority Projects would be designed to maintain spacing between lines sufficient to prevent bald eagles from simultaneously touching conductor and shield wires. This is expected to prevent any bald eagles that may roost on structures or fly through the lines from being electrocuted. As a result, the Priority Projects are not expected to cause the electrocution death of bald eagles.

Collision Risk. Bald eagles are known in parts of Texas to nest on transmission line structures (Ortego *et al.* 2009). Therefore, it is expected that any bald eagles occurring in the Permit Area would not necessarily avoid transmission line structures and could occasionally be flying in the immediate proximity of the transmission lines. Collision with power lines is a known source of mortality for bald eagles (Olendorff and Lehman 1986, Service 1990c).

The Priority Projects would cause a very small percentage increase in the number of collision risks on the landscape within the Permit Area. Existing collision risks include transmission lines, distribution lines, guyed and unguyed radio and television towers, cellular phone towers, buildings, and, to some extent, even aircraft. To increase the visibility of the proposed transmission lines to bald eagles and decrease the potential that bald eagle collisions would occur, LCRA TSC is proposing in its FHCP to mark certain sections of the transmission lines

[9] This distance is based on Service National Bald Eagle Management Guidelines (Service 2007b) that recommend transmission lines not be placed within 660 feet of a bald eagle nest.

with traditional marker balls, spiral vibration dampeners, or air flow spoilers. These markers would be installed on the shield wires with spacing dependent on the type of marker used. Markers would be placed on all sections of transmission line occurring within 1.3 miles of known bald eagle nests, and on the lines at all crossings of major rivers, as rivers may preferentially be followed by migrating eagles or by eagles making movements within their nesting or wintering territories. Markers placed at river crossings would extend from the river centerline out to a distance of 300 feet beyond each river bank as measured perpendicular to the river bank, not as measured along the length of the alignment. These markers would be inspected and replaced as necessary as part of routine maintenance activities.

Marking the Priority Projects as described is expected to reduce the potential for bald eagle collision mortality to occur. However, the potential for collision mortality to occur cannot be reduced absolutely to zero. Collision with transmission lines was not identified as a threat to the species in Texas by Campbell (2003a) or by Ortego *et al.* (2009). Thus, while construction of the Priority Projects would create a collision risk for eagles, that risk is considered to be very low because few bald eagles occur in the Permit Area and because of the proposed marking of the transmission lines. Therefore, the number of bald eagle collisions with the Priority Projects over time is expected to be very low, if not zero, and so the risk of collision is considered to be a negligible threat to the bald eagle.

4.7.4.1.1.2 Direct and Indirect Habitat Impacts

Bald eagles in the Permit Area primarily hunt in riverine and other aquatic habitats, although they could hunt in nearly any open habitat available. The Priority Projects would largely be constructed across upland habitats. Accordingly, the clearing of ROW for the transmission lines is expected to have a negligible adverse impact on the amount of habitat available for bald eagles. It is possible, though not probable, that the clearing of ROW for any river crossing could result in the removal of trees used by bald eagles for roosting.

No indirect impacts to bald eagle habitat are expected as a result of completion of the Priority Projects. As evidenced by their nesting on transmission line structures (Ortego *et al.* 2009), and as their collision and electrocution history attest, bald eagles do not avoid transmission line corridors. Consequently, the Priority Projects are not expected to cause bald eagles to abandon any habitats in the Permit Area that they might currently be using for hunting, nesting, or roosting, or dissuade eagles from using any areas in the future for any of these same activities.

4.7.4.1.1.3 Minimization Measures and Mitigation Measures

LCRA TSC, in its FHCP, has proposed the following measures to avoid and minimize potential impacts to bald eagles:

- Because the possibility exists that some pairs of bald eagles could be nesting in the vicinity of a transmission line route unbeknownst to TPWD, LCRA TSC would search for bald eagle nests within its easements within 1.3 miles of any body of water that has potential to support nesting eagles, whether or not these water bodies are crossed by the transmission line alignments. Coordination with TPWD and the search for eagle nests would be performed to ensure that ROW clearing activities do not result in the removal of active or inactive bald eagle nests. If any bald eagle nests are discovered by LCRA

TSC during its surveys, the nest locations and status (active/inactive) would be reported within 48 hours of discovery to the Service and TPWD.

- To avoid potential for electrocution, both Priority Projects would be designed to maintain spacing between lines sufficient to prevent bald eagles from simultaneously touching two or more lines.
- LCRA TSC would mark its transmission lines at all major river crossings and wherever the transmission lines occur within 1.3 miles of active bald eagle nest locations. Markers would consist of traditional marker balls, spiral vibration dampeners, or air flow spoilers. These markers would be installed on the shield wires with spacing dependent on the type of marker used. Markers placed at river crossings would extend from the river centerline out to a distance of 300 feet beyond each river bank. Markings would be added to lines through the life of the transmission lines within 1.3 miles of any active bald eagle nests discovered subsequent to original construction for as long as bald eagles are protected under the Bald and Golden Eagle Protection Act and/or retain status as a state-listed species. Line markers would be inspected and replaced as necessary as part of routine maintenance activities.
- Pursuant to Service recommendations to site transmission lines at least 660 feet from bald eagle nests, if a bald eagle nest is found to occur within 660 feet of the edge of ROW for a transmission line route, LCRA TSC would evaluate its ability to locally reroute the line to maintain a setback from the nest of at least this distance. Local rerouting is allowed by the PUC only under a highly restrictive set of guidelines, and only if the shift does not engender cost increases or introduce other impacts not previously contemplated.
- LCRA TSC would notify all personnel performing Covered Activities within 1.3 miles of a bald eagle nest of their proximity to that nest. These same personnel would also be provided with training on how to identify bald eagles and would be instructed to avoid the nest and conduct their work as quickly and quietly as possible in order to minimize the time that eagles would be exposed to their presence.
- If any bald eagle nests occur within 660 feet of the edge of ROW and construction of the involved transmission line must be performed during the time of year that the bald eagles are actively nesting, LCRA TSC would deploy a biological monitor to watch the eagles while construction activities (ROW clearing, structure erection, stringing of line, and cleanup) are performed within 660 feet of the nest. The biological monitor would be empowered and required to halt construction if a bald eagle is seen to approach an activity that could present a significant risk to the bird, or if construction activities appear to be preventing the eagles from regularly attending the nest. In order for the latter determination to be made, the monitor would be deployed at least two days prior to the commencement of construction activities so that general eagle activity patterns can be learned.

4.7.4.1.2 Alternative B – Maximum Take Avoidance

Impacts to bald eagles under Alternative B would generally be similar to those expected under the Preferred Alternative. Approximately 17.6 percent less ROW clearing would take place under Alternative B, but this reduced clearing of woodland and shrubland is not likely to alter how construction of the Priority Projects would impact bald eagles given that these types of habitat are not typically used by the species.

4.7.4.1.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using similar impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Adverse impacts to bald eagles under Alternative C would be negligible and similar to those under Alternative B.

4.7.4.1.4 Summary of Impacts

None of the alternatives considered would be expected to alter the status and distribution of bald eagles in the Permit Area or cause a meaningful increase in the number of threats to bald eagles present in the Permit Area. Thus, clearing of the ROW and other activities related to the construction of the Priority Projects are expected to have a negligible direct impact on bald eagles. Due to the relatively low number of bald eagles within the Permit Area, the rate of collisions with the proposed transmission lines over time is expected to be very low, if not zero, and so the risk of collision is also considered to be a negligible threat to the bald eagle.

4.7.4.2 Least Tern

4.7.4.2.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.4.2.1.1 Direct Impacts to Least Terns

Neither Priority Project is expected to be constructed in proximity to a nesting location for least terns, so no direct impacts to individuals of this species are expected to result from construction activities associated with the Priority Projects.

Collision Risk. Least terns are neither known nor expected to breed in proximity to the routes chosen for the Priority Projects. The route selected for the Twin Buttes–Big Hill transmission line lies 2.75 miles or more west of the reservoirs in Tom Green County where this species is known to nest. Least terns are expected to approach these reservoirs in the spring from the east and depart them in the fall to the east, so this line is not considered to be a collision risk for the least terns that nest in Tom Green County. The Big Hill–Kendall alignment crosses lands with potential to be traversed by least terns when traveling to or from the Tom Green County reservoirs. Both Priority Project alignments cross lands that have the potential to be traversed by migrating least terns that nest outside of Tom Green County but inland to the west or northwest of the Permit Area.

In general, it is expected that least terns, when migrating over land, would be flying at heights above those of the proposed transmission lines. Flying well above ground provides greater protection from predators, potentially stronger tail winds, reduced air density, and less exposure to turbulence, all resulting in more efficient use of energy (Leichti *et al.* 2000). Consequently, least terns flying over land are expected to have a negligible risk of colliding with either Priority Project.

4.7.4.2.1.2 Direct and Indirect Habitat Impacts

None of the Priority Projects is expected to be constructed in proximity to an area used for nesting by least terns, and neither Priority Project alignment crosses a river large enough to be

expected to be used for foraging by migrating least terns. Therefore, no direct or indirect impacts to least tern habitat are expected as a result of the Preferred Alternative.

4.7.4.2.1.3 Minimization Measures and Mitigation Measures

LCRA TSC proposes to mark the Priority Projects at all crossings of major rivers to increase their visibility for all avian species (see Section 4.7.4.1.1.4). No other minimization or mitigation measures relative to least terns have been proposed by LCRA TSC.

4.7.4.2.2 Alternative B – Maximum Take Avoidance

Impacts to least terns under Alternative B would be similar to those expected under the Preferred Alternative.

4.7.4.2.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same impact avoidance and minimization measures as used in Alternative A (Preferred Alternative). Therefore, impacts to least terns under Alternative C are expected to be similar to those expected under Alternative A or Alternative B.

4.7.4.2.4 Summary of Impacts

No change in the status and distribution of least terns within the Permit Area is expected as a result of any of the alternatives. None of the three alternatives is expected to result in direct or indirect impacts to the species.

4.7.4.3 Sprague's Pipit

4.7.4.3.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.4.3.1.1 Direct Impacts to Sprague's Pipits

Sprague's pipits are expected to occur in the Permit Area only during their non-breeding season. For this reason, any Sprague's pipits occurring in the Permit Area can be expected to be highly mobile individuals capable of avoiding any of the Covered Activities. Therefore, construction activities associated with the Preferred Alternative are not expected to result in any direct impacts to Sprague's pipits.

Collision Risk. The Service in its 12-Month Finding to list Sprague's pipit as endangered or threatened did not identify collision with transmission lines as a threat to the species (Service 2010c). However, transmission lines are known to pose a collision risk to many varieties of birds, including passerines. As discussed for bald eagle, the Priority Projects would represent a very small percentage increase in the number of collision risks on the landscape in the Permit Area.

Construction of the Priority Projects would create a collision risk for Sprague's pipit wherever they crossed potentially suitable habitat because the underlying habitat could attract flying pipits towards the transmission lines. The risk of Sprague's pipits colliding with the transmission lines where the lines cross non-suitable habitat is expected to be extremely low because the birds

would be expected to be flying higher off the ground at those times. As discussed for least tern, migrating birds typically fly well above ground because it provides greater protection from predators, potentially stronger tail winds, reduced air density, and less exposure to turbulence, all resulting in more efficient use of energy (Leichti *et al.* 2000).

Marking of transmission lines is not proposed specifically for Sprague's pipits; however, this species may incidentally benefit from marking proposed for the whooping crane (see Section 4.7.4.4.1.1, below). Although the Permit Area lies outside of the whooping crane migration corridor, as discussed in Section 4.7.4.4.1.1, LCRA TSC is proposing to mark certain sections of the transmission lines at all crossings of major rivers and in the vicinity of potential whooping crane roost sites. Lands surrounding potential whooping crane roost sites could also prove attractive to Sprague's pipits, so the marking of the transmission lines in these areas may serve to reduce the potential for collision with these sections of line by Sprague's pipits.

It cannot be concluded that construction of the Priority Projects would not cause the occasional Sprague's pipit transmission line collision mortality. However, rates of collision mortality are expected to be low and any Sprague's pipit collision mortality is expected to have a negligible impact on the species.

4.7.4.3.1.2 Direct and Indirect Habitat Impacts

The Twin Buttes–Big Hill transmission line route and roughly the western half of the Big Hill–Kendall route lie within the wintering range of Sprague's pipit as mapped by Lockwood and Freeman (2004), and the species can occur as a migrant throughout the Permit Area. Sprague's pipits typically occur in areas that support short grass, such as grasslands and pastures. No clearing of ROW would be necessary wherever the transmission lines crossed such short grass areas, so apart from any habitat lost within the footprints of transmission line structures, no loss of potential Sprague's pipit habitat is expected from construction of the Priority Projects. It is likely that some transmission line structures would ultimately be placed in pastures or other shortgrass areas, but the number of structures placed in such habitats cannot be quantified precisely at this time because the transmission line construction plans have not been completed. Where transmission lines are constructed across wooded communities, ROW clearing would be expected to result in the replacement of woody vegetation with grassy or herbaceous vegetation. However, this would not be expected to increase the amount of wintering or migrating habitat available to Sprague's pipits because the birds typically prefer more extensive areas of grassland, and Sprague's pipits may avoid transmission line structures (as discussed below). Therefore, any increase in grassland as a result of clearing of ROW for the Priority Projects is expected to be of negligible benefit to the species.

Studies suggest that on their breeding grounds Sprague's pipits avoid roads and other non-grassland features such as trees, oil wells, and human-made structures (Service 2010c). It is unknown how sensitive Sprague's pipits may be on their wintering grounds to non-grassland features, apart from their avoiding grasslands that have been invaded by brush (Service 2010c). Sprague's pipits certainly do not avoid roads during migration and other non-breeding periods, as mowed grassy roadsides within grassland areas afford some of the best opportunities to observe this species during migration (Service 2010c).

If Sprague's pipits avoid human-made structures during migration and when on their wintering grounds, then it could be expected that the Priority Projects, where constructed in suitable Sprague's pipit habitat, could reduce the viability of that habitat within some distance of each structure location. While the Service used 750 feet as the distance that Sprague's pipits would be expected to withdraw from human-made structures on their breeding grounds, there is no evidence that the species is highly sensitive to human-made structures when on their wintering grounds.[10]

Construction of the Priority Projects is expected to result in the presence on the landscape of some transmission line structures that could indirectly reduce the viability of adjacent grasslands if Sprague's pipit do in fact avoid human structures. Since nothing is known about avoidance behavior of this species relative to human structures, the amount of habitat potentially impacted cannot be quantified. Regardless, any indirect impacts would be negligible because the amount of grassland expected to occur along the transmission lines represents only a tiny percentage of all habitat available to wintering and migrant Sprague's pipits.

4.7.4.3.1.3 Minimization Measures and Mitigation Measures

LCRA TSC is proposing to mark the transmission lines at river crossings and in the vicinity of potential whooping crane migration stopover sites to increase their visibility for all avian species (see Sections 4.7.4.1.1.4 and 4.7.4.4.1.1). No other minimization or mitigation measures for Sprague's pipits are proposed by LCRA TSC.

4.7.4.3.2 Alternative B – Maximum Take Avoidance

Impacts to Sprague's pipits under Alternative B would be similar to those under the Preferred Alternative. The amount of woody vegetation that would be cleared and replaced by grassy or herbaceous vegetation would be reduced compared to the Preferred Alternative, meaning the likelihood of this species benefitting from construction of the Priority Projects, already negligible under the Preferred Alternative, would be even lower.

4.7.4.3.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using similar impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Impacts to Sprague's pipit under Alternative C would therefore be similar to those expected under Alternative B.

4.7.4.3.4 Summary of Impacts

No change in current threats to Sprague's pipit within the Permit Area is expected under any of the alternatives. The Preferred Alternative may result in a negligible loss of habitat that could be used by wintering or migrant Sprague's pipit. Construction of the transmission lines would slightly increase the number of collision hazards for Sprague's pipits within the Permit Area. However, collision with transmission lines has not been identified as a threat to this species. Clearing of the transmission line ROW might result in an increase in the amount of herbaceous

[10] Sprague's pipits are known to winter regularly in a large mowed field at Anzaldulas County Park, Hidalgo County, Texas (Hidalgo County Birding Pages 2010). The center of this field lies approximately 500 feet from stands of woodland, a road, and the park entrance booth.

habitat available to migrant Sprague's pipits, although this increase would be of negligible benefit to the species. Impacts to Sprague's pipit under all three alternatives are considered to be negligible.

4.7.4.4 Whooping Crane

4.7.4.4.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.4.4.1.1 Direct Impacts to Whooping Cranes

Whooping cranes are expected to occur only rarely in the Permit Area and then for only brief periods of time, so the likelihood of any whooping cranes being exposed to any of the Covered Activities is extremely low. Any whooping cranes that did occur in the Permit Area would also be expected to be capable of avoiding harm from the Covered Activities, so no direct impacts to whooping cranes are expected to result from the Priority Projects.

Collision Risk. The Twin Buttes–Big Hill and Big Hill–Kendall alignments lie outside of the 200-mile-wide whooping crane migration corridor. Based on this, it is highly unlikely that whooping cranes fly through any portion of the Permit Area on a regular basis. This suggests that, overall, construction of the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines would pose a very low risk of collision for whooping cranes.

In general, the mostly rocky and hilly terrain of the Permit Area suggests that any whooping cranes occurring in the region are far more likely to fly over the Permit Area than they are to stop to rest within it. This supposition is supported by the near lack of records of whooping cranes from the Permit Area. The FHCP describes a methodology developed by LCRA TSC in coordination with the Service that LCRA TSC would use to identify the relative collision risk that presence of the proposed transmission lines would pose to whooping cranes, with that risk to be ranked on a scale of 0 (lowest) to 6. As described in Section 4.6.1 of the FHCP, ranking of risk is based on the proximity of potentially suitable whooping crane roost and feeding sites to the transmission line ROWs. Because the Twin Buttes–Big Hill and Big Hill–Kendall transmission lines would be constructed outside of the 200-mile-wide whooping crane migration corridor and pose a relatively low collision risk, LCRA TSC would mark the sections of those lines where the level of risk to whooping cranes was ranked as 4 or greater.

Transmission lines would be marked using traditional marker balls, spiral vibration dampeners, or air flow spoilers. Markers would be placed on the shield wire with spacing dependent on the type of marker used. Spacing for bird flight diverters is generally recommended at 16 foot intervals (Dave Bouchard, APLIC, personal communication, 2011). These markers would be inspected and replaced as necessary as part of routine maintenance.

The majority of whooping crane mortality occurs during migration, and the principle known cause of mortality is collision with utility lines (Stehn 2009). As mentioned in Section 3.7.5.4, just sixteen whooping cranes in introduced populations have died from collision with transmission lines since 1956, although just one whooping crane of the wild population has been recorded as colliding with a transmission line over that same time span (8 wild whooping cranes are known to have died from collision with distribution lines), despite their traversing what must

be dozens of transmission lines twice a year during their migrations. This suggests that the risk of a wild whooping crane colliding with a transmission line at any point in time is quite low. The risk that a whooping crane would collide with a Priority Project transmission line is considered to be extremely low because of the location of the alignments outside the whooping crane migration corridor. The proposed marking of the Priority Projects to increase their visibility is expected to decrease even further the risk of whooping cranes colliding with these particular lines. With passage of time, it seems nearly certain that another whooping crane of the wild population will collide with a transmission line, although where and when such a collision might occur cannot be known. Given the proposed marking of the Priority Projects, location of the projects outside of the whooping crane migration corridor, and the very low rate at which collision with transmission lines has occurred within the wild population, construction of the Priority Projects is expected to have a negligible effect on the rate at which future whooping crane collision mortality or injury occurs.

4.7.4.4.1.2 Direct and Indirect Habitat Impacts

No designated critical habitat or any traditional stopover locations known to be used on a consistent and regular basis by migrating whooping cranes occur within the Permit Area. Potential stopover sites within the Permit Area (e.g., stock tanks) are expected to be used on an unpredictable, opportunistic, and extremely infrequent basis by whooping cranes, and the vast majority of sites probably will never receive stopover use by whooping cranes despite their apparent suitability for that purpose because of their location outside the migration corridor.

Transmission line structures are most often placed on topographic high points, which generally are not likely to coincide with areas with potential to be used by whooping cranes, and generally would not be placed in stock tanks or low-lying wet areas that could provide roosting habitat. Some sections of the transmission line routes cross cropland and pasture, so it is possible that structure construction would result in the loss of a small amount of vegetation that could potentially have been used for foraging by whooping cranes at some future time. However, as the base of each structure would cover only several hundred square feet, structures would be placed many hundreds of feet apart, and the Priority Projects lie outside of the whooping crane migration corridor, the amount of vegetation lost to structure construction is expected to be inconsequential with regard to the ability of a particular area to support migratory whooping cranes. Consequently, the direct impact of the Priority Projects on the availability of stopover habitat for whooping cranes is expected to be negligible.

Because the Priority Projects would be constructed hundreds of miles away from the wintering and breeding ranges of the whooping crane and outside of the migration corridor, the Covered Activities have extremely limited ability to indirectly impact whooping cranes. Theoretically, the presence of transmission line structures in a particular area that supports suitable stopover habitat could cause whooping cranes to avoid that habitat, thereby reducing the amount of stopover habitat available to migrating cranes. However, being that both Priority Projects are located outside of the migration corridor for the species, none of the fields, pastures, and stock tanks occurring in proximity to the Priority Projects is considered to qualify as true potential stopover habitat and so construction of the Priority Projects is not considered to have the potential to result in the indirect loss of stopover habitat.

The Permit Area, being situated in the mostly hilly and rocky Hill Country, contains very little habitat that can be considered especially suitable for whooping crane stopovers since croplands are scarce and, so, potential feeding areas are few. On the other hand, lakes, ponds, and stock tanks suitable for roosting are comparatively common and widespread. Thus, while construction of the Priority Projects might, in the future, cause any wayward whooping crane or cranes to avoid a particular stock tank that in absence of the lines could have provided a suitable roost site, the Priority Projects are not expected to prevent whooping cranes from finding suitable roost sites in the Permit Area as they migrate to and from their wintering grounds. Therefore, any indirect impact on the availability of stopover habitat in the Permit Area is expected to have a negligible impact on the species.

4.7.4.4.1.3 Minimization Measures and Mitigation Measures

As described above, LCRA TSC proposes to mark those sections of the Priority Projects considered to pose the greatest collision risk to whooping cranes based on methodologies described in the FHCP. Transmission lines would be marked using traditional marker balls, spiral vibration dampeners, or air flow spoilers. Markers would be placed on the shield wire with spacing dependent on the type of marker used. These markers would be inspected and replaced as necessary as part of routine maintenance.

4.7.4.4.2 Alternative B – Maximum Take Avoidance

Impacts to the whooping crane under Alternative B would be similar to those expected under the Preferred Alternative. Differences in the amount of clearing performed in the ROW are not expected to influence how either alternative impacts this species.

4.7.4.4.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using similar impact avoidance and minimization measures as used in Alternative B (Maximum Take Avoidance alternative). Impacts to the whooping crane under Alternative C would be similar to those expected under the Preferred Alternative or Alternative B.

4.7.4.4.4 Summary of Impacts

It is expected that migrant whooping cranes would periodically suffer mortality and injury from collisions with transmission lines, distribution lines, and other hazards under all three alternatives, although these impacts are typically expected to occur within the migration corridor for the species. All three alternatives are expected to result in a negligible increase in the risk of future collisions because of the location of the Priority Projects outside of the migration corridor. Construction of the transmission lines under any of the alternatives could in the future cause whooping cranes to avoid stopping over at a particular stock tank within the Permit Area, but presence of the transmission lines is not expected to prevent any whooping cranes that might fly over the Permit Area from being able to find a suitable overnight roost site.

4.7.4.5 Tobusch Fishhook Cactus

4.7.4.5.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

The Tobusch fishhook cactus typically occurs on flat to gently sloping hilltops, but may also occur on more level areas on steeper rocky slopes and in rocky floodplains (Service 1987, Poole *et al*. 2007). Vegetation where this species occurs is typically open, with openings set within oak/juniper woodlands. This general type of habitat is common and widespread across much of the Big Hill–Kendall portion of the Permit Area. The Twin Buttes–Big Hill portion of the Permit Area lies outside the geographic range of this cactus. As discussed in Section 3.7.5.9, the northern, western, and eastern limits of the range of this cactus are not known with certainty and it is considered possible that its range extends into southwestern Gillespie and southern Menard counties.

4.7.4.6.1.1 Direct Impacts to Tobusch Fishhook Cactus

LCRA TSC would avoid direct impacts to any Tobusch fishhook cactus occurring on federally or state-owned lands. It is not possible at this time to quantify how many, if any, Tobusch fishhook cactus occurring on private lands would be directly impacted by construction of the Big Hill–Kendall project, because the status of the cactus is poorly known outside of those publicly owned lands that occur within its range. Long-term studies of Tobusch fishhook cactus on state-managed lands indicate that distribution of this plant is typically patchy, and that numbers of this cactus fluctuate greatly over time, perhaps in response to weevil parasitism (Service 2010b). For these reasons, it is extremely difficult to develop an average density of occupation of potentially suitable habitat and any estimate of the number of cacti occurring in the Big Hill–Kendall ROW that might be made to gauge the number of cacti that could be directly impacted by the Priority Projects is likely to be highly inaccurate. As reiterated in Section 4.7.4.6.1.3, below, LCRA TSC has incorporated many construction BMPs into the FHCP (Section 4.10.1) aimed at minimizing impacts to Tobusch fishhook cactus and its habitat during performance of the Covered Activities. Despite implementation of these BMPs, it is considered possible, if not probable, that the Covered Activities could result in the direct loss of individual Tobusch fishhook cactus on private lands. Cacti could be crushed by vehicles performing ROW clearing activities or traveling the ROW between structure locations and cacti could be damaged or destroyed at structure locations if they were not able to be avoided. As some of these cacti can be extremely small and occur on uneven, rocky ground, it is also considered possible, if not probable, that some Tobusch fishhook cactus would be driven over without their incurring harm.

Based on the known population of this cactus (3,395), which is not expected to include any cacti that may be impacted by the Priority Projects, the Service has recommended downlisting the cactus to threatened (Service 2010b). The take of Tobusch fishhook cactus on private lands is not prohibited by Section 9 of the ACT.

4.7.4.6.1.2 Direct and Indirect Habitat Impacts

An estimate of the amount of Tobusch fishhook cactus habitat that could occur within the ROW for the Big Hill–Kendall transmission line was developed as a means of quantifying possible impact to this cactus from the Priority Projects. Developing this estimate required the use of some assumptions because of uncertainty concerning the northern and eastern limits of the range of this species. Assumptions used in formulating this estimate were: 1) occurrence of the cactus in the Big Hill–Kendall portion of the Permit Area is limited to substrates underlain by Edwards

Formation limestone; 2) all exposures of Edwards Formation limestone occurring in Gillespie, Kerr and Kimble counties are within the range of this cactus; and 3) all exposures of Edwards Formation limestone crossed by the selected Big Hill–Kendall route have potential to support Tobusch fishhook cactus.

Based on these assumptions and using surface geology of the Big Hill–Kendall portion of the Permit Area as mapped by the University of Texas (Bureau of Economic Geology 1981a, 1981b, 1983), approximately 1,253.3 acres of the 160-foot wide ROW for the Big Hill–Kendall transmission line qualify as potential Tobusch fishhook cactus habitat.

As a "worst case" estimate, the number of acres of Tobusch fishhook cactus habitat that would be directly impacted by ROW clearing activities is taken to be the number of acres of potential habitat present within the 160-foot-wide ROW, or 1,253.3 acres. At the same time, it is important to note that this acreage is believed to over-represent the amount of Tobusch fishhook cactus habitat that would actually be directly impacted as part of the Covered Activities for the following reasons: 1) the area assumed to be the geographic range of the species likely exceeds the true range to the northwest and southeast; 2) it is expected that even within its true range, the Tobusch fishhook cactus does not fully occupy all areas underlain by the Edwards Formation, even where vegetation communities appear suitable for occurrence of the cactus; 3) the cactus occurs in clearings within woodlands, so if the species does occur within the transmission line ROW it is possible that no clearing of vegetation would need to be performed in areas where cacti are located; and 4) the ROW is not likely to be cleared to a width of 160 feet along its full length.

A total of approximately 4,640,753 acres of surface outcrop of the Edwards Formation limestone (and its stratigraphic equivalents) are mapped by the University of Texas (Bureau of Economic Geology 1976, 1981a, 1981b, 1983) as occurring in the eight counties in which Tobusch fishhook cactus is known to occur. This acreage may over-represent to some degree the amount of potential habitat available to Tobusch fishhook cactus because it includes outcrop of the Edwards Formation in eastern Kerr County where the cactus is not expected to occur. However, this acreage also does not include outcrop of Edwards Formation in southwestern Gillespie County or southern Menard County, where occurrence of the cactus is presumed possible. With assumption that the extent of surface outcrop of Edwards Formation limestone in the eight counties of its known range defines the potential geographic range of the cactus, the 1,253.3 acres of Edwards Formation that may be cleared within the ROW for the Big Hill–Kendall project represents approximately 0.027 percent of the potential habitat available for the cactus. Based on this low percentage, construction of the Priority Projects is expected to have a minor direct impact on habitat for Tobusch fishhook cactus.

ROW clearing activities would result in the creation of vegetative debris, which LCRA TSC sometimes shreds and disposes of as mulch by spreading it across its ROW. As part of the BMPs identified in Section 4.7.4.6.1.3 below, LCRA TSC would not spread any mulch resulting from clearing of ROW in areas identified as potential Tobusch fishhook cactus habitat, so the Covered Activities would not result in a decrease in the amount of area available for this species to occupy.

The clearing of woodland from within the Big Hill–Kendall ROW would decrease the amount of shaded ground and possibly increase habitat suitability for the cactus within the ROW. This could allow the species to colonize previously unoccupied areas and increase the size of local populations. However, any beneficial improvements to habitat for Tobsuch fishhook cactus resulting from the clearing of woodland from the ROW is expected to be of negligible benefit to this cactus. Because the ROW is expected to be maintained in an open condition, habitat conditions within the ROW should remain suitable for Tobusch fishhook cactus for as long as the ROW is maintained. Vegetation clearing is not expected to adversely alter habitat microclimatic conditions for the species as these cacti occur in open, sun-lit areas.

If any cacti are destroyed during performance of the Covered Activities, this would result in an overall decrease in local populations. The presence of fewer cacti in a particular area could increase the risk of that local population being eradicated by weevils or through some other natural process. The severity of that risk would depend on the number of cacti destroyed and the size of local populations.

For the same reason that direct impacts to this subspecies cannot be quantified, the indirect effect of the Covered Activities on Tobusch fishhook cactus also cannot be quantified. If no cacti are directly harmed by the Covered Activities, then indirect impacts may be limited to positive improvement of habitat conditions. If some cacti are destroyed by Covered Activities, then some negative impacts to local populations may be realized, although potential would still exist for improvement in local habitat conditions.

4.7.4.6.1.3 Minimization Measures and Mitigation Measures

Prior to commencement of construction activities, LCRA TSC would delineate areas within the Big Hill–Kendall ROW that have potential to support Tobusch fishhook cactus. This delineation would be based on known range of the species and performed using a combination of aerial photography and geologic maps. This delineation would represent a refinement of the delineation of potential cactus habitat discussed above because through review of aerial photography it will be possible to eliminate obvious non-habitat such as roads, pastures, and water. The delineation would then be presented to the Service for its review and approval. LCRA TSC would incorporate BMPs into the construction and maintenance methodologies used within the Service-approved areas identified as potentially supporting Tobusch fishhook cactus in order to minimize the potential for the Covered Activities to result in direct impacts to this species. These BMPs would include the following:

- Identification of potential habitat for Tobusch fishhook cactus. LCRA TSC will delineate potential cactus habitat within the Big Hill–Kendall ROW. The limits of the potential habitat will be finalized through review and approval by the Service.
- Pre-construction surveys for the cactus within the transmission line ROW within 150 feet of structure locations. Erecting a structure typically results in complete disturbance of the ground at the structure foundation site and heavy vehicle/equipment use within the ROW within 150 feet of the foundation site. Any Tobusch fishhook cactus found within 150 feet of a structure location would be protected behind construction fencing where possible. If use of fencing is not possible, locations of the cactus would be marked with survey pin flags so that equipment operators can see and avoid them. If cacti are located

such that avoidance of the area containing the cacti is not possible, cacti may be temporarily covered with construction matting if such a covering itself would not crush the plants.

- Pre-construction surveys for the cactus within the ROW on any federally or state-owned land identified as potential habitat that would be crossed by the transmission line. Any Tobusch fishhook cactus found within the Big Hill–Kendall easement on federally or state-owned land would be avoided when performing the Covered Activities. State-owned lands crossed by the transmission line are anticipated to be largely, if not exclusively, limited to highway ROW readily accessible to the public. Consequently, LCRA TSC would not mark any cacti found in highway ROW or protect them behind construction fencing in order to prevent their being noticed and subsequently collected. LCRA TSC would instead employ a construction monitor to guard the plants and ensure their avoidance during the time transmission line construction activities were being performed in that specific area.
- Use of flail mowers or similar equipment to clear vegetation in ROW within delineated potential habitat. Flail mowers cut vegetation above ground level. Cutting vegetation above ground level as opposed to blading it would avoid soil disturbance and minimize the potential for clearing of the ROW to destroy any Tobusch fishhook cactus that may be present.
- Avoidance of the spread of mulch in potential habitat areas. LCRA TSC would not spread mulch resulting from the clearing of vegetation within the ROW within areas identified as potential Tobusch fishhook cactus habitat. This would prevent mulch from smothering or shading out any cacti that may be present in the ROW.
- Prohibition on the use of herbicides. No herbicides would be used as part of ROW maintenance activities within areas identified as potential Tobusch fishhook cactus habitat.
- LCRA TSC has not proposed any compensatory mitigation to off-set possible impacts to Tobusch fishhook cactus or its habitat resulting from the Priority Projects.

4.7.4.6.2 Alternative B – Maximum Take Avoidance

Under Alternative B, clearing of the Big Hill–Kendall ROW within areas identified as potential habitat for the Covered Species would occur only within 150 feet of structure locations. Outside of habitat areas for the Covered Species, it is assumed for purposes of analysis that the ROW would be cleared to its full 160-foot width (although this is unlikely). Using the same hypothetical structure locations that were used to estimate reductions in impact to Covered Species habitat that would be realized under Alternative B, GIS software was used to identify areas where occurrence of potential Tobusch fishhook cactus habitat (as identified as described above) coincided with occurrence of potential habitat for the Covered Species. GIS software was then also used to identify the acreage of these overlapping habitat areas that would not be disturbed under Alternative B. This acreage was then subtracted from the maximum amount of Tobusch fishhook cactus habitat expected to be impacted under Alternative A to identify the maximum amount of potential habitat for the cactus that could be directly impacted under Alternative B. This amount is approximately 956.8 acres, or approximately 296.5 acres less than would be expected to be impacted under Alternative A (Preferred Alternative).

As with Alternative A, the number of Tobusch fishhook cactus that would be directly impacted under Alternative B cannot be quantified at this time. The same BMPs that were identified above and incorporated into the FHCP to minimize the potential for Covered Activities to directly impact Tobusch fishhook cactus would be enacted under Alternative B. Certainly no more Tobusch fishhook cactus would be directly impacted under Alternative B than would be impacted under Alternative A. However, owing to the uneven distribution of Tobusch fishhook cactus, the reduced impact to potential cactus habitat expected under Alternative B might not equate to any difference in the actual number of cactus impacted directly under either alternative. It could be that the only cacti occurring on private lands in the ROW occur in areas that could not be avoided during construction of the transmission line structures.

Also, as with Alternative A, the indirect effects of the Covered Activities on Tobusch fishhook cactus under Alternative B cannot be quantified owing to a lack of knowledge of the status and distribution of the cactus within the Big Hill–Kendall ROW. Approximately 296.5 fewer acres of potential Tobusch fishhook cactus habitat would be cleared under Alternative B than under Alternative A, so Alternative B may have less of a positive benefit on cactus habitat conditions within the Permit Area than Alternative A. If fewer cacti were directly impacted under Alternative B, then this alternative could make local cactus populations less susceptible to eradication by weevils or some other natural processes that would Alternative A.

4.7.4.6.3 Alternative C – No Action

Because the amount of land disturbed under Alternative C (No Action) would similar to that disturbed under Alternative B, impacts to Tobusch fishhook cactus under Alternative C are expected to be similar to those that would occur under Alternative B.

4.7.4.6.4 Summary of Impacts

Under all three alternatives, construction of the Big Hill–Kendall transmission line is likely to have minor adverse impacts on the Tobusch fishhook cactus. Alternative A (Preferred Alternative) could result in the clearing of up to 1,253.3 acres of potential Tobusch fishhook cactus habitat, while the maximum amount of potential Tobusch fishhook cactus that would be disturbed under Alternative B or C would be approximately 956.8 acres. Based on the amount of potential habitat that would be disturbed, impacts under Alternatives B and C could be proportionally less than those occurring under Alternative A, or impacts could be identical, if all cacti within the ROW occur at sites where structures must be constructed and disturbance to them could not be avoided.

Under all three alternatives, if any Tobusch fishhook cactus occur along the alignment selected for the Big Hill–Kendall transmission line, impacts to those cactus may be avoided or reduced as a result of their occurring in open areas where ROW clearing may not be required, and as a result of the construction BMPs incorporated into the project by LCRA TSC.

4.7.5 State Special Status Species

A total of 10 state threatened species and 46 Species of Concern have been identified by the TPWD as occurring in, having occurred in, or having potential to occur in the counties of the Permit Area. Ten of these species are not expected to occur at this time in the Permit Area and

so the potential for the Priority Projects to affect these species was dismissed in Section 3.7.6 (see Table 3.10 for more information on these 10 species).

Eleven more state threatened species and Species of Concern occur in the Permit Area only on an extremely irregular basis, or occur only in the Llano Uplift region, which is not crossed by the either of the routes selected for the Priority Projects. Because these species are so unlikely to occur in the Permit Area or are so unlikely to be affected by the alternatives under consideration, they need not be carried forward for detailed effects analysis. These species are as follows:

- Black bear
- White-nosed coati
- Llano pocket gopher
- Texas tortoise
- Creeper
- Basin bellflower
- Edwards Plateau cornsalad
- Enquist's sandmint
- Granite spiderwort
- Rock quillwort
- Small-headed pipewort

Black bear and white-nosed coati are not carried forward because neither is a resident of the Edwards Plateau. Both species have potential to occur in the Permit Area only on an extremely infrequent basis, and potential for occurrence is limited to highly mobile individuals that could easily avoid the Covered Activities. The Permit Area lies outside the natural range of Texas tortoise as mapped by Dixon (2000), so the Covered Activities do not have potential to impact habitat for Texas tortoise or directly impact naturally occurring members of the species. Creeper is a freshwater mussel that may occur in creeks that would be crossed by the Priority Projects. However, because the transmission lines will span all perennial streams, and because of measures that will be implemented by LCRA TSC to avoid and minimize impacts to water quality and, concomitantly, freshwater mussels, at all stream crossings, it is extremely unlikely that construction of the Priority Projects under any of the alternatives under consideration in this EA would result in adverse effects to freshwater mussels. These measures are identified in the FHCP, but would be implemented even under the No Action Alternative (e.g., no ITP, no HCP) to meet the requirements of a TCEQ SWPPP.

Llano pocket gopher and all six of the plant species identified above are restricted in occurrence within the Permit Area to the Llano Uplift region. Because neither of the transmission line routes crosses this region, the Covered Activities do not have potential to adversely affect these species. If the Big Hill–Kendall route is changed as a result of the appeal to the PUC's Final Order with respect to this project, the potential for construction of this transmission line to adversely impact Llano pocket gopher or any of these six species of plant will be analyzed for any new route.

The expected impacts of Alternatives A, B, and C on the remaining 36 state special status species addressed in this section are described below, either by individual species or by groups of species

if the species are similar ecologically or in their potential to be affected by the Preferred Alternative. Definitions of impact intensity are similar for all Species of Concern and are as follows:

- Negligible: Species would not be affected or the change would be so small as to not be of any measurable or perceptible consequence to the population.
- Minor: There would be a measurable effect on one or more species or their habitats, but the change would be small and relatively localized.
- Moderate: There would be a noticeable effect with moderate consequences to a population of a species. The effect would be of consequence to populations or habitats.
- Major: Changes to the existing primary threats to the Evaluation Species, their habitats, or the natural processes sustaining them would be readily detectable over most of the range of that species within the Permit Area, and would be outside the range of natural variability for long periods of time or be permanent. Direct impacts or habitat alterations could substantially affect the distribution and abundance of the species in the Permit Area.

4.7.5.1 Common Black-Hawk

4.7.5.1.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.5.1.1.1 Direct Impacts to Common Black-Hawks

No direct impacts to common black-hawks are expected to result from the Covered Activities. The species is not known to currently nest in the vicinity of the route selected for the Twin Buttes–Big Hill transmission line.

Collision Risk. No common black-hawks are known to nest in proximity to the routes selected for the Twin Buttes–Big Hill and Big Hill–Kendall projects. Therefore, construction of the Priority Projects is not expected to result in the placement of overhead transmission lines in proximity to any active common black-hawk nests, and the potential for common black-hawks to collide with any of the transmission lines of the Priority Projects is considered to be negligible.

4.7.5.1.1.2 Direct and Indirect Habitat Impacts

No habitat known to be used currently by common black-hawks is expected to be directly or indirectly impacted by construction of the Priority Projects. The Twin Buttes–Big Hill crossing of Dove Creek could result in the removal of approximately 1.9 acres of riparian woodland developed along this creek, if the ROW is cleared to the maximum width of 160 feet. A pair of common black-hawks nested in this general area up until about three years ago (T. Maxwell/Angelo State University, pers. comm. to SWCA on 15 November 2010). Given the small amount of woodland that would be cleared compared to the total amount of woodland developed along Dove Creek, it is not expected that clearing for the ROW would deter common black-hawks from again nesting in the future along Dove Creek.

The proposed transmission lines would span all perennial and intermittent streams, and their construction is not expected to influence the level of water flow in any such water bodies (see Section 4.6.1.1, Surface Water). Therefore, construction of the Priority Projects is not expected to alter the structure or composition of any riparian woodlands developed within the Permit Area

(apart from the clearing of riparian woodland as needed within the Priority Project ROW), and so the Priority Projects are not expected to alter the ability of remaining riparian woodlands within the Permit Area to serve as nesting habitat for common black-hawks.

4.7.5.1.2 Alternative B – Maximum Take Avoidance

Because the only primary difference between Alternative B and Alternative A (Proposed Acton) is in the amount of Covered Species habitat that would be removed during the clearing of ROW, and because the riparian woodland developed along Dove Creek does not constitute habitat for either Covered Species, impacts to common black-hawk under Alternative B would be similar to those expected under Alternative A.

4.7.5.1.3 Alternative C – No Action

Impacts to vegetation under Alternative C would be similar to those expected under Alternative B. Therefore, impacts to common black-hawk under Alternative C would be similar to those expected under Alternative B or Alternative A.

4.7.5.1.4 Summary of Impacts

Construction of the Priority Projects and performance of the Covered Activities are not expected to result in any direct impacts to common black-hawks or directly or indirectly impact any habitat known to be used currently by the species.

4.7.5.2 Peregrine Falcon

4.7.5.2.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.5.2.1.1 Direct Impacts to Peregrine Falcons

No direct impacts to American peregrine falcons are expected from the Preferred Alternative. Peregrine falcons are expected to occur in the Permit Area primarily as migrants and individual falcons should easily be able to avoid being directly affected by construction, maintenance, and repair activities.

Peregrine falcons would use transmission line structures for perching, so migrant peregrines occurring within the Permit Area could be expected to occur occasionally on the structures erected as part of the Priority Projects. A wide variety of types of birds have been documented as being killed through electrocution, although this form of mortality is most common among larger birds that are capable of completing a circuit by simultaneously touching conductor and shield wires, or by touching a conductor while still in contact with a grounded structure (Lehman 2001). As identified in Section 4.7.4.1.1.1, both Priority Projects would be designed to maintain spacing between lines sufficient to prevent bald eagles from simultaneously touching conductor and shield wires. As bald eagles are much larger than peregrine falcons, this design would also prevent any peregrine falcons that may perch on structures or fly through the lines from being electrocuted. Therefore, the Covered Activities are not expected to result in the direct impact to peregrine falcons through electrocution.

Collision Risk. Because peregrine falcons are known to perch on transmission line structures, members of this species are not expected to avoid transmission line structures and can be

expected to occasionally fly in the immediate proximity of the transmission lines. Collision with power lines is a known source of mortality for peregrine falcons (Redig and Tordoff 1992), although studies indicate that high voltage transmission lines pose a low risk to raptors and that most raptor mortality is incurred on medium-voltage (≤ 60 kV) power lines (Bayle 1999). As discussed for bald eagle, the Priority Projects would represent a very small percentage increase in the number of collision risks on the landscape in the Permit Area. As discussed in Sections 4.7.4.1.1.1 and 4.7.4.4.1.1, LCRA TSC is proposing to mark certain sections of the transmission lines with traditional marker balls, spiral vibration dampeners, or air flow spoilers to increase visibility of the transmission lines to bald eagles, whooping cranes, and other birds. These markers would be installed on the shield wires, with spacing dependent on the type of marker used, on the lines at all crossings of major rivers and in the vicinity of potential whooping crane roost sites. No marking of other sections of transmission line is proposed as an effort to make the transmission lines more visible to peregrine falcons. Like bald eagles, some peregrine falcons may preferentially follow river corridors when migrating because waterbirds can provide concentrations of prey that could be attractive to peregrine falcons. Some peregrine falcons may also be attracted to potential whooping crane roost sites as such sites could also attract smaller species of waterbirds on which peregrine falcons would prey. However, it is expected that some peregrine falcons would also migrate directly overland without influence of direction by bodies of water.

Marking the Priority Projects as described is expected to reduce the potential for peregrine falcon collision mortality to occur, although the potential for collision mortality to occur cannot be reduced absolutely to zero. Collision with transmission lines is not considered to be a significant threat to American peregrine falcons (Service 1999). Thus, while construction of the Priority Projects would create a collision risk for peregrine falcons that would not exist in absence of the Priority Projects, the risk of collision is considered to be very low and reduced somewhat by the proposed marking of the transmission lines. Consequently, while the possibility cannot be ruled out conclusively that peregrine falcon collision could occur, the risk of collision mortality is considered to represent a negligible threat to American peregrine falcon.

4.7.5.2.1.2 Direct and Indirect Habitat Impacts

Peregrine falcons do not breed nor winter regularly within the Permit Area, and are expected to occur in the Permit Area primarily as migrants. Peregrine falcons largely hunt in open habitats and would use transmission line structures for roosting and as perches from which they scan for potential prey items. Consequently, the construction of the Priority Projects could have a slightly beneficial effect on habitat conditions for peregrine falcons within the Permit Area, although given the scope of the projects compared to the breadth of central Texas, this effect is expected to be of negligible benefit to the species.

4.7.5.2.2 Alternative B – Maximum Take Avoidance

Impacts to peregrine falcons under Alternative B would be similar to those expected under the Preferred Alternative, because this alternative would create a similar very low increased level of collision risk in the Permit Area and result in the creation of a similar number of potential hunting perches.

4.7.5.2.3 Alternative C – No Action

Impacts to peregrine falcon under Alternative C would be similar to those expected under Alternative A or B, because Alternative C would create a similar very low increased level of collision risk in the Permit Area and result in the creation of a similar number of potential hunting perches.

4.7.5.2.4 Summary of Impacts

All three alternatives would cause a very slight increase in the number of collision hazards present within the Permit Area, although the risk of any peregrine falcons colliding with the proposed transmission lines is considered to be low and represent a minor threat to the species. All three alternatives would also result in an increase in the number of hunting perches available to peregrine falcons, although this increase is expected to be of negligible benefit to the species.

4.7.5.3 Zone-tailed Hawk

4.7.5.3.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.5.3.1.1 Direct Impacts to Zone-tailed Hawks

Because of their general scarcity in the Permit Area, it is very unlikely that an active zone-tailed hawk nest would happen to occur within the ROW of either Priority Project. However, even if one or more pair of zone-tailed hawks did happen to nest regularly in the vicinity of the route chosen for a Priority Project, because LCRA TSC is proposing to clear vegetation within its ROW during the non-breeding season in order to avoid the potential of directly impacting GCWAs and BCVIs, ROW clearing activities are not expected to result in the destruction of any active zone-tailed hawk nests. Adult and fledged juvenile hawks would be capable of avoiding the Covered Activities. Therefore, no direct impacts to zone-tailed hawks are expected from the Preferred Alternative.

Collision Risk. As has been discussed for all previous avian species, construction of the Priority Projects would result in a slight increase in the number of collision risks on the landscape within the Permit Area. Any zone-tailed hawks occupying a territory in proximity to a Priority Project, or migrating or otherwise traveling at low altitude across a landscape crossed by a Priority Project, would be at risk of colliding with the proposed transmission lines. Because this species occurs in very low densities within the Permit Area, overall the Priority Projects are considered to pose a low risk of collision to this species. While it cannot be ruled out that one or more zone-tailed hawks would ultimately collide with the proposed transmission lines, it is expected that any collision mortality realized over time would have no more than a negligible impact on the species.

4.7.5.3.1.2 Direct and Indirect Habitat Impacts

Zone-tailed hawks typically occur in hilly areas and canyonlands that support habitats ranging from desert scrub to woodland, and typically nest in taller trees along drainage courses. If a Priority Project were constructed across an area regularly occupied by a pair of zone-tailed hawks, the clearing for that ROW might result in a reduction in the amount of woodland or brush present within that territory, with that woodland or brush expected to be replaced by grassy habitat, or a mixture of herbaceous vegetation and low scrub. Such habitat would remain within

the range of habitat types that are used by zone-tailed hawks, so the clearing of ROW for the Priority Projects in general is expected to have a negligible direct impact on zone-tailed hawk habitat.

As indicated, it is considered very unlikely that a Priority Project would be constructed directly across a zone-tailed hawk nest site. However, if in fact a project happened to be constructed across a nest location, clearing for the ROW could result in the removal of the nest tree and other trees in the general vicinity. Such clearing would require the birds to seek a new tree for nesting, which could influence the locations of the boundaries of the territory subsequently defended by that pair. If, on the rare chance a route chosen for a Priority Project happened to cross over a zone-tailed hawk nest location, construction of that project then could cause a minor direct habitat impact.

The introduction of a set of transmission lines to an area occupied by zone-tailed hawks is not expected to cause those birds to abandon that area, so the Priority Projects are not expected to indirectly impact any habitat used by zone-tailed hawks.

4.7.5.3.2 Alternative B – Maximum Take Avoidance

Impacts to zone-tailed hawks under Alternative B would be generally similar to those expected under Alternative A (Preferred Alternative). The reduced amount of vegetation clearing expected under this alternative in GCWA habitat areas results in an even lower chance that a zone-tailed hawk nest tree could be removed by ROW clearing activities. Both Alternative A and Alternative B would create a similar incremental increase in the number of collision hazards present on the landscape within the Permit Area.

4.7.5.3.3 Alternative C – No Action

Impacts to zone-tailed hawk under Alternative C would be similar to those expected under Alternative B because the amount of vegetation expected to be cleared under each alternative is similar, and each would result in construction of transmission lines.

4.7.5.3.4 Summary of Impacts

Each of the three alternatives would result in a slight increase in the number of collision risks for zone-tailed hawk within the Permit Area, and would create the potential for transmission lines to be constructed across areas occupied by members of this species. Clearing for ROW is expected to have a negligible impact on habitats used by zone-tailed hawks, unless a transmission line happened to be constructed directly across a nest site location. The probability of a transmission line crossing directly over a zone-tailed hawk nest site is believed to be very low given the scarcity of this species in the Permit Area and the small amount of land that would be crossed by the lines relative to total land area within the Permit Area.

4.7.5.4 Ferruginous Hawk and Western Burrowing Owl

4.7.5.4.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

No direct impacts to ferruginous hawk or western burrowing owl are expected from the Preferred Alternative. The Priority Projects are expected to result in a negligible loss of habitat available to ferruginous hawks and western burrowing owls. Ferruginous hawks are known to roost on,

and search for prey from, transmission line structures. The proposed design of the Priority Projects would prevent ferruginous hawks from being electrocuted as a result of the Preferred Alternative. Western burrowing owls typically stay close to the ground and so are generally not at risk of electrocution by transmission lines. The Priority Projects would result in a slight increase in the number of collision risks for these species present in the Permit Area. Ferruginous hawks can be expected to fly at transmission line height on a regular basis, while burrowing owls likely fly at that height only when migrating. Because ferruginous hawks occur rarely to uncommonly in the Permit Area, it is expected that collisions by ferruginous hawks with the proposed transmission lines would occur on an extremely rare basis. Because western burrowing owls also occur rarely to uncommonly in the Permit Area and typically stay low to the ground, it is expected that members of this species would also collide with the proposed transmission lines on an extremely rare basis, if at all. Consequently, the collision risk posed by the Priority Projects to ferruginous hawk and western burrowing owl is likely to result in minor and negligible impacts to these two species, respectively.

4.7.5.4.2 Alternative B – Maximum Take Avoidance

Impacts to ferruginous hawks and western burrowing owls under Alternative B would be similar to those expected under the Preferred Alternative. Differences in the amount of clearing of vegetation that would be performed between the two alternatives are not expected to influence how these species are impacted by the Covered Activities.

4.7.5.4.3 Alternative C – No Action

Construction of the Priority Projects under this alternative is expected to result in levels of impact to ferruginous hawk and western burrowing owl similar to those expected under Alternatives A and B.

4.7.5.4.4 Summary of Impacts

No direct impacts to ferruginous hawk or western burrowing owl are expected from construction activities performed under any of the three alternatives. All three alternatives would create a collision risk that is expected over time to result in minor impacts to ferruginous hawks and negligible impacts to western burrowing owl.

4.7.5.5 Black-tailed Prairie Dog and Plains Spotted Skunk

4.7.5.5.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Both of these species use open habitats, with the skunk also utilizing woodland and shrubland habitats. Black-tailed prairie dog is not known to occur along the route for either Priority Project, but it has the potential to occur in the general vicinity of the Twin Buttes–Big Hill route. The presence of prairie dogs in a particular area is obvious, and no prairie dog towns were observed along the Twin Buttes–Big Hill alignment during the field assessments performed by SWCA (P. Sunby/SWCA pers. obs.). Occurrence of this species along this route is therefore not expected, although some limited potential exists for this species to move into lands crossed by this project prior to commencement of construction.

Because both of these species use open habitats, the clearing of ROW for the Priority Projects is not expected to result in an appreciable direct loss of habitat available to black-tailed prairie dogs

or plains spotted skunks. Neither of these species is expected to avoid transmission lines, so the Priority Projects are not expected to indirectly impact the amount of habitat available for either species. If black-tailed prairie dogs are found to occur along the Twin Buttes–Big Hill alignment, it could only be in areas supporting extremely short grass where clearing of the ROW would not be needed. Therefore, LCRA TSC should be able to identify and avoid impacting any prairie dog towns, unless it was necessary to place a transmission line structure within a town. As no prairie dog towns currently occur along the alignment, this seems very unlikely to be necessary. However, if it were, such construction would likely cause minor, short-term impacts to a small number of black-tailed prairie dogs or their burrows. Following completion of construction, it is expected that prairie dogs would repair damaged burrows and continue to occupy the area surrounding the transmission line structure.

Structure construction and vegetation clearing activities within the transmission line ROW and along access roads should generally be able to be avoided by plains spotted skunks, unless such activities happened to disturb a den site containing kits. In such a case, construction or clearing activities could result in the death or injury of young spotted skunks. Clearing of the ROW per se is not expected to cause more than negligible impacts to habitats used by plains spotted skunks, although it could convert some woodland or shrubland habitat to more open, herbaceous habitat. Because the potential exists for the Covered Activities to result in disturbance to skunk den sites, the Preferred Alternative is considered to have the potential to result in minor impacts to plains spotted skunks. If no skunks were actually harmed during the construction phase of the Priority Projects, then impacts to this species would be expected to be negligible.

4.7.5.5.2 Alternative B – Maximum Take Avoidance

Impacts to black-tailed prairie dogs and plains spotted skunks under Alternative B would be similar to those expected under Alternative A. The reduced amount of vegetation clearing within the ROW that would occur under this alternative is not expected to influence the potential for clearing activities to harm skunk den sites because the spotted skunk breeding season overlaps that of the Covered Species (Schmidly 2004), so no impacts to skunk den sites within Covered Species habitat areas is expected under either alternative.

4.7.5.5.3 Alternative C – No Action

Impacts to black-tailed prairie dog and plains spotted skunk under Alternative C would be similar to those expected under Alternative A or Alternative B.

4.7.5.5.4 Summary of Impacts

The Preferred Alternative, Maximum Take Avoidance alternative, and No Action alternative are all expected to result in negligible impacts to black-tailed prairie dog and minor to negligible impacts to plains spotted skunk.

4.7.5.6 Cave Myotis and Pale Townsend's Big-eared Bat

4.7.5.6.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

No direct impacts to either bat species are expected from construction activities associated with the Priority Projects. Clearing of shrubland and woodland for the ROW could result in local decreases in the amount of flying insect prey available to bats, although such decreases are

expected to have negligible indirect effects on the ability of individuals of these bat species to support themselves since the amount of woody vegetation removed from the ROW would represent a tiny fraction of the amount of woody vegetation present on the landscape. Therefore, the Priority Projects are not expected to cause more than a negligible direct or indirect loss of habitat available to either of these bat species. Construction of the transmission lines would result in a slight increase in the number of collision risks for bats in the Permit Area. It is not known but expected that some cave myotis roost seasonally under road bridges within the Permit Area (e.g., along the I-10 corridor) and so this species is expected to occur in immediate proximity to the Priority Projects. Pale Townsend's big-eared bats typically roost in caves and no big-eared bat roost sites are known to occur in proximity to the Priority Project alignments (TPWD 2010c). Bats rarely collide with transmission lines, presumably because of their ability to detect them through echolocation. Therefore, the Priority Projects are expected to result in negligible impacts to cave myotis and pale Townsend's big-eared bats as a result of collision.

4.7.5.6.2 Alternative B – Maximum Take Avoidance

Impacts to cave myotis and pale Townsend's big-eared bats under Alternative B would be generally similar to those under the Preferred Alternative. Less woody vegetation would be cleared from the ROW under this alternative than under Alternative A, but given that the difference in the amount of vegetation that would be cleared is comparatively small, and that vegetation is spread across miles of ROW, the difference in clearing methodologies between the two alternatives is not expected to result in more than a negligible difference in the amount of flying insect prey available to either bat species.

4.7.5.6.3 Alternative C – No Action

The Priority Projects would be constructed under this alternative using a methodology similar to that which would be used under Alternative B. Consequently, impacts to these two bat species under Alternative C is expected to similar to those expected under Alternative B.

4.7.5.6.4 Summary of Impacts

All three alternatives are expected to result in negligible, local decreases in the amount of flying insect prey available to bats. A slight increase in the number of collision risks present in the Permit Area, but because bats rarely collide with transmission lines, this increase in collision risk is expected to have negligible impacts on these bat species.

4.7.5.7 Cagle's Map Turtle

4.7.5.7.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Occurrence of Cagle's map turtle in the Permit Area is believed to be limited to the Guadalupe River. The Twin Buttes–Big Hill project lies outside of the Guadalupe River watershed, and the route selected for the Big Hill–Kendall project, while lying partially within this watershed, does not cross this river. The nearest this route approaches the river is approximately one mile.

4.7.5.7.1.1 Direct Impacts to Cagle's Map Turtle

Because the route for the Big Hill–Kendall transmission line does not cross the Guadalupe River, no transmission line construction work is expected to occur near the river and, consequently, no direct impacts to Cagle's map turtle are expected. Cagle's map turtles are expected to lay their

eggs close to the river's edge, and so are not expected to ever travel close to the Kendall Substation or eastern terminus of the Big Hill–Kendall transmission line.

4.7.5.7.1.2 Direct and Indirect Habitat Impacts

As indicated above, the route for the Big Hill–Kendall transmission line does not get closer than one mile to the Guadalupe River, so no direct impacts to habitat occupied by Cagle's map turtle is expected as a result of construction of the Priority Projects. Clearing of ROW for this transmission line and the construction of foundations for transmission line structures within the Guadalupe River watershed have the potential to result in the temporary increase in levels of sediment and other suspended solids in surface water runoff leaving the transmission line ROW, with that runoff then having potential to reach the Guadalupe River where Cagle's map turtles can be expected to occur. LCRA TSC adheres to project-specific SWPPPs and employs certain construction BMPs to minimize the potential for its construction projects to result in erosion and sedimentation. Because of these measures and because of the temporary nature of the proposed construction activities, the Priority Projects are expected to have a negligible effect on the quality of surface waters in the Permit Area (see Section 4.6.1.1). Therefore, construction of the Big Hill–Kendall transmission line within the Guadalupe River watershed is expected to cause a negligible indirect impact on habitat occupied by Cagle's map turtle in the Guadalupe River.

4.7.5.7.2 Alternative B – Maximum Take Avoidance

Impacts to Cagle's map turtle under Alternative B would be similar to those under the Preferred Alternative. Very little potential habitat for the Covered Species occurs on lands within the Guadalupe River watershed within the Permit Area, so differences in the clearing of vegetation from within the ROW between the two alternatives are not likely to result in an appreciable difference in the potential for construction activities to cause erosion or sedimentation within the Guadalupe River watershed.

4.7.5.7.3 Alternative C – No Action

Impacts to Cagle's map turtle under Alternative C would be similar to those expected under Alternative A or Alternative B.

4.7.5.7.4 Summary of Impacts

No beneficial or negative impacts to Cagle's map turtle are expected under any of the three alternatives. All three alternatives would create the potential for surface water runoff from the transmission line ROW within the Guadalupe River watershed to carry increased levels of suspended solids to the river during the construction phase. Any increase in the amount of suspended solids reaching the Guadalupe River during the construction phase is expected to have a negligible indirect effect on habitat quality for Cagle's map turtle.

4.7.5.8 Spot-tailed Earless Lizard and Texas Garter Snake

4.7.5.8.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Spot-tailed earless lizards occur in open habitats, so the clearing of the ROW for the Priority Projects is expected to have a slightly positive direct impact on the amount of habitat available for this species. Given the scale of the Priority Projects, any positive impact is likely to be of negligible benefit to the species. Texas garter snakes typically occur near moisture, but in a

variety of habitats. Texas garter snake has not been recorded in any of the counties crossed by the approved alignments for the Priority Projects, but appears to have potential to occur in at least Kendall County given its known occurrence in Bexar and Blanco counties (Dixon 2000). Therefore, any clearing of vegetation in the vicinity of drainage channels is not expected to cause appreciable direct impacts to habitats used by this species. Individuals of either species could be harmed by transmission line structure construction, if that construction happened to occur in a location where one or more of the individuals were hibernating. The probability of such direct impact occurring is likely to be low because this snake is rare, is not known to occur in the counties crossed by the approved Priority Project routes, and few structures would be built in suitable habitat for the species. Spot-tailed earless lizards, and to a much lesser degree, Texas garter snakes, could also be present in the ROW or on access roads when traveled by vehicles performing maintenance and repair activities, which would put them at risk of suffering collision mortality. It is expected that these individuals would largely be able to avoid collisions because vehicles travel the ROW at low speeds. Therefore, any impacts to these species resulting from the Preferred Alternative are expected to be minor.

4.7.5.8.2 Alternative B – Maximum Take Avoidance

Impacts to spot-tailed earless lizards and Texas garter snakes under Alternative B would generally be similar to those under Alternative A. Less riparian habitat with potential to be used by Texas garter snakes would be impacted under Alternative B than under Alternative A.

4.7.5.8.3 Alternative C – No Action

Because the Priority Projects would be constructed under Alternative C using a methodology similar to that used under Alternative B, impacts to spot-tailed earless lizard and Texas garter snake under Alternative C would be similar to those expected under Alternative B.

4.7.5.8.4 Summary of Impacts

The clearing of ROW under all three alternatives could result in a positive, though likely negligible, benefit to the amount of habitat available to spot-tailed earless lizards. All three alternatives would also create a minor potential for lizards and snakes to be harmed during structure construction or by vehicles traveling the ROW and access roads.

4.7.5.9 Texas Horned Lizard

4.7.5.9.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.5.9.1.1 Direct Impacts to Texas Horned Lizard

Texas horned lizards are comparatively slow moving and because of their small size and coloration, they can be difficult to see. They also hibernate during cold weather periods. The Preferred Alternative would create potential for Texas horned lizards to suffer mortality from being run over by equipment and vehicles traveling within transmission line ROW and on access roads during the times of year when Texas horned lizards are active, which in the Permit Area is probably from late March or early April into October. The potential for such impact to occur would be near zero on both transmission line routes during the period of late October through the middle of March because the lizards would then be hibernating and not be present on roads or in the transmission line ROW.

The number of Texas horned lizards that could be impacted by being run over by equipment and vehicles performing the Covered Activities cannot be quantified. The potential for such mortality to occur is likely greatest along the route for the Twin Buttes–Big Hill project and on the western end of the Big Hill–Kendall transmission line route. Potential for such impacts to occur is lower along the central and eastern portions of the Big Hill–Kendall route because these segments of the route cross mostly rocky ground that is largely unsuitable for use by the species. Texas horned lizards burrow into soil or hide under rocks when inactive. For this reason, some potential also exists for Texas horned lizards to be directly impacted by the construction of transmission line structures, if any members of the species happened to be taking shelter in an area cleared or excavated to facilitate erection of a structure. Because Texas horned lizards are expected to be rare in the Permit Area outside of the vicinity of the route for the Twin Buttes–Big Hill project and the western end of the Big Hill–Kendall route, the potential for this type of direct impact to occur appears to be extremely low except where structures may be constructed in Tom Green, Schleicher, and Sutton counties and, perhaps, western Kimble County. Even where Texas horned lizards are expected to be somewhat common, the chance of this type of direct impact occurring appears to be relatively low owing to the small areas that would be disturbed at each structure site and the ability of Texas horned lizards to move away from some potentially harmful activities, if those activities were performed during the time of year when the lizards are active.

Direct impacts to Texas horned lizards may be incurred as a result of the Priority Projects, but only in counties where the species is expected to be comparatively common. Consequently, direct impacts to Texas horned lizard as a result of the Priority Projects are expected to have a minor effect on the species.

4.7.5.9.1.2 Direct and Indirect Habitat Impacts

Texas horned lizards occur in areas where vegetation is sparse. The clearing of ROW for the transmission lines, where that clearing is performed in brushy or woody areas, could improve local habitat conditions for Texas horned lizards by creating more open habitat. Vehicles traveling the ROW, by creating lanes worn free of vegetation, could also create preferred foraging and basking areas for the lizards. Such improvements would have local beneficial direct impacts on habitat quality, but could also increase the potential for vehicle collision mortality to occur on any post-construction days during the spring, summer, and early fall months when the ROW were traveled for maintenance and repair purposes. No indirect impacts to Texas horned lizard habitat are expected as a result of the Preferred Alternative because the species occurs in open habitats and ROW clearing is not expected to alter conditions within such habitat.

4.7.5.9.2 Alternative B – Maximum Take Avoidance

Impacts to Texas horned lizards under Alternative B would be generally similar to those expected under the Preferred Alternative. Because less of the ROW would be cleared or traveled under this alternative, less potentially suitable habitat for Texas horned lizard would be created within the ROW under Alternative B, and Alternative B carries slightly less risk of Texas horned lizards suffering collision mortality from vehicles used to perform repair and maintenance activities.

4.7.5.9.3 Alternative C – No Action

Because the ROW would be cleared in a similar fashion under Alternatives B and C, impacts to Texas horned lizard under Alternative C are similar to those expected under Alternative B.

4.7.5.9.4 Summary of Impacts

All three alternatives would create a limited potential for direct impacts to Texas horned lizard to occur during the construction phases of the Priority Projects, especially the Twin Buttes–Big Hill project and along the western end of the Big Hill–Kendall transmission line. All three alternatives could also locally improve habitat conditions for Texas horned lizard through the clearing of ROW, with the Preferred Alternative (Alternative A) having potential to create or improve more habitat than Alternative B or C. All three alternatives would create potential for Texas horned lizards to suffer vehicle collision mortality when the ROW was driven during the performance of maintenance and repair activities, if the driving was performed during the times of year when Texas horned lizards were active, with this potential also greater under the Preferred Alternative than under either of the other alternatives. Overall, the effect of ROW clearing on habitat for Texas horned lizard is expected to have a negligible impact on the species because of the comparatively small amount of land area that would be affected compared to the total land area in the counties traversed by the Priority Projects.

4.7.5.10 Cascade Caverns salamander, Comal blind salamander, Valdina Farms Sinkhole salamander and Cave- and Spring-dwelling Amphipods

Cave- and spring-dwelling amphipods considered in this section include bifurcated cave amphipod, Cascade Cave amphipod, Clear Creek amphipod, long-legged cave amphipod, Reddell's cave amphipod, and Russell stygobromid.

4.7.5.10.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

The three salamanders and all of the amphipods considered in this section occur in caves or at springs, with all of these species known and expected to occur only in some of the counties crossed by the Big Hill–Kendall route. The disturbance of these types of natural features would be purposely avoided by LCRA TSC. Construction of transmission line structures would not create a level of disturbance great enough to appreciably alter the amount of recharge reaching any aquatic sites that support any of these species. The clearing of ROW, if resulting in the clearing of woodland within a recharge area that supports any of these species, could slightly increase the amount of water infiltrating the ground and reaching the caves or springs where the species occur, although owing to the scale of the Priority Projects any such increase is likely to be of negligible benefit to the species. It appears possible, though unlikely, that construction of a transmission structure could breach a previously unknown cave that supports a population of one of the salamanders or one of the cave-dwelling amphipods. In the event that a cave is breached during the construction process, LCRA TSC would have a qualified karst specialist inspect the feature to determine its potential to support any Species of Concern. The breaching of a cave that contains one of these species could result in moderate impacts to that local population, although the odds of this actually occurring during construction of the priority projects appear to be very low. It is much more likely that any underlying cave would be discovered early in the construction process and before its roof was heavily damaged, allowing for the damage to be repaired and future damage to be avoided by relocating the structure site.

4.7.5.10.2 Alternative B – Maximum Take Avoidance

Impacts to the Cascade Caverns, Comal blind, and Valdina Farms Sinkhole salamanders and all species of cave- and spring-dwelling amphipods under Alternative B would be similar to those under the Preferred Alternative. The potential for any of these species to be impacted by the Priority Projects is limited to disturbances related to construction of transmission line structures, and the number of structures built under either alternative is expected to be similar. The locations of some structures might differ between alternatives, and this difference might result in a difference in impacts to one or more of these species between the two alternatives, but because impacts would occur only if currently unknown caves are breached, it is impossible to quantify how any difference in structure locations might affect levels of impacts to these species.

4.7.5.10.3 Alternative C – No Action

Because the Priority Projects are expected to be constructed under Alternative C with a methodology similar to that used under Alternative B, impacts to the Cascade Caverns, Comal blind, and Valdina Farms Sinkhole salamanders and all species of cave- and spring-dwelling amphipods under Alternative C would be similar to those expected under Alternative B or Alternative A.

4.7.5.10.4 Summary of Impacts

Negligible impacts to the Cascade Caverns, Comal blind, and Valdina Farms Sinkhole salamanders and all species of cave- and spring-dwelling amphipods are expected under all three alternatives. Each alternative does create the potential for currently unknown caves supporting one or more of the species to be breached during the transmission structure construction process. Any such breaching is unlikely to occur overall, and because if a breach were to occur, it is expected to occur early in the construction stage at any particular site, allowing for the damage to be repaired and that structure site to be relocated to avoid future damage.

4.7.5.11 Guadalupe Bass, Leonora's Dancer, and Allenhyphes michaeli (a Mayfly)

4.7.5.11.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

All three of these species are expected to occur in or along the margins of some perennial streams in the Permit Area. Perennial streams would be spanned by the Priority Projects so no direct impacts to any of these species are expected. Because LCRA TSC would perform transmission line construction in accordance with SWPPPs and BMPs intended to control erosion and sedimentation, construction of the transmission lines is expected to have no more than a small, temporary increase in turbidity in any streams crossed by the Priority Projects. Because most streams crossed by the Priority Projects are unlikely to experience any adverse impacts, and any increases in turbidity that do occur would be temporary and minor, any impact on Guadalupe bass, Leonora's dancer, or *Allenhyphes michaeli* would be negligible.

4.7.5.11.2 Alternative B – Maximum Take Avoidance

Impacts to Guadalupe bass, Leonora's dancer, and *Allenhyphes michaeli* under Alternative B are expected to be negligible and generally similar to those occurring under Alternative A as a result of LCRA TSC performing its construction activities in accordance with SWPPPs and BMPs intended to control erosion and sedimentation. Fewer streams might experience temporary,

minor increases in turbidity under Alternative B than under Alternative A because of the reduced amount of clearing of vegetation within the ROW that would occur under Alternative B.

4.7.5.11.3 Alternative C – No Action

Impacts to Guadalupe bass, Leonora's dancer, and *Allenhyphes michaeli* under Alternative C are expected to be generally similar to those occurring under Alternative B because construction methodologies used near permanent stream crossings would be similar.

4.7.5.11.4 Summary of Impacts

No direct impacts to Guadalupe bass, Leonora's dancer, or *Allenhyphes michaeli* are expected under any of the three alternatives. Each alternative has the potential to result in temporary, minor increases in turbidity in streams occupied by these species, but because these increases would be temporary, the potential for any of the three alternatives to indirectly impact habitat occupied by these species is considered to be negligible.

4.7.5.12 Rawson's Metalmark and Sage Sphinx

4.7.5.12.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Rawson's metalmark may occur in wooded canyons that would be crossed by the Big Hill–Kendall transmission line. The status of sage sphinx in Texas is poorly known, and it could occur locally throughout the Permit Area in areas that support grassland or open brush. The clearing of vegetation from transmission line ROW during performance of the Covered Activities could directly impact the eggs and larvae of these species, and directly impact habitat used by these species. As sage sphinx appears to be a rare species in Texas, and because it utilizes open habitats that are not likely to be disturbed extensively by ROW clearing activities, the probability that any direct impacts to this species would result from the Preferred Alternative appears to be low and so direct impacts to this species are likely to be negligible. The clearing of woodland from canyon slopes in Kerr and Kimble counties would appear to have greater potential to disturb habitat used by Rawson's metalmark. Given the scale of the proposed project compared to the range of the species, impacts to Rawson's metalmark are expected to be minor.

4.7.5.12.2 Alternative B – Maximum Take Avoidance

Fewer impacts to Rawson's metalmark are expected under Alternative B than under Alternative A because woodlands used by this species also can provide habitat for the GCWA. As summarized in Tables 4.5 and 4.6, approximately 298.0 acres of GCWA habitat are expected to be directly impacted under Alternative A, while approximately 80.3 acres of warbler habitat are expected to be directly impacted under Alternative B. As such, approximately 217.7 acres fewer acres of woodland with potential to be used by Rawson's metalmark would be disturbed under Alternative B than under Alternative A. It is possible that woodland not qualifying as GCWA habitat could also be used by Rawson's metalmark, so total impact to potential habitat for this species occurring under Alternative B would likely be greater than 80.3 acres. The clearing of woodland under this alternative also has the potential to cause the destruction of eggs and larva of this species, but as for Alternative A, given the scale of the proposed project, such clearing is expected to result in no more than minor impacts to this species.

Similar to Alternative A, the potential for the Covered Activities to directly impact sage sphinx under Alternative B appears to be low given the scarcity of this species in Texas and its use of open habitats that are unlikely to be disturbed extensively by clearing of the ROW. Therefore, any impacts to this species resulting from Alternative B are likely to be negligible.

4.7.5.12.3 Alternative C – No Action

Impacts to Rawson's metalmark and sage sphinx under Alternative C are expected to be similar to those expected under Alternative B, because the Priority Projects would be constructed with similar methodologies under each alternative.

4.7.5.12.4 Summary of Impacts

All three alternatives would create potential for the clearing of vegetation in the Priority Project ROW to result in negligible to minor direct impacts to the eggs, larvae, and habitat of these two species. The potential for such impacts to occur to sage sphinx appears to be low because of the scarcity of this species in Texas and because it uses open habitats that are not likely to be disturbed extensively by ROW clearing activities. Approximately 217.7 fewer acres of potential habitat for Rawson's metalmark would be cleared under Alternatives B or C than under Alternative A, so Alternatives B and C have the potential to result in fewer direct impacts to Rawson's metalmark and its habitat than does Alternative A.

4.7.5.13 Plant Species of Concern

4.7.5.13.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

The potential for each of the six plant Species of Concern addressed in this section to be directly or indirectly impacted by the Preferred Alternative is summarized in Table 4.13. In general, most of the plant species, because they are rare, are unlikely to occur in any given segment of transmission line ROW. Many of these species also occur in habitats that are not likely to be disturbed even if the plants do occur in a ROW segment (e.g., steep limestone slopes and river banks), which reduces the potential for the Preferred Alternative to result in impacts to these species. Three of the species (broadpod rushpea, Hill Country wild-mercury, and Warnock's coral root) occur in upland habitats, with individuals of these plants then having potential to be disturbed by ROW clearing activities if present in a ROW segment. However, all three of these species are herbs, so individuals of these species, if present in a ROW, could be left undisturbed by the clearing activities unless located at a structure location where disturbance would be more extensive.

Most species occur in open habitats, so the clearing of ROW is not expected to result in indirect impacts to those habitats. For this reason too, it can be expected that these plants would continue to grow or re-establish themselves within the ROW following construction. The habitat for Warnock's coral root, if any habitat for the species occurs within a ROW segment, could be indirectly impacted by ROW clearing because that clearing could alter microclimatic conditions within woodland adjacent to the edges of the ROW. Impacts to plant Species of Concern resulting from the Preferred Alternative are expected to be negligible or minor because of the likelihood that most would be absent from the transmission line ROW, and ROW clearing would preclude few, if any, of these species from continuing to occupy the ROW, or re-establish themselves in ROW, if present in an area crossed by a transmission line.

Table 4.13. Expected Impact of the Preferred Alternative on Texas Plant Species of Concern

Common Name	Potential for Direct Impacts	Likelihood of Direct Impact	Potential for Indirect Impacts	Rationale
Big red sage	Yes	Very Low	No	Occurs on steep slopes, which are likely to be spanned without being cleared
Broadpod rushpea	Yes	Moderate	No	Occurs in upland habitats of Kimble and Sutton counties; could be disturbed by ROW clearing.
Canyon rattle-snake-root	Yes	Low	No	Occurs on lower canyon slopes which could be spanned without clearing.
Hill Country wild-mercury	Yes	Moderate	No	Fairly widespread in uplands of the Permit Area outside of the Llano Uplift Region
Texas mock-orange	Yes	Very Low	No	Occurs on steep exposures of limestone, which are not likely to be disturbed.
Warnock's coral root	Yes	Low	Yes	Rare so chance of occurring in a given ROW is very low. Occurs in woodlands on upper canyon slopes, so if present, plants or their habitat could be directly impacted by ROW clearing. Clearing of ROW could indirectly alter micro-climatic conditions in adjacent woodlands.

4.7.5.13.2 Alternative B – Maximum Take Avoidance

Impacts to all six plant Species of Concern under Alternative B might be generally similar to those expected under the Preferred Alternative, although reduction in the clearing of habitat for Covered Species could also result in fewer impacts occurring under Alternative B to broadpod rushpea, which could occur in habitat for the BCVI, and Hill Country wild-mercury and Warnock's coral root, both of which could occur in habitat for the GCWA. No impacts, or negligible impacts, to big red sage, canyon rattlesnake-root, and Texas mock-orange are expected under this alternative.

4.7.5.13.3 Alternative C – No Action

Impacts to the six plant Species of Concern under Alternative C are expected to be similar to those occurring under Alternative B, because the Priority Projects would be constructed with similar methodology under both alternatives.

4.7.5.13.4 Summary of Impacts

All three alternatives would create potential for negligible to minor adverse impacts for these six plant Species of Concern through damage to individual plants during the clearing of ROW and access roads, and the construction of transmission line structures. The Preferred Alternative may also indirectly impact some habitat for Warnock's coral root. Alternatives B and C could result in fewer impacts to broadpod rushpea, Hill Country wild-mercury, and Warnock's coral root because some habitat for these species might not be cleared under these alternatives because it could also be habitat for Covered Species. The potential for big red sage or Texas mock-orange to be impacted under any of the alternatives is extremely low because these two species occur on steep slopes that are likely to be spanned rather than be cleared.

4.7.5.14 Summary of Impacts Expected to State Special Status Species from the No Action, Preferred Alternative, and Maximum Take Avoidance Alternatives

The Preferred Alternative is expected to result in negligible to minor impacts to all State special status species considered in this EA. As a result, it is expected that impacts to these species occurring under the Preferred Alternative would not be distinguishable at the population level for these species from those impacts expected under the No Action alternative or the Maximum Take Avoidance alternative. For this reason, LCRA TSC is not proposing any minimization or mitigation measures with regard to any State special status species. The Preferred Alternative could lead to minor beneficial impacts for those special status species occurring on the mitigation properties that would be established and preserved as mitigation for impacts to Covered Species.

4.7.6 Invasive Species

As discussed in Section 3.7.7, invasive species have been defined as "alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13112, issued 1999). All invasive species addressed in Section 3.7.7 are plants.

The intensity of potential impacts on invasive species is defined as follows:

- Negligible: Individual invasive plant species may occasionally be removed by the Covered Activities, but measurable or perceptible changes in relative dominance of invasive species in local plant communities would not occur.
- Minor: Removal of invasive plant species from local plant communities (beneficial effect), or introduction of invasive plant species to local communities (adverse effect) would be measurable or perceptible, but would be confined to a small area.
- Moderate: A change in status of invasive species would occur over a relatively large area that would be readily measurable in terms of abundance, distribution, quantity, or quality. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
- Major: Effects to native plant communities would be readily apparent, and change in status of invasive species would substantially change vegetation community types over a large area in and out of the Permit Area. Extensive mitigation would be needed to offset adverse effects, and its success would not be assured.

4.7.6.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

4.7.6.1.1 Direct and Indirect Impacts

The Proposed Action would be expected to lead to construction of the Priority Projects and subsequent maintenance and repair activities. Construction of the Priority Projects would require the clearing of ROW and disturbing soils at structure locations and wherever access roads were constructed, and disturbed soils can be colonized rapidly by invasive plant species if they grow in the vicinity. Transmission lines are constructed on top of existing topography and without the need for use of introduced earthen fill material that could contain seeds of invasive species. Rock berms may be constructed in the vicinity of perennial streams to control erosion and sedimentation and guard against degradation of water quality. Rip-rap (small rocks) may also be placed in the beds of some intermittent or ephemeral drainages to facilitate vehicle crossings (see

Section 2.2.3). In either case, only clean rock would be used for these purposes (LCRA 2010), reducing the likelihood that invasive species would be introduced to the watercourses by these erosion control activities.

LCRA TSC is, for the most part, proposing to allow areas disturbed during the construction process to revegetate naturally. However, LCRA TSC would revegetate areas within 300 feet of perennial streams, areas where topography was particularly steep and risk of erosion was high, areas where natural revegetation would not provide adequate ground cover in a reasonable length of time, and areas where invasive species are a perceived threat, In such cases, seeding, sprigging, or hydroseeding would be used to encourage growth of ecologically desirable vegetation. All reseeding would be performed using seed mixes certified by the U.S. Department of Agriculture.

During the construction cleanup phase, if site-specific factors made it unusually difficult to establish a protective vegetative cover, other restoration procedures, such as the use of gravel, rocks, or concrete, could be used to prevent erosion. As with the possible rock berms and rip-rap, only clean gravel would be used for stabilizing erosion-prone areas, reducing the potential for invasive species to be introduced onto the project site.

The clearing of woodland for the Priority Project ROW could allow invasive grass species such as King Ranch bluestem to grow within ROW in place of the removed trees. However, such species would have to already be present in the soil seed bank or growing elsewhere in proximity of the ROW for them to be capable of establishing themselves in newly cleared ROW. Vehicles and equipment traveling down a transmission line alignment during the ROW clearing and line stringing phases of the Priority Projects could potentially transport seeds of invasive plants from one property to the next in any dirt or mud caught within tire treads. Invasive species could only grow up within transmission line ROW or be carried by tires from one property to the next if those species were already established locally, so these activities are expected to create no more than a minor potential for invasive species to be introduced or spread by the Proposed Action. The clearing of trees from the ROW could in some instances result in the removal of individual invasive species of tree, such as China-berry (*Melia azedarach*) or salt cedar. Such invasive tree species are capable of growing back from their root systems and this capability coupled with the limited amount of clearing that would be conducted in any particular area suggests that any removal of invasive tree species as a result of ROW clearing is likely to have a negligible impact on the status and distribution of invasive species in the Permit Area.

In sum, project-related activities have the potential to introduce or promote the growth of invasive species; however, due to the implementation of the described minimization measures the impacts should be no more than minor in intensity. Over the long term (i.e., the life of the ITP), it would be difficult, if not impossible, for LCRA TSC to control invasive species within the ROW. LCRA TSC does not own the land within the ROW, but rather acquires an easement from the landowner. LCRA TSC cannot control what landowners do on land adjoining the ROW.

4.7.6.1.2 Minimization Measures and Mitigation Measures

LCRA TSC, in most cases, would allow disturbed areas to revegetate naturally in order to avoid the potential for invasive species to be accidentally introduced to the transmission line ROW. Where revegetation would be performed to control erosion, it would be performed through seeding using a mix certified by the U.S. Department of Agriculture to minimize the potential for accidental introduction of invasive species.

If site-specific factors encountered during the cleanup phase make it unusually difficult to establish a protective vegetative cover through seeding alone, other restoration procedures, such as the use of gravel, rocks, or concrete, could be used to prevent erosion (see Section 2.2.3). Only clean rocks and gravel would be used for stabilizing erosion-prone areas to minimize the potential for introduction of seed of invasive species.

Because the Preferred Alternative is expected to have no more than a minor effect on the spread of invasive species, no compensatory mitigation measures have been proposed by LCRA TSC.

4.7.6.2 Alternative B – Maximum Take Avoidance

Impacts relative to invasive plant species under Alternative B would be generally similar to those expected under the Preferred Alternative. The reduced amount of clearing of the ROW that would occur under this alternative can be expected to lead to a reduced need for construction cleanup, and, possibly, the use of imported materials and revegetation of disturbed areas. Thus, Alternative B carries slightly less potential to result in the spread of invasive plant species than does Alternative A.

4.7.6.3 Alternative C – No Action

Because construction methodologies would be similar under Alternatives C and B, impacts relative to invasive plants under Alternative C would be similar to those expected under Alternative B.

4.7.6.4 Summary of Impacts

Invasive plant species are present within the Permit Area and can be expected to continue to spread through the region even in absence of construction of the Priority Projects under any of the three alternatives. The Preferred Alternative would create potential for some invasive species to increase their numbers within cleared ROW and for their seeds to be transported from property to property in dirt caught in equipment tire treads, but because this could only happen if the invasive species were already established locally, invasive species impacts resulting from the Preferred Alternative are expected to be minor. Invasive species impacts occurring under the No Action and Maximum Take Avoidance alternatives are similarly expected to be minor, although levels of impact under either of these alternatives could be less than under the Preferred Alternative because less clearing of vegetation would occur in the ROW for the Priority Projects.

4.8 CULTURAL RESOURCES

The intensity of potential impacts to cultural resources is defined as follows:

- Negligible: The effect would be at the lowest levels of detection, barely measurable, with no perceptible consequences to the resources. The National Historic Preservation Act of 1996 (NHPA) Section 106 determination would be "no adverse effect."
- Minor: The effect would be measurable or perceptible, but would be slight and affect a limited area of a site or group of sites. Slight alteration(s) to any of the characteristics that qualify the site(s) for inclusion in the National Register of Historic Places (NRHP) may diminish the integrity of the site(s). For purposes of NHPA Section 106, the determination would be "adverse effect."
- Moderate: The effect is measurable and perceptible. The effect changes one or more of the characteristics that qualify the site(s) for inclusion in the NRHP and diminishes the integrity of the site(s), but does not jeopardize the NRHP eligibility of the site(s). For purposes of NHPA Section 106, the determination would be "adverse effect."
- Major: The effect on the archeological site or group of sites is substantial, noticeable, and permanent. The action severely changes one or more characteristics that qualify the site(s) for inclusion in the NRHP, diminishing the integrity of the site(s) to such an extent that it is no longer eligible for listing in the NRHP. For purposes of NHPA Section 106, the determination would be "adverse effect."

This section assesses the potential for the Priority Projects to affect archaeological, historic, Native American, and other cultural resources. As noted previously, the direct Area of Potential Effect (APE) consists of all areas within which cultural resources have the potential to incur direct, physical impacts through construction of the Priority Projects. For purposes of this EA, the direct APE includes the total disturbance area along the length of the route alignments. The "indirect APE" consists of all areas within which indirect impacts to cultural resources may occur. Indirect impacts are typically associated with the introduction of visual, atmospheric, or audible elements that diminish the historic integrity of a property as a whole. Historic resources (i.e., standing structures) and Native American resources may be subject to indirect, as well as direct impacts. For purposes of this EA, the "indirect APE" includes all areas within 0.5-mile on either side of the proposed transmission lines (see Section 3.8.2 for methodology).

4.8.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

The data provided in this section for each of the proposed transmission lines are based on information reported in the environmental assessment reports prepared by PBS&J (2010a, 2010b) and on recent and ongoing field surveys conducted along the approved transmission line routes by LCRA TSC and SWCA Environmental Consultants.

As provided under 36 CFR 800, the Service acknowledges that issuance of any Federal permit can be deemed a "Federal undertaking" under the National Historic Preservation Act. However, because the requested LCRA TSC ITP would authorize only the incidental take of species, and not the activities that result in take, the Service has determined, pursuant to 36 CFR 800.3(a)(1), that the issuance of this ITP does not have the potential to cause effects on historic properties (Service 2010d).

4.8.1.1 Twin Buttes–Big Hill Transmission Line

4.8.1.1.1 Archaeological Resources

LCRA TSC conducted an intensive archaeological survey of the Twin Buttes–Big Hill transmission line between August of 2010 and February of 2011. A total of 35 newly recorded sites were documented, one previously recorded site was re-assessed, and one previously recorded site was revisited but not re-assessed.

Of the 37 sites documented during the intensive survey efforts, 5 are considered to be either eligible or potentially eligible for formal listing as State Archaeological Landmarks (SALs) or nomination to the NRHP. Site 41TG630 is an open camp with buried cultural material and high organic preservation. Site 41TG640 consists of a burned rock midden, bedrock mortar holes and petroglyphs. Sites 41TG642 and 41TG648 consist of large burned rock middens with intact subsurface deposits. Site 41TG660 is a discrete hearth or oven complex that creates an incipient burned rock midden. The locations of all these sites have been accounted for in transmission line design, construction, and future maintenance needs. Impacts that could potentially affect the research or interpretive potential of these five sites will be avoided by implementation of the measures listed in Section 4.8.1.3, below. The remaining 32 archaeological sites are considered to be fully recorded and not eligible for formal State Archaeological Landmarks status, or nomination to the NRHP.

4.8.1.1.2 Historic Resources

No previously recorded historic-age resources stand to be directly affected as a result of the construction of the proposed Twin Buttes–Big Hill transmission line. A total of 54 historic-age properties were identified within the indirect APE during survey efforts and viewshed analysis conducted by LCRA TSC between August of 2010 and February of 2011. These resources consist primarily of agricultural outbuildings, agricultural irrigation resources, single-family dwellings, and isolated agricultural outbuildings.

Two of these properties are considered to be potentially eligible for nomination to the NRHP. One is a dam along Spring Creek that is associated with an early-to mid-twentieth century irrigation system. Overall, the dam's setting is not considered to be a contributing factor to the significance of the property, which is related to the structure's function rather than its aesthetic environment. Additionally, the proposed transmission line would be largely screened by an existing vegetative buffer and only minimally visible from the actual dam structure.
The other NRHP-eligible property is a Craftsman Bungalow near the community of Knickerbocker in Tom Green County. This building is considered to be eligible for NRHP listing under Criterion C for Architecture at the local level of significance. However, examination of historic aerial imagery indicated that nearby contemporaneous buildings have been demolished, thus compromising the historical integrity of the property's setting. Additionally, the building is within a heavily vegetated area, effectively screening it from the proposed transmission line. Given the compromised setting and the vegetative buffer, any visual impacts associated with the proposed transmission line are not considered to have an adverse impact on the significant elements of the property.

There are four historic properties identified in inaccessible areas (i.e., those where access was not granted and where there was limited visibility from the public ROW). In all cases, to the extent these properties could be observed from the ROW, they were all found to have compromised settings, vegetative buffers, or other pre-existing visual impacts.

4.8.1.1.3 Native American Resources

To date, no Traditional Cultural Properties (TCPs) have been publicly documented within the direct or indirect APE, and none of the contacted tribes have responded to Service consultation efforts. As a result, impacts to Native American resources resulting from the construction and operation of the Twin Buttes–Big Hill transmission line are not anticipated. However, currently undocumented TCPs may exist in the vicinity of the transmission line. If so, such TCPs would likely go unrecognized and could be inadvertently affected by construction activities. Installation of the line could result in increased access to areas previously not accessible by roads. As a result, the potential may increase for inadvertent damage, looting, or vandalism at these unknown TCPs should they exist.

4.8.1.1.4 Other Resources

No known cemeteries or documented cultural resources other than those discussed above stand to be directly or indirectly impacted by the construction or operation of the Twin Buttes–Big Hill transmission line.

4.8.1.2 Big Hill–Kendall Transmission Line

The following analyses pertain to the approved Big Hill–Kendall transmission line route. Should the route be modified as the result of the pending appeal (see Section 1.3.2) any portion of the adjusted route that has not been evaluated for cultural resources will be surveyed and recorded.

4.8.1.2.1 Archaeological Resources

Intensive archaeological survey efforts along the proposed Big Hill–Kendall transmission line route commenced in March and September of 2011. To date, a total of 48 new archaeological sites (trinomials pending) have been documented, and three previously recorded sites have been revisited. Preliminary analysis of the collected data indicates that all but three of the documented archaeological sites are considered not eligible for designation as an SAL or nomination to the NRHP, and therefore, do not possess the necessary characteristics to warrant avoidance. Three of the sites (41KM245, 41KM276, and 41KR641) are of undetermined NRHP eligibility but are currently outside the project area due to ROW reroutes. Consequently, no further work is required for these sites. All three previously recorded sites (41KE80, 41KM11, and 41KM15) have been determined to be not eligible for designation as an SAL or nomination for the NRHP. The results of this investigation will be detailed in a forthcoming report submitted THC.

At this time, the majority of survey efforts have been completed. However, as of September 2011 several small sections of alignment were not accessible due to right-of-entry (ROE) issues. These remaining areas will be surveyed for cultural resources by LCRA at an undetermined later date once ROE has been coordinated. The results of this separate survey by LCRA will be presented in a separate report and submitted to the THC for consultation. LCRA will avoid adverse impacts to significant archaeological resources through implementation of the

minimization measures listed in Section 4.8.1.3 below and provided for in the PUC's Order approving the Big Hill–Kendall route.

4.8.1.2.2 Historic Resources

No previously recorded historic-age resources stand to be directly impacted as a result of the construction of the proposed Big Hill–Kendall transmission line.

The indirect APE includes the proposed transmission line and all areas within a 0.5-mile radius. A total of 554 historic-age resources were identified within the indirect APE during the viewshed analysis survey conducted by SWCA's architectural historians between March and September of 2011. The bulk of these resources are rural ranches and the small urban areas of Junction and Kerrville dating from circa 1880–1965. Of these 554 resources, 19 have been determined to be eligible for listing in the NRHP. Based upon the results of the visual impacts study, construction of the Big Hill–Kendall transmission line would have an adverse effect on the viewshed of six of the NRHP eligible properties. An additional 36 resources were not accessible to surveyors due to survey area restrictions. For these 36 resources, an assessment of building type, age, and NRHP eligibility was conducted through the use of historic and current aerial photographs and oblique angle pictometry. Based on the categories and methods listed above, six of these properties were deemed not eligible, nine were considered unknown, 13 were considered eligibility unknown with no adverse effect, and eight were considered potentially eligible with no adverse effect. None of the 36 non-accessible properties was found to be potentially eligible with adverse effects. A full draft report detailing the findings and recommendations regarding the viewshed analysis for the project was submitted to the THC for review and consultation. The THC concurred with SWCA's recommendations of eligibility for the resources and suggested taking public comment for solutions to reduce or mitigate the visual impact of the transmission lines on the six historic structural resources that would incur adverse effects. THC also asked for clarification on the review of this project, whether it is solely pursuant to the Antiquities Code of Texas, or whether any federal funding, licenses, or permits trigger compliance with Section 106 of the National Historic Preservation Act.

4.8.1.2.3 Native American Resources

To date, no TCPs have been publicly documented within the direct or indirect APE, and none of the contacted tribes have responded to Service consultation efforts. As a result, impacts to Native American resources resulting from the construction and operation of the Big Hill–Kendall transmission line are not anticipated. However, currently undocumented TCPs may exist in the vicinity of the transmission line. If so, such TCPs would likely go unrecognized and could be inadvertently affected by construction activities. Installation of the line could result in increased access to areas previously not accessible by roads. As a result, the potential may increase for inadvertent damage, looting, or vandalism at TCPs should they exist.

4.8.1.2.4 Other Resources

No known cemeteries or documented resources other than those discussed above stand to be directly impacted by the construction or operation of the Big Hill–Kendall transmission line.

4.8.1.3 Minimization Measures and Mitigation Measures

To avoid, minimize, and mitigate adverse impacts to cultural resources during construction of the Priority Projects, LCRA TSC and its contractors will implement the following measures:

- Locate structures, new access roads, staging areas, and any other Priority Project-related infrastructure so as to avoid known significant or potentially significant cultural resource sites.
- If significant or potentially significant cultural resource sites are close enough to construction sites to be potentially affected, establish buffers around such sites to the extent practicable as determined by LCRA TSC in consultation with Texas SHPO.
- To minimize ground disturbance, utilize existing access roads to the extent possible to reduce the need for new access roads, and limit heavy equipment to construction sites, access roads, and staging areas.
- Determine whether there are areas to be monitored in advance of any construction activities, and employ qualified monitors as appropriate. Determine prehistoric and historic site indicators (e.g., chipped stone, old glass) prior to initiation of construction, and train construction personnel in the recognition of such indicators.
- Should any presently unknown archaeological artifacts or other cultural resources be found during construction, then work shall halt in the vicinity of the discovery, and the LCRA Cultural Resources staff will be immediately contacted at 1-800-776-5272, ext. 6714 so that the find can be reported to the THC. The LCRA and THC will then make a determination as to whether any avoidance/mitigation measures are needed.
- For previously unknown artifacts, identify type and significance of discovered resource. Depending on the type and significance of any discovered resource, procedures resulting from consultation between the LCRA and THC may include testing the site with shovel test probes to determine site boundaries and any possible subsurface components. If results of the shovel test probes determine the presence of an extensive subsurface component, and if possible, move structure location to a suitable location that avoids the site. If moving a structure is not possible, then develop and implement a data recovery program for the site or other mitigation in consultation with the THC and affected tribes, if any.
- Stop construction immediately in the area should human remains and/or burials be encountered. Secure the area, placing it off limits for anyone but authorized personnel, and immediately notify LCRA Cultural Resources staff and the THC, who will respond in accordance with an unanticipated discovery plan prepared prior to initiation of construction activities.

Because any impacts to cultural and historic resources occurring during the operation, maintenance, and/or repair phases of the Priority Projects would likely be restricted to areas previously disturbed during the construction phase, few, if any, additional impacts to cultural or historic resources during operation and maintenance of the Priority Projects are anticipated.

4.8.2 Alternative B – Maximum Take Avoidance

Under Alternative B, the potential impacts to cultural resources would be similar to those under the Preferred Alternative. No adverse impacts to significant archaeological, historic, Native American, and other cultural resources are anticipated.

4.8.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same techniques as used in Alternative B (Maximum Take Avoidance alternative). Therefore, the potential impacts to cultural resources would be the same as those under the Preferred Alternative. Notably, however, NHPA Section 106 does not apply where there is no Federal undertaking. Thus, to the extent the Priority Projects and/or other transmission lines are constructed without Federal permitting under the No Action alternative, the strictures of Section 106 will not apply, and, except to the extent required by state law, if any, it is likely that no avoidance, minimization, or mitigation measures would be implemented.

4.8.4 Summary of Impacts

The cultural resources potentially affected by construction of the Priority Projects are the same for all three alternatives. A total of 85 archaeological sites occur within the direct APE: 37 sites in the Twin Buttes–Big Hill project area and 48 sites in the Big Hill–Kendall project area. Of these 85 sites, 5 sites, all in the Twin Buttes–Big Hill project area, are considered to be either eligible or potentially eligible for formal listing as SALs or nomination to the NRHP. As of September 2011 several small sections of alignment were not accessible due to ROE issues. These remaining areas will be surveyed for cultural resources by LCRA at an undetermined later date once ROE has been coordinated.

A total of 815 historic-age properties were identified within the indirect APE: 54 in the Twin Buttes–Big Hill project area and 761 in the Big Hill–Kendall project area. Of these properties, two in the Twin Buttes–Big Hill project area are considered to be potentially eligible for nomination to the NRHP. Neither are likely to be affected by the Priority Projects. Twelve historic-age properties in the Big Hill–Kendall project area possess the necessary characteristics to be considered eligible for the NRHP. Construction of the Big Hill–Kendall transmission line has the potential to adversely impact the viewshed of these resources, thus compromising their integrity.

Under all three alternatives, no TCPs have been publicly documented within the direct or indirect APE, and none of the contacted tribes have responded to Service consultation efforts. As a result, impacts to Native American resources resulting from the construction and operation of the transmission lines are not anticipated. This said, installation of the Priority Projects could result in increased access to areas previously not accessible by roads, increasing the potential for inadvertent damage, looting, or vandalism at currently undocumented TCPs should they exist. No known cemeteries or documented resources other than those discussed above stand to be directly impacted by the construction or operation of the Priority Projects under any of the three alternatives.

Under Alternative A and Alternative B impacts that could potentially affect the research or interpretive potential of the five eligible or potentially eligible archaeological sites would be avoided by implementation of the measures listed in Section 4.8.1.3. However, under Alternative C (No Action) it is likely that no avoidance, minimization, or mitigation measures (except to the extent required by state law, if any) would be implemented to protect any cultural resource properties potentially affected by the Priority Projects.

4.9 LAND USE

The intensity of potential impacts to land use is defined as follows:

- Negligible: Changes to land use functions in the vicinity of the proposed transmission lines would not be detectable.
- Minor: Land use functions in the vicinity of the proposed transmission lines, particularly agricultural uses and practices, would change to a small extent.
- Moderate: Land use functions in the vicinity of the proposed transmission lines, particularly agricultural uses and practices, would noticeably change.
- Major: Land use functions in the vicinity of the proposed transmission lines, particularly agricultural uses and practices, would change substantially.

4.9.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

As stated by PBS&J (2010a, 2010b) land use impacts from the construction and operation of the transmission lines are determined by the amount of land, of whatever use, displaced by the actual ROW (direct impacts) and by the compatibility of the transmission line with adjacent land uses (indirect impacts). Impacts may be short term, lasting only during the construction period or until ground cover is restored within the ROW, or they can be long term, lasting the life of the project. The following analysis of potential impacts to land use is largely based on information assembled by PBS&J (2010a, 2010b) for the environmental assessments prepared for the Priority Projects.

During construction of the Priority Projects, short-term impacts to land use in the ROW could result from the presence of construction workers, equipment, and materials in the ROW. Landowners would temporarily lose use of the ROW at active construction sites. Construction-related noise and dust, as well as some temporary disruption of traffic flow, may adversely affect residents and businesses in areas adjacent to the ROW. Coordination among LCRA TSC, contractors, and landowners regarding ROW access and construction scheduling would work to minimize any traffic disruptions. Airborne dust would be kept to a minimum with use of BMPs as described in Section 4.4.1 above. Noise impacts are discussed below in Section 4.14.1. Long-term impacts to land use primarily result from the presence of support structures and new access roads. These facilities would preclude any other use of the land occupied by these facilities. It is estimated that approximately 0.06–0.09 acre/mile would be displaced by support structures[11] over the life of the projects. That displacement would total approximately 2.3–3.4 acres for the Twin Buttes–Big Hill line and 8.4–12.6 acres for the Big Hill–Kendall line. The total area that will need to be cleared for Priority Project access roads has yet to be identified.

While landowners would lose use of some property within the Priority Project easements for some functions (e.g., planting crops), the cleared ROW and new access roads may benefit some landowners by providing improved access to portions of their property. While improved access to private land may be a benefit, it could also be an adverse impact if the ROW and roads are used by the public without authorization. Increased public access to private lands increases the potential for trespassing and any harmful impacts associated with trespassing. Official

[11] This estimate is based on an average of 4–6 structures per mile; 625-square-foot-basal area per lattice tower used as tangent structures and 900-square-foot-basal area per lattice tower used as angle structures; and a ratio of 9:1, tangent structure to angle structure.

enforcement of private land use and trespassing laws would be the responsibility of local law enforcement agencies. A discussion of how Priority Projects may affect property values is provided in Section 4.10.1.2.

The following sections focus on the potential impacts to four attributes of land use: 1) landownership; 2) agriculture; 3) nearby habitable structures (a proxy for the number of persons living in close proximity to the lines); and 4) parks, recreational areas, and conservation areas.

4.9.1.1 Landownership

As discussed in Chapter 3, the vast majority of land crossed by the approved transmission line routes is privately owned. The landowner maintains ownership of the property in the ROW, and continues to pay taxes on the property, but LCRA TSC will acquire an easement allowing it to use the ROW in exchange for a monetary payment to the landowner. LCRA TSC may buy the easement through a negotiated agreement, but it also has the power of eminent domain (condemnation) under Texas law if the landowner and the utility cannot agree on terms. However acquired, the final easement agreement between the landowner and the utility will outline any use restrictions applying to the easement. Although the landowner will still have use of the land under easement, the easement agreement will prohibit certain types of vegetation and the placing of structures within the ROW. On balance, the adverse impacts of these restraints on the ability of landowners to make use of their land will be long term and likely vary from minor to moderate, depending to a large degree on the size of the property (the larger the property, the smaller the percent of land effected). For a discussion of the potential impacts of the Priority Projects on property values, see Section 4.10.1.2.

4.9.1.2 Agriculture

Based on PBS&J (2010b) data, Table 4.12 provides an estimate of grazing land and cropland crossed by the Twin Buttes–Big Hill approved route. Approximately 34 miles, or 94.4 percent of the route, crosses grazing land, while approximately 1.7 miles, or 4.7 percent of the route, crosses cropland. Table 4.13 provides the same information for the approved alignment for Big Hill–Kendall. Approximately 131.2 miles, or 93.7 percent of the route, crosses grazing land, while approximately 2.3 miles, or 1.7 percent of the route, crosses cropland.

The overwhelming majority (well over 90 percent) of land use potentially affected by installation of the proposed transmission lines is agricultural, primarily livestock grazing on ranches and farms. A very small percentage is devoted to growing crops. Despite the fact that most of the land crossed, by a great margin, is used for agricultural purposes (primarily livestock grazing), the level of impact to those uses is expected to be minor. In the short term, impacts on grazing and farming would result from disturbance at construction sites (e.g., support structure sites, staging areas). Ranchers and farmers would lose the productivity of those sites until grazing forage is restored or farmers can replant disturbed areas. Long-term impacts may result from loss of grazing land or cropland permanently displaced by the structures and new access roads that would permanently remain.

During project operation, most of the land within the ROW would once again be available for grazing and crop production. Over both the short term and the long term, the proportion of

agricultural property along the route of the transmission lines that would be unavailable for grazing or crop production would be small; therefore, anticipated adverse impacts to agriculture would be minor.

4.9.1.3 Habitable Structures

An indicator for predicting the level of impact on people living in close proximity to a transmission line is the number of habitable structures located within a specified distance from the line. PBS&J (2010b) determined that four habitable structures are located within 500 feet[12] of the Twin Buttes–Big Hill transmission line ROW centerline (see Table 4-14). All four structures are already within 500 feet of an existing transmission line; that is, none of the four would be newly affected. As a result, inhabitants of those four structures are unlikely to perceive a significant change in their environment.

For the Big Hill–Kendall transmission line, 134 habitable structures are located within 500 feet of the ROW centerline of which 131 would be newly affected. None of these habitable structures occur within the ROW. The inhabitants of newly affected structures are likely to experience short-term impacts related to construction activities (e.g., noise) and permanent

Table 4.14. Approximate Amount (in Miles) and Percentage of Twin Buttes–Big Hill ROW on Grazing Land and Cropland and Number of Habitable Structures within 500 Feet of ROW Centerline

Land Use	Approved Route[1]
Grazing Land in Miles (km) % of Respective ROW	~33.8 ~94.4%
Cropland in Miles (km) % of Respective ROW	~1.7 ~4.7%
Number of Habitable Structures within 500 ft of Twin Buttes–Big ROW Centerline	4
Number of Habitable Structures Newly Affected (i.e., Not within 500 ft of Any *Existing* ROW Centerlines)	0
Number of Habitable Structures within Twin Buttes–Big ROW	0

[1] The data for grazing land and cropland are those calculated by PBS&J (2010b) for alternative Route TM6, which was adjusted slightly by the PUC to become the approved Route TM9. Because Route TM9 is about 7 percent longer than TM6, the figures shown here are not exact; rather they are close approximations. The data on habitable structures is correct for the route approved by the PUC (2010).

Table 4.15. Approximate Amount (in Miles) and Percentage of Big Hill–Kendall ROW on Grazing Land and Cropland, Number of Habitable Structures within 500 Feet of the ROW Centerline, and Number of Structures within ROW

Land Use	Approved Route[1]
Grazing Land in Miles (km) % of Respective ROW	131.2 93.7%
Cropland in Miles (km) % of Respective ROW	2.3 1.7%
Number of Habitable Structures within 500 ft of Big Hill–Kendall ROW Centerline	134
Number of Habitable Structures Newly Affected (i.e., Not within 500 ft of Any Existing ROW Centerlines)	131
Number of Habitable Structures within Big Hill–Kendall ROW	17

[1] The data for grazing land and cropland were calculated based on a ROW length of 138.48 miles (SOAH 2011). The data on habitable structures is correct for the route (MK63) approved by the PUC (2011).

[12] It is important to note that the 500-foot metric is a notice consideration and is part of the PUC's notice rules. It is not a "safety" metric under the PUC's routing criteria.

alteration of their viewsheds. While these particular inhabitants would likely be adversely affected in these ways, overall, adverse impacts to regional land use would be minor.

4.9.1.4 Parks, Dispersed Recreation, and Conservation Areas

Potential adverse effects to existing parks would primarily be associated with impacts to the visual landscape. For those impacts see Section 4.2.1, Visual and Aesthetic Qualities. Some recreational opportunities (e.g., hunting) may benefit from improved access provided by cleared ROW and new access roads.

None of the conservation areas identified in Chapter 3 of this EA—Walter Buck WMA, Old Tunnel WMA, James River Bat Cave Preserve, and Fort McKavett State Historical Site—are located near the routes for the Priority Projects, and none are expected to be affected by the projects.

Under the Preferred Alternative, the total acreage of conserved land would increase. Mitigation for potential impacts to the Covered Species includes acquiring up to 3,902 conservation credits for GCWA and BCVI combined.

4.9.2 Alternative B – Maximum Take Avoidance

In general, impacts to land use along the transmission line routes under Alternative B are expected to be similar to those under the Preferred Alternative, with the following differences. The ROW would not be cleared in areas of Covered Species habitat, reducing the likelihood that landowners would have to alter their use of the ROW. This difference notwithstanding, landowner use of the ROW would still be limited by the provisions of LCRA TSC easement agreements.

Compared to the Preferred Alternative, the total acreage of conserved land would be reduced by approximately 50 percent. Under Alternative B, mitigation for potential impacts to the Covered Species would include acquiring up to 1,954.0 conservation credits for GCWA and BCVI combined.

Recreational hunting may benefit from improved access to otherwise inaccessible areas; however, to a lesser degree than under the Preferred Alternative because less ROW would be cleared.

4.9.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same techniques as used in Alternative B (Maximum Take Avoidance alternative). Impacts to land use along the transmission line routes are expected to be similar to those under Alternative B, except land will likely not be conserved to mitigate for project impacts to the GCWA and the BCVI.

4.9.4 Summary of Impacts

Under all three alternatives, landownership patterns in the Permit Area would not change, nor would the dominant land use, livestock grazing. However, building the Priority Projects would result in minor, adverse, indirect and direct, short-term and the long-term changes to uses of

some land in the Permit Area. During the construction phase, all affected landowners would lose use of the ROW on their property, a short-term impact, but the majority of landowners (particularly ranchers) would regain use of most of the ROW after construction activities ceased and disturbed areas were restored, either through natural revegetation or by the restoration measures described above in Section 2.2.4.4. Land occupied by the support structures and new access roads could not be used for any other purposes for the life of the proposed transmission lines; however, relatively little property is expected to be affected by these facilities.

Adverse impacts to regional land use as measured by the number of newly affected habitable structures would be minor.

No existing conservation areas are expected to be affected under any of the three alternatives. Alternative A (Preferred Alternative) and Alternative B would both result in an increase in the total acreage of conserved land, a moderate beneficial impact. Alternative A provides for approximately 50 percent more conservation credits (3,902) than Alternative B (1,954). Under all three alternatives, recreational hunting may benefit from improved access provided by cleared ROW and new access roads, with the Preferred Alternative providing the greatest benefit because more ROW would be cleared than under the other two alternatives.

4.10 SOCIOECONOMICS

The intensity of potential impacts to socioeconomic resources is defined as follows:

- Negligible: Changes to socioeconomic indicators would be slight and short term.
- Minor: The effect would be slight, but detectable, and would impose only minor increases or decreases to socioeconomic indicators.
- Moderate: The effect would be readily apparent and would impose increases or decreases in socioeconomic indicators.
- Major: The effect would be severely adverse or beneficial changes in socioeconomic indicators.

4.10.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP.

4.10.1.1 Demographics

Potential changes in population levels in the Permit Area would be driven by estimated project-related employment. As noted in Section 4.10.1.3., below, the total direct, indirect, and induced employment related to construction of the Priority Projects total an estimated 1,075 jobs. All jobs would be temporary. Total population in the seven counties within Permit Area boundaries was 229,332 in 2009 (see Table 3.11 in Chapter 3). If all 1,075 workers migrated into the Permit Area from elsewhere, which would be highly unlikely, that would result in a 0.48 percent increase in population across the seven-county area during the 18-month duration of construction activities. If most of the workers were local residents, there would be a negligible effect on regional population. In sum, the short-term impact on population in the Permit Area would be negligible to minor in intensity; the long-term impact would be negligible.

4.10.1.2 Property Values

Considerable research has been conducted on the effect of overhead high-voltage transmission lines on adjacent property values; the results of these studies have been summarized by Kroll and Priestly (1992) and Pitts and Jackson (2007). Research has shown that the effects of transmission lines on residential and agricultural property values are varied and relate to several factors, including proximity to support structures and lines, the view of support structures and lines, the type and size of support structures, the appearance of easement landscaping, and surrounding topography. Many studies, at least half, indicated that transmission lines had no significant effect on property values (Kroll and Priestly 1992, Pitts and Jackson 2007). Other studies indicate a small loss in value attributable to the close proximity of lines (Pitts and Jackson 2007). Researchers agree that factors other than overhead transmission lines have a greater influence on property value variability. These factors include neighborhood characteristics, characteristics of the land and improvements, local economic conditions, interest rates, and market supply and demand behavior. For agricultural properties, additional factors include productivity levels and distance from shipping points.

Where adverse impacts have been reported, they have generally ranged from 1 to 10 percent of property value, usually in the lower end of that range and very rarely over 10 percent (Kroll and Priestly 1992, Pitts and Jackson 2007). These impacts have been attributed to the visual unattractiveness of the transmission lines, bothersome noise, concern for potential health hazards, and safety concerns. Researchers have found little evidence that tower height or type and line voltage are directly related to level of impact, but the issue has not been systematically investigated (Kroll and Priestly 1992).

Based on these findings, it is reasonable to conclude that, while construction of the Priority Projects may result in a relatively small reduction in value for an unpredictable number of, but certainly not all, properties near the lines, it is also reasonable to conclude that there may be no reduction in value at all.

4.10.1.3 Employment

The direct, indirect, and induced employment related to construction of the Priority Projects totals an estimated 1,075 jobs. During the construction phase, the Twin Buttes–Big Hills line may require an estimated 175 employees and the Big Hill–Kendall line may require an estimated 600 employees. If both lines were constructed simultaneously (which is unlikely) direct employment during construction could total approximately 775 workers over 18 months.

Direct employment of an additional 300 workers in support industries (indirect and induced employment) may result from construction of the projects. Indirect and induced jobs are typically the result of additional spending by the project, and by construction workers. The top five industries that would experience the employment increase would be construction; food services and drinking places; architectural/engineering and related services; wholesale trade businesses; and retail (food and beverage, general merchandise, and motor vehicle parts).
If all the workers were local, industry employment during the estimated 18-month-long construction period would increase by less than 1.0 percent over 2008 levels. It is more likely that some, perhaps many, of the project construction workers would come from outside of the Permit Area. Most, if not all, of the indirect and induced jobs would be filled locally. The short-

term impact on employment in the region would be beneficial, but negligible to minor in intensity. Long-term impacts on employment would be negligible.

4.10.1.4 Industry Output

A direct increase of approximately $100 million in industry output, the value of industry production, may result from construction of the Priority Projects. Indirect and induced output could increase an additional $38 million, for a total increase of approximately $138 million in the seven-county area. The top five industry categories that could experience the output increase would be construction; rental activity; wholesale trade; architectural/ engineering and related services; and monetary authorities and depository credit intermediation activities. Industry output may increase an estimated 0.89 percent over 2008 output (see Table 3.14 in Chapter 3) as a result of project-related construction and employment. The short-term impact on industry output in the region could be beneficial, but minor in intensity. Over the long term, the presence of the Priority Projects is unlikely to affect economic conditions in the Permit Area. Tourism is important in the Hill Country portions of the Permit Area, but in that region the approved Big Hill–Kendall route parallels I-10, a high-speed thoroughfare that visitors use to reach their destinations. Electrical lines are commonplace along highways, and travelers may be conditioned to seeing them. It is unlikely that potential tourists would be dissuaded from visiting the Hill Country because they would see transmission lines along I-10. Long-term impacts on industry output in the Permit Area are expected to be negligible.

4.10.2 Alternative B – Maximum Take Avoidance

Impacts to socioeconomic conditions under Alternative B are expected to be similar to those under the Preferred Alternative, except that fewer workers would likely be needed during the construction phase because less ROW would be cleared.

4.10.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same techniques as used in Alternative B (Maximum Take Avoidance alternative). Thus, impacts to socioeconomic conditions under Alternative C (No Action) are expected to be similar to those under Alternative B.

4.10.4 Summary of Impacts

Under all three alternatives, any impact on population size in the Permit Area would be negligible to minor in the short term and negligible over the long-term. It is likely that the value of many, probably most, properties along the proposed transmission line routes would not be affected by construction of the proposed transmission lines. However, based on a broad spectrum of studies, it is reasonable to conclude that the value of some properties along the ROW could be reduced. The nature and magnitude of such impacts would be highly variable and impossible to predict. Any impact on employment and industry output in the Permit Area are expected to be beneficial, but negligible to minor in the short term and negligible over the long term.

4.11 ENVIRONMENTAL JUSTICE

4.11.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP.

4.11.1.1 Minority Communities

As described in Section 3.11.2 in Chapter 3, two counties (Schleicher and Sutton) and several communities within the Permit Area have minority representation greater than the state's and thus meet the criterion for consideration under environmental justice laws and regulations. The Priority Projects are not expected to disproportionately affect the minority populations of these two counties and communities. Of the seven counties that may be affected by the presence of the transmission lines, five do not have minority population percentages greater than those of the state as a whole. The routes for the Priority Projects were selected according to certain criteria (LCRA TSC 2009), and were chosen with the intent to minimize impacts to the human environment, including that of minority populations. Potential adverse impacts to the human environment, including that of minority populations, would be mitigated to the extent possible as described throughout this chapter and in Chapter 2.

4.11.1.2 Low-Income Population

As described in Section 3.11.3 in Chapter 3, three counties (Kimble, Schleicher, and Sutton) and several communities in the Permit Area had poverty levels that exceed that of the state as a whole. These low income populations are not expected to be disproportionately affected by the Priority Projects for the same reasons cited in the preceding section. Members of low income populations may receive some economic benefit associated with the short-term increases in employment described in Section 4.10.1.3.

4.11.1.3 Disproportionately High and Adverse Human Health Effects

No minority or low income population is expected to suffer disproportionately high adverse effects to human health as a result of this alternative (see Section 4.13.1, below).

4.11.2 Alternative B – Maximum Take Avoidance

No minority or low income population is expected to be disproportionately affected by this alternative.

4.11.3 Alternative C – No Action

No minority or low income population is expected to be disproportionately affected by this alternative.

4.11.4 Summary of Impacts

None of the alternatives is expected to result in disproportionately high and adverse impacts to the health or environment of minority and low income population in the Permit Area.

4.12 ROADS AND AVIATION

The intensity of potential impacts to roads and aviation is defined as follows:

- Negligible: No change in use of area roadways or operation of aviation facilities would be perceptible.
- Minor: Use of area roadways or operation of aviation facilities would be disrupted for very short periods and cause little inconvenience to users.
- Moderate: Use of area roadways or operation of aviation facilities would be disrupted for short or long periods and cause noticeable inconvenience to users.
- Major: Use of area roadways or operation of aviation facilities would be disrupted over the long term and cause substantial inconvenience to users.

4.12.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP.

4.12.1.1 Roads

Potential impacts on regional roadways of constructing the proposed transmission lines are expected to be similar for both projects. For a list of roadways potentially affected, see Section 3.12.1 in Chapter 3.

During construction of the Priority Projects, heavy and light vehicles would use Federal highways, state highways, county roads (farm-to-market roads and ranch-to-market roads), and private roads to deliver equipment and material to work sites. Workers would travel to and from the construction site using personal vehicles. The Priority Projects would generate only minor construction traffic at any given time or location, and impacts to traffic in the vicinity of the construction site would last a short time. Potential minor direct adverse impacts effects to roads and traffic could include increased volume and disruption of local traffic for short periods (PBS&J 2010a). Heavy construction equipment could also cause minor direct adverse impacts to road surfaces. Such impacts to Federal, state, and county roads would endure until those surfaces were repaired according to routine road and highway maintenance activities. Repairs to damaged private roads would be the responsibility of LCRA TSC and its contractors. Repairs would be completed immediately if such damage impeded access to a landowner's property, or upon termination of the construction activities that required use of those roads if the damage was minor.

LCRA TSC would obtain road-crossing and access permits from TxDOT for any state-maintained roads or highways used, which include U.S. and state highways and FM/RM roads, crossed by the eventual approved route (PBS&J 2010a). After construction is completed, these roadways would be used by workers to access the transmission line corridors to conduct periodic inspections and routine maintenance and repairs. This activity would occur sporadically and involve very few vehicles. Negligible adverse impacts to roads or traffic would result.

4.12.1.2 Aviation

The data provided in this section were taken largely from the PBS&J environmental assessment reports prepared for the Permit Area (PBS&J 2010a, 2010b).

Support structure heights for the Priority Project transmission lines are expected to range from approximately 120 to 180 feet, depending upon location and design. According to Federal

Aviation Regulations (FAR), Part 77 (FAA 1975), notification of the construction of the proposed transmission line would be required if structure heights exceed the height of an imaginary surface extending outward and upward at a slope of 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway of an FAA-registered public or military airport having at least one runway longer than 3,200 feet. If a runway is less than 3,200 feet, notification is required if structure heights exceed the height of an imaginary surface extending outward and upward at a slope of 50 to 1, for a distance of 10,000 feet. Notification is also required for structure heights exceeding the height of an imaginary surface extending outward and upward at a slope of 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff for heliports.

4.12.1.2.1 Twin Buttes–Big Hill Transmission Line

No FAA-registered airports or heliports are sufficiently close to the approved Twin Buttes–Big Hill transmission line alignment to require FAA notification (PBS&J 2010b, PUC 2010). According to PBS&J (2010b), three private airstrips are located within 10,000 feet of alternative route TM6, which was modified to become TM9, the approved alignment. None of these three airstrips is equipped to allow night operations. The presence of the Twin Buttes–Big Hill transmission line would present a minor risk of collision to low-flying aircraft in the area of these airstrips. LCRA TSC will install marker balls on the spans of the transmission line that cross the approach directions of the airstrips to improve the visibility of the transmission line at those locations..

4.12.1.2.2 Big Hill–Kendall Transmission Line

One FAA-registered airport, the Kimble County Airport, lies within 10,000 feet of the centerline of the approved Big Hill-Kendall alignment, requiring FAA notification (SOAH 2011). One private heliport is within 5,000 feet of the ROW centerline, and 11 private airstrips are within 10,000 feet of the (SOAH 2011). The presence of the Big Hill–Kendall transmission line would present a minor risk of collision to low-flying aircraft in the area. Based on coordination with the FAA and in accordance with FAA requirements, LCRA TSC will install marker balls on the spans of the transmission line that cross the approach directions of the Kimble County Airport and private airstrips and that occur in the vicinity of the private heliport to improve the visibility of the transmission line at those locations. Owing to planned structure heights, the FAA did not require lighting of the structures in the vicinity of any of these facilities.

4.12.2 Alternative B – Maximum Take Avoidance

Potential impacts to aviation under Alternative B are expected to be similar to those under the Preferred Alternative, except the use of helicopters to string wire in this alternative would increase the presence of low-flying aircraft in the vicinity of the transmission line corridor. For the most part, project-related flights would occur in rural areas with little air traffic, and such flights would be of low frequency (probably just one in any given area) and short duration. It is unlikely that these flights would interfere with or pose a risk to other aircraft. There may be a minor increase in collision risk if helicopters are used in the vicinity of airports and private airstrips where air traffic in the Permit Area is heaviest. This said, pilots in general are trained to be vigilant and are accustomed to sharing air space with other aircraft. Any increase in the overall volume of air traffic and associated safety risks would be very small.

4.12.3 Alternative C – No Action

Helicopters would also be used under No Action; therefore, the potential impacts to aviation of this alternative would be very similar to those of Alternative B.

4.12.4 Summary of Impacts

Construction of the proposed transmission lines under all three alternatives has the potential to result in minor direct adverse short-term impacts to roadways and local traffic in the Permit Area. The presence of the proposed transmission lines potentially presents a minor risk of collision to low-flying aircraft, particularly in the vicinity of landing strips. The use of helicopters to string wire in Alternatives B and C pose a slight, but no more than minor, increase in air traffic and associated collision risks near the proposed transmission line corridors.

4.13 HUMAN HEALTH AND SAFETY

The intensity of potential impacts to human health and safety is defined as follows:

- Negligible: The impact to health and safety would not be measurable or perceptible.
- Minor: The impact would be measurable or perceptible, and it would be limited to a relatively small number of persons at localized areas.
- Moderate: The impact to health and safety would be sufficient to cause a permanent change in disease and/or accident rates at existing locations where rates for those types of diseases and accidents are low.
- Major: The impact to health and safety would be substantial with a high potential for serious disease or accidents.

4.13.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. Potential impacts on human health and safety of constructing the proposed transmission lines and associated facilities are expected to be similar for both Priority Projects.

Concern was raised during public scoping for this EA about the health effects of exposure to low frequency-electric and magnetic fields (ELF-EMF) generated by transmission lines. Exposure to ELF-EMF is not unique to transmission lines. It is ubiquitous in American homes, schools, work places, businesses, and public facilities; in fact, in every place where electricity is used. The ELF-EMF generated by high-voltage transmission lines is no different in kind from the ELF-EMF generated by any home electrical fixture or appliance. Often, the exposure levels from transmission lines are lower, depending on the distance from the source (see Tables 3.19 and 3.20 in Chapter 3). As discussed at more length in Section 3.13.1 in Chapter 3, no scientific studies have shown a cause-and-effect relationship between ELF-EMF exposure and disease. Results of epidemiological studies have been mixed, with a few studies demonstrating a statistical relationship between proximity to transmission lines and childhood leukemia (NIEHS 1999). Other studies have found no relationship. In the face of inconclusive and contradictory scientific findings, the National Institute of Environmental Health Sciences has concluded that ELF-EMF exposure "cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard" (NIEHS 1999: iii). Until more is known, however, this statement may be as applicable to refrigerators as it is to transmission lines.

As shown in Figure 4.1, the strength of the ELF-EMF generated by a 345-kV transmission line diminishes rapidly with distance from the ROW centerline. Within 200 feet of the centerline, exposure levels are very low. Given the sparsely populated rural areas through which both proposed lines would cross for the great majority of their lengths, few individuals would be within 200 feet of the centerline for any appreciable length of time. Consequently the risk of significant exposure to ELF-EMF to the general public is expected to be small. For the relatively few individuals who might spend long periods of time within 200 feet of the ROW centerline (within 120 feet of the edge of the ROW), the risk of exposure would increase as shown in Figure 4.1. The health risk of such exposure is unknown.

The risk of shock to the general public from the proposed transmission lines is expected to be minor for several reasons. The potential for shock due to induced currents (see Section 3.13.2) is expected to be low because the facilities that might conduct such currents (e.g., fences parallel to and near the transmission lines) are likely to be grounded. Spark-discharge shocks can occur when people carry conducting objects (such as pipe) under transmission lines, but such nuisance shocks do not pose a health risk. Steady-state shocks, which can occur when an object comes in contact or close contact with a transmission line, can be lethal to an individual touching that object. Contact with transmission line conductors is rare, however, because the wires are elevated high enough above the ground to allow normal vehicles (including large farm machines) to pass safely underneath. In addition, the Priority Project alignments traverse sparsely populated areas over the great majority of their routes, further reducing the likelihood of injury due to shock. Corona noise, a crackling or hissing sound generated by transmission lines under certain conditions (see Section 3.1.4.2) may be perceived as unsafe, but this noise is of sufficiently low level as to not pose a health risk.

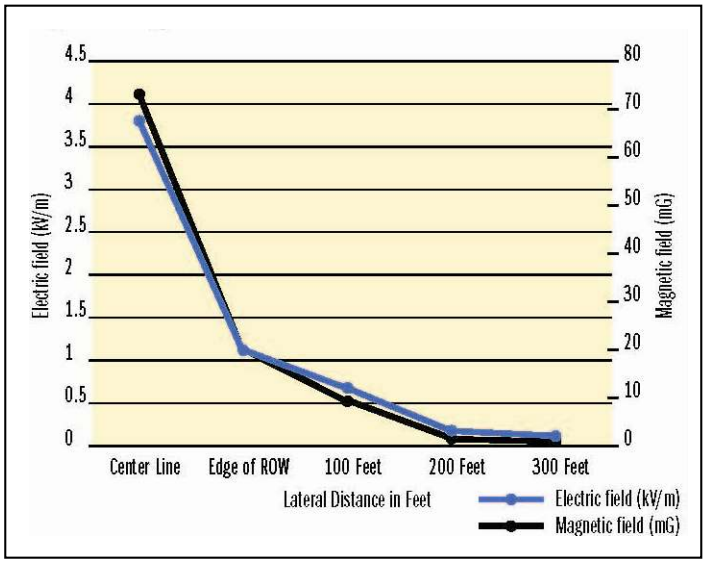

Figure 4.1. Attenuation with distance from ROW centerline of electrical and magnetic fields generated by a typical 345-kV transmission line. Source: CapX 2020 Certificate of Need application to the Minnesota Public Utilities Commission for three 345-kV transmission line projects (8/16/2007, MPUC Docket No. ET02, E-002/CN-06-1115).

There is a public perception that all power lines can be a direct cause of wildfire ignitions, but power line-caused fires are relatively rare and much more prevalent for distribution and lower-voltage transmission lines compared with the higher-voltage transmission lines that characterize the Priority Projects (California Public Utilities Commission 2008). The energized conductors on distribution and lower-voltage transmission lines are much closer together (as close as 2 feet) compared with those of higher-voltage transmission lines (more than 15 feet for 345-kV lines). Fallen or wind-blown tree limbs and debris can more easily come into contact with and bridge two distribution conductor phases, which can cause electrical arcs that can set fire to woody

debris. Because higher voltage transmission line conductors are spaced much farther apart, this phenomenon is extremely rare on lines of 230 kV or more.

Arcing from a single conductor to ground through vegetation contact can also occur, but this is rare with high-voltage lines (such as 345-kV lines) because they are typically mounted on very tall structures to provide adequate, safe distance from vegetation, buildings, and other structures. Large bird-caused flashovers are highly unlikely for the Priority Projects due to the fact that the distances between conductors are greater than the wingspan of the largest bird species in the project vicinity. The potential for wildfires is also minimized by the standard use of protection systems on transmission lines that are designed to shut off power flow in a fraction of a second should something come in contact with conductors.

Transmission line support structures have been known to collapse, but this happens rarely and usually as a result of extreme weather events, particularly heavy ice and snow storms. Such storms are very unlikely to occur in the Permit Area owning to its latitude, reducing the potential for structure failure in this region. High winds, including tornado-force winds, do occur in the region and could cause one or more structures to collapse in isolated events. Should this happen, and a conductor were to snap or come into contact with some object, flow of power would automatically shut off. Given the sparsely populated nature of the Permit Area and the very few habitable structures near the alignments (see Section 4.9.1.3), it is highly unlikely that a collapsing structure would threaten anyone's health and safety.

Other possible causes of failures include flaws in the structures themselves. This may be the explanation for a recent partial collapse of three lattice structures in Travis County, Texas, because weather conditions did not appear to be a factor. The towers were part of a new transmission line being constructed for LCRA TSC. The event was unprecedented for LCRA TSC, which has approximately 29,000 transmission line structures in its system, ranging over 44,000 miles. While the cause of collapsed structures in Travis County has yet to be determined, LCRA TSC is now acutely aware of the potential for failure in new towers and can be expected to be even more vigilant about the procurement, testing, and installation of such structures in the future.

4.13.2 Alternative B – Maximum Take Avoidance

Impacts to human health and safety under Alternative B are expected to be similar to those under the Preferred Alternative.

4.13.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same techniques as used in Alternative B (Maximum Take Avoidance alternative). Therefore, impacts to human health and safety under Alternative C are expected to be similar to those under the Preferred Alternative.

4.13.4 Summary of Impacts

All three alternatives would result in a small increase in the risk of adverse health and safety effects but that increase is anticipated to be negligible to minor.

4.14 NOISE

The intensity of potential impacts to noise is defined as follows:

- Negligible: Existing sounds would prevail. Effects to existing sound environment would be at or below the level of detection and such changes would be so slight that they would not be of any measurable or perceptible consequence to residents in the area.
- Minor: Effects to the existing sound environment would barely be detectable, or would be clearly audible but short term. The effects would be of little consequence to residents in the area.
- Moderate: Effects to the existing sound environment would be readily detectable, short- or long-term, and would have some consequences to residents in the area.
- Major: Effects to the existing sound environment would be obvious, long-term, and have substantial consequences to residents in the area.

4.14.1 Alternative A – Issuance of Section 10(a)(1)(B) Permit (Preferred Alternative)

Under this alternative, the Service would issue the requested ITP, and LCRA TSC would build the Priority Projects as described in the FHCP. Potential noise impacts of installing the proposed transmission lines are expected to be similar for both Priority Projects. Noise is a potential concern during both the construction and the operation of the proposed transmission lines.

4.14.1.1 Construction Phase Noise

Construction activities would generate noise from heavy construction equipment and trucks used along the access roads and ROW. Levels of construction noise would be variable and intermittent, as equipment would be operated only when needed for a specific task. It is expected that construction activities would typically be limited to daytime hours; thus would not impact existing ambient nighttime noise levels. Peak noise levels in the range of near 100 dBA (A-weighted decibel) would occur on the active construction sites. These noise levels are high, but would be temporary and intermittent. Table 4.16 presents the peak noise levels (dBA)

Table 4.16. Typical Peak Attenuated Noise Levels (dBA) of Construction Equipment Likely to Be Used during Construction of the Priority Projects[1]

Source	Peak Noise Level	Distance from Source						
		50 ft (15 m)	100 ft (30 m)	200 ft (61 m)	400 ft (122 m)	1,000 ft (305 m)	1,700 ft (518 m)	2,500 ft (762 m)
Heavy Trucks	95	84–89	78–83	72–77	66–71	58–63	54–59	50–55
Dump trucks	108	88	82	76	70	62	58	54
Concrete mixer	108	85	79	73	67	59	55	51
Jackhammer	108	88	82	76	70	62	58	54
Scraper	93	80–89	74–82	68–77	60–71	54–63	50–59	46–55
Bulldozer	107	87–102	81–96	75–90	69–84	61–76	57–72	53–68
Generator	96	76	70	64	58	50	46	42
Crane	104	75–88	69–82	63–76	55–70	49–62	45–48	41–54
Loader	104	73–86	67–80	61–74	55–68	47–60	43–56	39–52
Grader	108	88–91	82–85	76–79	70–73	62–65	58–61	54–57
Pile driver	105	95	89	83	77	69	65	61
Forklift	100	95	89	83	77	69	65	61

Source: Golden *et al.* 1980 as cited in U.S. Department of Energy 2003.

[1] Attenuation with distance is dependent on the frequency of the sound and thus varies for some of the sources shown and is shown as a range.

typically associated with a single sound event from types of equipment commonly used during construction. Most of the proposed transmission line routes (well over 90 percent) would pass through sparsely populated grazing land with few habitable structures (noise receptors) within 500 feet (see Section 4.9.1.3, above). As a result, relatively few people would be affected by the noise.

4.14.1.2 Operational Phase Noise

Once construction is completed, potential noise impacts associated with the proposed transmission lines would be from transmission wires and towers (corona, insulator, and wind noise) and activities associated with routine inspection and maintenance of the line. Corona noise, a crackling or hissing sound, may be the most bothersome sound to some people because it may be perceived as sounding electrical and therefore possibly unsafe (although it has no health impacts). Corona noise is unlikely to be heard during dry weather because the sound levels generated are expected to be similar to ambient conditions. During wet conditions, however, corona noise may reach 60 dBA at the edge of the ROW, the sound level of a normal conversation, and may be heard several yards away from the ROW. During wet weather, the corona effect may also cause interference with amplitude-modulated (AM) broadcast radio for receivers in close proximity to the transmission lines. Such interference typically occurs immediately below a transmission line and dissipates quickly with distance from the line. Impacts would be negligible to minor.

Noise from insulators is expected to be negligible because new polymer insulators would be used for the Priority Projects, and, as explained in Section 3.1.4.2, most insulator noise results from old ceramic or glass insulators. Noise produced by the wind blowing through the wires and/or structures would be intermittent and negligible to minor in intensity.

Noise impacts from the occasional maintenance activities on the transmission lines would be intermittent and most often be the sound of light trucks, which are common in rural areas. Other types of equipment would be used on occasion, but it is expected that noise generated by maintenance operations would rarely be bothersome to people in the area. Impacts would be negligible to minor.

4.14.2 Alternative B – Maximum Take Avoidance

During the construction phase, noise impacts under Alternative B would be different from those under the Preferred Alternative because helicopters would be used to string wire in place of clearing Covered Species habitat. Noises generated during the structure construction process would be similar under both alternatives. Sounds generated by the equipment used to clear vegetation in Covered Species habitat areas under Alternative A would be replaced under alternative B by sounds generated by a low-flying helicopter. The sound level produced by a helicopter stringing wire—flying at tower height—could be 90 dBA or more for a receptor directly under the helicopter (FAA 1979). Those exposed to this level of sound would most likely be construction workers. As with other noise sources (see Table 4.16), helicopter-generated sound decreases rapidly with distance from the source. As a result, the sound level perceived by any receptors in the area surrounding the ROW would likely be much lower. Wire-stringing requires little time; therefore, any noise impacts associated with that activity would be of short duration. LCRA TSC helicopters traveling to and from the construction site would do so

at a sufficiently high altitude to minimize noise impacts. Exposure to the sound of the helicopter passing overhead would be of short duration.

4.14.3 Alternative C – No Action

Under No Action, it is expected that the Priority Projects, or a similar group of individual transmission lines, would be constructed using the same techniques as used in Alternative B (Maximum Take Avoidance alternative). As a result, noise impacts are expected to be similar to those under Alternative B.

4.14.4 Summary of Impacts

For all three alternatives, noise impacts from construction activities would be temporary, variable, and intermittent. While the noise levels would be loud at times, most of the activity would take place in sparsely populated areas with relatively few noise receptors. Construction-related noise impacts would vary from minor to moderate. Overall, noise impacts from the transmission lines and maintenance activities would often be intermittent and range from negligible to minor for people in close proximity to the ROW.

4.15 INDIRECT GROWTH-RELATED IMPACTS

This section addresses the potential for the proposed activities to indirectly affect the environmental factors tracked in this document by causing growth and development inside and outside the permit area. As defined by NEPA regulations, indirect impacts are those effects "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern in land use, population density or growth rate…" (40 CFR 1508.8).

In accordance with NEPA regulations, it is appropriate to consider the degree to which the Covered Activities and any connected actions are likely to induce other growth and development that may have further effects on the resources under consideration in this EA. If the Service considers the construction of the Priority Projects to be a connected action to the issuance of the ITP, then the Service should also consider the degree to which such construction will induce other growth and development. The paragraphs below set forth the relevant tests for causation. The Act's regulations provide that assessment of a Federal proposed action must consider the effects caused by that action, but do not provide guidance on the nature of causal inquiry to be conducted. Case law concerning indirect effects and causation is rare, and little guidance has issued from the courts over the past 15 years. Older cases that addressed causation did not directly address what the test of causation should be or how it should be applied to complex factual situations of the type considered in this EA. (See, e.g., *National Wildlife Federation v. Coleman*, 529 F.2d 359 [5th Circuit], cert. denied, 429 U.S. 979 (1976) and *Riverside Irrigation District v. Andrews*, 758 F.2d 508 [10th Cir. 1985]).

Regulatory language that defines indirect impacts and incorporates the concept of causation under the Act is the same framework used under NEPA. In both cases, the causal test is established only by the phrase "indirect effects are caused by the action" (40 CFR 1508.8[b] and 50 CFR 402.02). NEPA and the Act, thus, appear to have the same test for causation. Under

NEPA, judicial opinions have provided significant guidance on how to conduct causal analysis. These decisions address complex fact patterns comparable to the issues addressed in this section. The Ninth Circuit has held that an effect is caused by the action if the action is an "indispensable prerequisite" or an "essential catalyst" to the effect (*City of Davis v. Coleman*, 521 F.2d 661, 674 (9th Cir. 1975). However, it is not enough that the actions might be related or that each "might benefit from the other's presence." *Sylvester v. U.S. Army Corps of Engineers*, 884 F.2d 394 (9th Cir. 1989). Similarly, it is not enough if a proposed action "may induce limited additional development" when the "existing development necessitated the [action]" (*City of Carmel-by-the-Sea v. DOT*, 123 F.3d 1142 (9th Cir. 1997). In *City of Carmel-by-the-Sea*, the Ninth Circuit upheld an analysis that stated that the proposed project "had the potential to facilitate growth" but would not ultimately do so because of the development constraints imposed by local authorities. Similarly, in a case involving an airport expansion project designed to address existing levels of air traffic, the Ninth Circuit rejected the argument that airport expansion removed a constraint to growth because without the project, growth could not occur safely. The Ninth Circuit stated, "The fact that it might also facilitate further growth is insufficient to constitute a growth-inducing impact…" *Morongo Band of Mission Indians v. Federal Aviation Administration*, 161 F.3d 569 (9th Cir. 1998).

In a fairly recent example of the application of the causal analysis to a complex fact pattern, the court in Border Power Plant Working Group v. Dept. of Energy, (2003 WL 21037927 [S.D. Cal.]) followed the analysis established by *Sylvester v. U.S. Army Corps of Engineers, City of Carmel-by-the-Sea v. DOT*, and *Morongo Band of Mission Indians v. FAA*. The court found that authorization of a power transmission line on the U.S./Mexico border did not require analysis of emissions from a Mexican power plant that could use the new line to transmit power to the U.S. The court held that the turbines in the plant dedicated to production of power for Mexico were not causally linked to the new transmission line "in a way that makes the BPP line a necessary prerequisite or essentially catalyst to their operation." The court also noted that "because the line of causation is too attenuated between these turbines and the Federal action permitting the BPP line, the Ninth Circuit authority makes clear that the emissions of the non-export turbines were not effects of the BPP line and that the Federal defendants, therefore, were under no NEPA obligation to analyze their emissions as effects of the action." The court also found that because the turbine in the plant that was dedicated to the export of power had an alternate route, the BPP line could not be considered the but-for cause of the export turbine's operation and effects from the operation of the turbine were, therefore, not indirect effects of the BPP line.

Based on existing judicial guidance, relevant factors in the causal analysis concerning growth-inducement include whether the action is the sole cause, whether the action has a useful purpose other than serving new growth, whether the action is intended to induce growth or to address existing levels of demand, and whether growth is being regulated at the local level. The test embraced by the courts demonstrates a pragmatic approach that recognizes a stopping point must exist in any causal analysis.

The Service has considered this issue previously with respect to electric and water transmission facilities (e.g., *Final Environmental Assessment/Habitat Conservation Plan for Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit for Incidental Take of the Houston Toad (Bufo houstonensis) by Aqua Water Supply Corporation, Lower Colorado River Authority,*

Bluebonnet Electric Cooperative, Inc., and Austin Energy During the Routine Maintenance and Repair of Facilities and Installation of New Facilities in Portions of Bastrop and Lee Counties, Texas, Permit No. TE-078366-0) and has concluded that infrastructure of this nature typically responds to rather than induces growth. This is likely to be particularly the case with respect to the Priority Projects, which do not provide distribution of electricity to consumers, but function as a component of the high voltage transmission grid. While the existence of the Priority Projects is expected to provide more opportunities for the already populous cities of east and central Texas to use renewable energy, it cannot be demonstrated that the construction of the Priority Projects induces or causes the construction of wind energy or other renewable energy facilities, as, with or without the Priority Projects, the construction or not of any such facilities is speculative in light of numerous other factors, not the least of which is market demand and the existence or not of Federal and/or state governmental financial support.

That being said, as was discussed in Section 1.2.1, it is acknowledged that PUC mandated the construction of the CREZ transmission lines to carry renewable energy from generation sources in western Texas and the Texas Panhandle eastward to the populous eastern half of the state. As such, the CREZ transmission lines are most properly viewed as projects induced by desire on the part of the federal government and State of Texas to increase the share that renewable energy contributes to energy consumed in the state and nationally. The CREZ transmission line projects cannot cause or induce the development of wind energy or other types of renewable energy projects (and, therefore, the impacts associated with construction of those types of projects cannot be viewed as indirect effects of construction of the CREZ transmission lines.

The extent to which any additional wind energy or other renewable energy generation projects will be constructed within the CREZ serviced by the Priority Projects is not known. The State of Texas in 2005 established a Renewable Portfolio Standard (RPS) requiring that 5,880 MW of energy produced in the state be generated from renewable sources and setting a goal of 10,000 MW of renewable energy capacity by 2025 (American Council on Renewable Energy 2011, State Energy Conservation Office 2011). The 10,000 MW goal was reached in 2009. Largely for this reason, the U.S. Energy Information Administration (US EIA) has forecast that renewable energy capacity in the ERCOT region, which contained approximately 9,400 MW of the total 10,000 MW in Texas in 2009, will increase by approximately 7.4 percent to 10,100 MW by the year 2035 (U.S. Energy Information Administration 2011).[13] This is a modest rate of growth compared to that experienced over the past decade, and it is possible that changes to the RPS could be made by the State of Texas in the future that cause the US EIA estimate to be inaccurate.

However, if accurate, this estimate suggests that approximately 700 MW of renewable capacity will be added to the ERCOT region over the next 24 years. The largest wind generation project in Texas has a capacity of approximately 781.5 MW (American Council on Renewable Energy 2011), although most projects have a capacity less than 100 MW. This suggests that if the 700 MW estimate is accurate, the number of wind generation projects constructed in the ERCOT region over the next 24 years would be comparatively few, perhaps ranging from 10 to 14 if

[13] Renewable energy projects located in most of the Texas Panhandle and portions of east Texas lie outside the ERCOT region (U.S. Energy Information Administration 2011).

individual projects have capacities averaging from 50 to 70 MW. Again, whether any new wind generation projects will be built in the CREZ serviced by the Priority Projects is unknown.

Any wind generation projects built in that CREZ would be expected to transmit their generated electricity to the ERCOT high voltage transmission grid via the Priority Projects. Because it is not known where any such projects might be constructed, it is not possible to quantify the environmental and socioeconomic impacts expected to result from that construction. In general, the construction of a wind generation project results in the direct disturbance of vegetation and wildlife habitat in those areas cleared for construction of wind turbine generators, access roads, installation of collector lines, and any necessary substations. Construction of wind turbine generators creates collision hazards for birds and bats, can result in local displacement of certain wildlife species, can decrease aesthetic qualities of local viewsheds, and can increase ambient noise levels at the local scale. Impacts to geologic resources and soils resulting from the construction of wind generation projects are typically minimal given the surficial nature of the projects. Wind generation projects can also have positive socioeconomic benefits by creating temporary construction-related employment opportunities and a small number of permanent employment opportunities.

CHAPTER 5
CUMULATIVE AND UNAVOIDABLE IMPACTS AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

5.1 INTRODUCTION

As required under NEPA, this section considers "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). "Reasonably foreseeable future actions" are defined in these regulations as actions that are not speculative—they have been approved, are included in short- to medium-term planning and budget documents prepared by government agencies or other entities, or are likely given trends. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

With the exception of climate change and the Covered Species (GCWA and BCVI), the geographic area of cumulative impact analysis for all impact topics is the seven-county Permit Area defined in Chapter 1. The impact topics are the same as those analyzed in the preceding chapter for direct and indirect impacts. The information provided in this analysis regarding existing conditions in the Permit Area is drawn from Chapter 3 of this EA. Appropriate references are provided there.

Generally speaking, the Permit Area is predominantly rural, with ranching and, to a lesser degree, farming constituting the predominant land uses. Hunting is the principal dispersed recreational activity in the region. Areas of urbanization, such as San Angelo and Kerrville, are limited within the Permit Area, as is the presence of much industrial development. Portions of the Permit Area support some amount of industry, including oil and gas exploration, quarries, and mining. It is projected that the majority of the Permit Area will experience low to moderate population growth for the foreseeable future. While this population growth will necessitate some growth in residential and commercial development, particularly in Kendall County, which borders burgeoning Bexar County (City of San Antonio), it is likely that the majority of the Permit Area will retain its rural, agricultural status for the foreseeable future.

Population projections vary across the region. Due to its proximity to the San Antonio metropolitan area, the population in Kendall County is expected to grow substantially over the next 30 years, with a projected increase of 43.5 percent. Populations of Tom Green, Schleicher, Sutton, and Kerr counties are expected to grow less dramatically over this same period, with increases ranging from 4.1 percent (Schleicher County) to 18.9 percent (Tom Green County). The populations of Gillespie and Kimble counties are expected to decrease over the next 30 years by between 3.7 percent (Gillespie County) and 10.9 percent (Kimble County). In total, the population within the seven-county Permit Area is expected to increase by a moderate 14.5 percent over the next 30 years (see Table 3.11) (Texas State Data Center and Office of the State Demographer 2010).

Increases in human population will need to be accommodated through the construction of housing, roads, utilities such as water and sewer systems, electrical transmission and distribution lines, telephone lines, and, in all likelihood, cellular phone towers. However, there is little available information on actual, reasonably foreseeable projects to accommodate such an increase in population. Depending on the intensity of development, increases in population would also lead to the construction of additional schools and buildings for service industries such as stores, gas stations, restaurants, medical clinics, and police and fire stations. Concentrated growth is likely to occur in proximity to existing population centers such as the City of San Angelo in Tom Green County, City of Kerrville in Kerr County, and areas in Kendall County near the City of Boerne and greater San Antonio. Growth can also be expected to occur more diffusely across the Hill Country through the development of subdivided ranch properties (i.e., "ranchette" subdivisions) (Wilkins *et al.* 2003).

Because the Permit Area is largely rural, only limited information is available on reasonably foreseeable growth and development. In support of this cumulative effects analysis, a review of publicly available information on past, present, and future public and private infrastructure efforts in the Permit Area was conducted. The results of that review are summarized in Table 5.1, which is appended at the end of this chapter.

In any NEPA analysis, it is preferable to quantify the assessment of impacts on each affected resource. Where possible, the following analysis of cumulative impacts is quantified. However, because the scope of reasonably foreseeable future projects identified within the Permit Area is not always available, quantifying impacts is not always possible. Where quantification is not possible, a meaningful and qualified judgment of cumulative impacts is included to inform the public and the decision maker.

5.2 CUMULATIVE IMPACT ANALYSIS

5.2.1 Visual and Aesthetic Qualities

Lands in the Permit Area are used for a variety of purposes, including ranching, farming, residential development, parks and open space, mineral extraction (including oil and gas), wind energy, roads and transportation, natural gas pipelines, transmission and power distribution, and hunting. These past and present land uses have all contributed to the current landscape character of the Permit Area.

Over the next 30 years, the projected population growth and concomitant commercial and residential development in most counties of the Permit Area are expected to result in changes to the existing landscape character in those counties. Counties where human populations are expected to decrease are expected to retain a greater proportion of currently undeveloped lands and undeveloped viewsheds. Adverse cumulative impacts to the visual and aesthetic quality of the Permit Area are not likely to be substantial. This is expected because the total projected growth in population across the Permit Area is comparatively low at about 38,000 people over the next 30 years, and development is likely to be concentrated around existing population centers or be clustered in "ranchette" subdivisions. This pattern of development would result in the continued presence of extensive amounts of undeveloped woodland and ranchland.

Reasonably foreseeable future actions in the Permit Area that would result in changes to landscape character include potential developments associated with projected population growth in Tom Green, Schleicher, Sutton, Kerr, and Kendall counties and the installation of wind turbines. The construction of each new building, utility project, or wind farm will incrementally increase the number of human-made objects on the landscape within the Permit Area and incrementally decrease the amount of rural viewshed available in the foreground and background visual zones for those people that reside in and visit the Permit Area. The hilly terrain in eastern portions of the Permit Area is likely to limit or even preclude the ability to view some future development from public roadways.

Cumulative Impact Determination. Construction of the Priority Projects would nominally contribute to this expected increase in number of human-made objects visible on the landscape, although the transmission line structures, because of their height, would be able to be seen from greater distances than most other human-made features. The Priority Projects are expected to make only a minor contribution to the cumulative impacts to visual and aesthetic quality of the Permit Area as a whole. However, locally, to those residing or working within sight of the transmission lines, and to those traveling on I-10 and other roads paralleling the lines, the Priority Projects may add to cumulative impacts on the visual and aesthetic quality of the landscape.

5.2.2 Climate Change and Cumulative Impacts

Regional climate results from processes that can be regional, continental, and even global in scale. Therefore, it is not appropriate to limit the examination of cumulative impacts to a specific geographic Permit Area as was done in the section above and as is done in later sections. The EPA (1997) predicts that over the next century, climate in Texas is likely to become warmer, with wider extremes in both temperature and precipitation. Weather in Texas is already highly variable and it is expected to become more so.

Over the next 30 years, the U.S. and world populations are each expected to increase by roughly 30 percent, with the U.S. population expected to increase by nearly 100 million people and the world population expected to increase by about 2 billion people (U.S. Census Bureau 2010). As the human population increases, so will demand for fossil fuels, renewable forms of energy, and other natural resources. Also expected to increase are the number of vehicles on roads, the number of motorized boats on the water, the number of planes in the air, the number of homes, businesses, and industries whose operations result in the emission of greenhouse gases, the number of people burning firewood for cooking and heating, and all other activities associated with an expanding human population.

Cumulative Impact Determination. As discussed in Section 4.3, under all three alternatives, construction and operation of the Priority Projects are expected to contribute imperceptibly to regional, national, and global outputs of greenhouse gases. The potential contributions, however, would be imperceptible when compared against regional, national, and global outputs of greenhouse gases.

5.2.3 Air Quality

Emissions from increased motorized vehicle use, oil and gas fields, mining, agriculture, road construction projects, and other construction activities have all contributed to the existing quality of air in the Permit Area. Although these emissions have had a direct effect on the Air Quality in the Permit Area, the seven counties in the Permit Area are currently in attainment for all criteria pollutants (EPA 2010a).

Reasonably foreseeable future actions would also affect air quality. Over the next 30 years and beyond, the population of the Permit Area is expected to increase by 14.5 percent, or approximately 38,147 people. This increase in population can be expected to result in an increase in the Permit Area in the use of gas-powered private and commercial vehicles, the use of gas-powered equipment such as lawnmowers, and the use of gas-powered motor boats. It can also be expected to result in an increase in the number of people using fireplaces and charcoal grills. Although these activities would likely result in a cumulative increase in emissions of criteria pollutants, because the projected growth in population is comparatively low at about 14.5 percent, the Permit Area is expected to remain in attainment for all criteria pollutants.

Cumulative Impact Determination. Under each of the three alternatives, the Priority Projects are expected to result in negligible short-term, temporary impacts to local air quality as a result of construction, maintenance, and repair activities, and concomitant vehicle emissions. The contribution of the Priority Projects to the cumulative degradation of the air quality of the Permit Area would be negligible as well.

5.2.4 Soils and Geology

Past and present impacts to soils in the Permit Area reflect land uses and are primarily associated with livestock grazing and tilling of cropland, both of which have altered vegetation cover and natural soil regimes. However, public concern for soils as a resource focuses not on the preservation of a soil's natural characteristics but on the availability and suitability of soil for agricultural production (particularly prime farmland soils). In Texas, rural properties have increasingly been subdivided and developed (Wilkins *et al*. 2003). As a result the availability of soils for agricultural uses has been reduced. This trend is expected to continue, especially in areas near existing communities.

Over the next 30 years and beyond, the projected population growth and concomitant development in most counties of the Permit Area is expected to result in periodic, localized minor disturbances to soils in those counties. Such disturbances can be expected from grading for new roads, trenching for the installation of underground utilities, and the clearing of land for construction of houses, commercial buildings, and parking lots. Most recent residential development in the Permit Area has occurred in hilly areas and outside of prime farmland soils and other arable lands suitable for agricultural purposes, and it is expected that most future development in the Permit Area would occur in similar topographic situations. Some farmland may be subdivided and developed near existing urban areas; however, to a lesser degree than the far more common ranchland. Adverse cumulative impacts to soils of the Permit Area are not likely to reach noteworthy levels because the total expected growth in population across the Permit Area is comparatively low and would be spread across a broad area, and because most, but not all, development is expected to occur outside of areas containing prime farmland soils.

Some quarries and sand/gravel mines are present in the Permit Area. It is expected these facilities will continue to operate in the Permit Area over the next 30 years, with these operations resulting in the extraction and removal of geologic resources from the Permit Area. Some gravel produced in the Permit Area could also be used as base for new roads constructed in the Permit Area in response to its increasing population, and some local rock could be used to build homes or other buildings. Igneous and metamorphic rocks of the Llano Uplift region offer collecting opportunities for llanite, a uniquely Texas gemstone, and topaz. It is expected that the collection and removal of specimens of these minerals from the Permit Area will also continue over the next 30 years.

Cumulative Impact Determination. Under all three alternatives, the Priority Projects would displace soil only at support structure sites and access roads. This represents a small proportion of the total soil available for agricultural purposes in the Permit Area. Consequently, the Priority Projects are expected to contribute only nominally to the cumulative impact to soils (particularly prime farmland soils) in the Permit Area. Under all three alternatives, the contribution of the Priority Projects to the cumulative impacts to the geology of the Permit Area is expected to be negligible.

5.2.5 Water Resources

Lands in Permit Area are used for a variety of purposes, including ranching, farming, residential development, parks and open space, mineral extraction (including oil and gas), wind energy, roads and transportation, natural gas pipelines, transmission and power distribution, and hunting. Additionally, there are a number of reservoirs, irrigation systems, and storm water detention facilities associated with the operation of past and present actions in the Permit Area. These past and present land uses have resulted in impacts to water quality and quantity within the Permit Area.

Reasonably foreseeable future actions in the Permit Area are associated with the projected 14.5 percent population growth over the next 30 years within the Permit Area. An increasing human population is expected to result in an increased demand for water within the Permit Area. Although the population is projected to more than double over 60 years, water demand in Texas is projected to increase by only 27 percent, from almost 17 million acre-feet of water in 2000 to a projected demand of 21.6 million acre-feet in 2060. This smaller increase is primarily due to declining demand for agricultural irrigation water and increased emphasis on municipal water conservation" (TWDB 2006). Some residents of the Permit Area may build retention dams, which could alter local surface water drainage patterns. Development projects performed in response to an increasing population can be expected to cause temporary impacts to water quality through construction-related effects associated with erosion and sedimentation. The increasing number of residents within the Permit Area and increased use of roads by those residents can be expected to result in increases in the amounts of fertilizers, herbicides, and pesticides running off residential properties and into local streams, and increases in the amounts of oil and grease running off highways and entering local streams.

Agricultural activities within the Permit Area are expected to continue, with some of these activities relying on irrigation using water drawn from surface water or groundwater sources.

Withdrawals from aquifers and the construction of retention dams could lead to decreased levels of flow in, or the drying of, some stream segments.

Cumulative Impact Determination. Construction of the Priority Projects is expected to result in no more than minor, short-term, temporary construction-phase impacts to the quality of water in stream segments crossed by the transmission lines. The contribution of the Priority Projects under the three alternatives to the cumulative degradation of the water quality of the Permit Area would be similar, and is expected to have no more than negligible impacts on surface waters and groundwater.

5.2.6 Biological Resources

5.2.6.1 Vegetation and Wildlife

The vegetation communities and wildlife typical of the Permit Area, much of which is popularly referred to as Texas Hill Country, are described in Chapter 3, Sections 3.7.2 and 3.7.3. Past and present actions in the Permit Area have contributed to the direct loss of vegetation as well as injury, mortality, loss of habitat, habitat fragmentation, avoidance, and displacement of general wildlife species. Most of the obvious adverse impacts to vegetation and general wildlife species in the last decade have resulted from population growth and urban/suburban/extra-urban development. In addition, counties where populations have been comparatively stable or declined have largely retained their rural landscapes.

In these counties, agricultural activities, livestock grazing, and associated land clearing is more likely than residential development to have affected vegetation communities and the wildlife species that inhabit them. These types of impacts are not as obvious, but can result in the displacement of woodland species from a cleared property, with the replacement of those species by species that prefer open habitats. The inverse may happen in areas where decreasing population levels lead to discontinuation of land clearing activities. In those areas, species that prefer woody habitats could increase locally in abundance, and the abundance of species preferring open habitats could decrease locally.

In parts of the Permit Area where the human population and development is anticipated to increase, many wildlife populations are likely to decline, as habitat needed for shelter, breeding, foraging, and to support prey species is lost or altered. Increased levels of development can be expected to increase the number of collision risks to avian species present within the Permit Area. The types of collision risks that could increase in number within the Permit Area include electrical distribution and transmission lines, guyed and unguyed radio towers, cellular phone towers, wind turbine generators, windows and buildings, and fences. In general, the cumulative impact on wildlife is adverse; however, some species, such as raccoons, birds, and squirrels, could benefit from an increase in human development.

Oak wilt is a known threat to oak trees in several counties within the Permit Area. It is expected that, through time, oak wilt will spread within the Permit Area as a result of natural vectors, the cutting and pruning of oak trees by residents or to clear land for development projects, and by the transport of freshly cut oak firewood.

In sum, over the next 30 years and beyond, the projected population growth and associated commercial and residential development in some of the counties within the Permit Area may result in localized cumulative adverse impacts to native vegetation and wildlife communities. At the same time, decreases in population of some other counties and associated changes in land use management may cause localized shifts in the structure and composition of native vegetation and wildlife communities that could be measurable, but, in the absence of humans placing greater value on some species than others, those results would not necessarily be considered "adverse" or "beneficial," just "different."

Cumulative Impact Determination. Owing to the scale of the Priority Projects compared to the total land area contained in the Permit Area, the contribution of the Priority Projects under any of the three alternatives to the cumulative impact to woodland and shrubland plant and wildlife communities is expected to be minor. The contribution of the Priority Projects to cumulative impacts on herbaceous plant and wildlife communities is expected to be negligible.

The clearing of ROW for the Priority Projects potentially could contribute to the spread of oak wilt in localized areas if the cutting of oak trees must be performed during the period of February through July in areas where oak wilt is already present; however, and as discussed in Chapter 4 of this EA, it is the policy of LCRA TSC to minimize the risk of spread of oak wilt whenever possible. For this reason, the contribution of the Priority Projects to the cumulative spread of oak wilt is considered minor.

Given the number of collision risks to avian species already present within the area, and the expected increase in such risks in the future, the contribution of the Priority Projects to the cumulative number of collision risks expected to be present within the Permit Area in 30 years is considered minor.

5.2.6.2 GCWA

Based on recent modeling efforts by Morrison *et al*. (2010), Texas contains approximately 4,148,138 acres of potential GCWA habitat. While it can reasonably be expected that ongoing population growth within the Permit Area will result in further loss of potential habitat, a review of Service records reveals that there are few, if any, activities affecting warbler habitat in the Permit Area that meet the standard of "reasonably foreseeable" under applicable regulations. The Service will continue to monitor levels of habitat and address its regulatory and enforcement functions with respect to the GCWA as the need may arise. It can reasonably be expected that more rapidly growing areas within the Permit Area may experience relatively greater loss of potential habitat. However, since the Permit Area is expected to remain predominantly rural, it can also be reasonably expected that substantial areas of potential GCWA habitat will persist for the foreseeable future.

The following discussion concerns the entire range of the GCWA in order to establish as much context for evaluating cumulative effects as possible. Impact is expressed in acres of GCWA breeding habitat modified or lost, or that has been authorized to be modified or removed, due to the Covered Actions. Unauthorized clearing of GCWA habitat has likely occurred in the past across the range of the GCWA; however, the location and extent of such clearing is unknown and is not included in the following analysis.

According to our consultations tracking database, there have been 48 formal section 7 consultations on the GCWA range-wide. The action area these consultations covered was over 70.8 million acres. Four of these consultations were on Fort Hood; therefore, we've only counted that action area once in the total area covered by formal consultations. One consultation covered almost half of Texas at 60 million acres. Over 60,290 acres of GCWA habitat were authorized to be effected by these consultations. Several large consultations make up the majority (over 52,000) of this acreage: 1) over 33,000 acres were associated with Fort Hood activities; 2) over 14,000 acres were associated with brush control projects throughout the GCWA's 35 county range; and 3) 5,000 acres were for activities on Camp Bullis, less than 15 percent of which was considered occupied. The result of these consultations is over 63,000 acres of GCWA habitat maintained on DOD land and over 68,000 acres of land preserved and/or maintained for the benefit of the GCWA.

Additionally, we have issued 129 individual 10(a)(1)(B) incidental take permits covering more than 885,819 acres (note: this is the permit area, not the actual acres of effected habitat). The majority of this acreage comes from two Regional HCPs: the BCP at 561,000 acres and Williamson County at 316,883 acres. In total all permits authorized effects to over 29,900 acres of GCWA habitat. Mitigation for these effects resulted in preservation of over 15,000 acres of GCWA habitat and almost $1.3 million dollars towards GCWA conservation either to the BCP to buy additional lands or to TPWD to manage the 4,500 acre Parrie Haynes Ranch in perpetuity. Additionally, the BCP has another 20,000 acres of land as part of their preserve, some of which does support GCWAs; and if Williamson County exercises their entire take authorized, an additional 4,000 acres will be preserved in perpetuity for the GCWA.

Should the Service issue the ITP to LCRA TSC, such authorization would result in the loss of up to 1,146 acres of habitat, or an additional 0.03 percent of available habitat rangewide. Under the No Action and Maximum Take Avoidance alternatives, there would be a loss of up to 881.2 acres rather than 1,146.0 acres, or an additional 0.02 percent of available habitat rangewide.

Future actions that are likely to affect GCWA breeding habitat are impossible to predict with any precision. However, within the 35 counties identified as containing GCWA breeding habitat (Service 1992), human population growth is expected to increase by approximately 40 percent over the life of the HCP (Texas State Data Center and Office of the State Demographer 2010). While it is not possible to project how much of this growth will occur in GCWA habitat, a 40 percent increase in population and associated development is likely to result in a cumulative loss of GCWA habitat.

Cumulative Impact Determination. Over the next 30 years and beyond, the projected population growth and concomitant commercial and residential development in the Permit Area could result in some adverse impacts to GCWAs and their habitat. The degree of adverse impacts will depend to a large degree upon the level of compliance with the ACT throughout the species' range in Texas. It is important to note that recent estimates of the amount of potential warbler habitat present on the landscape are significantly greater than the amount of habitat estimated present at the time of the listing of the warbler. The several large-scale HCPs either completed or in the planning stages (Williamson County Regional Habitat Conservation Plan [RHCP], Balcones Canyonlands Conservation Plan, Hays County RHCP, Comal County RHCP, and

Southern Edwards Plateau RHCP) together cover the seven most rapidly developing counties within the GCWA's breeding range. These conservation plans provide mechanisms for a higher level of compliance with the Act than has been seen in most parts of this area in the past, and lay the foundation for the establishment of several large GCWA preserves all along the southeastern portion of the species' breeding range. The high visibility of these conservation plans is also expected to encourage additional regional and individual compliance actions for the GCWA. With increased compliance with the Act and heightened enforcement by the Service of non-compliance, the cumulative adverse impacts of development on the GCWA should be substantially reduced.

The Priority Projects will affect only a very small fraction of the total amount of GCWA habitat in Texas, and will not make more than a minor contribution to cumulative adverse impacts to the species. In fact, implementation of the conservation measures in the FHCP could reduce the cumulative adverse impacts on GCWA habitat.

5.2.6.3 BCVI

As with the GCWA, future actions that are likely to affect BCVI breeding habitat are impossible to predict with any precision. The breeding range of the BCVI in the United States (four percent of the known breeding population resides in Mexico) comprises almost 34 million acres of rangeland, including approximately 1,450,000 acres of potential breeding habitat in 53 counties across the species range in Texas (Service 2007a). For the BCVI, the Service has consulted on 13 separate projects and approved the removal of approximately 7,567 acres of occupied or potentially occupied habitat (Service 2007a). The impact of past unauthorized take is unknown.

According to our consultations tracking database, there have been at least 22 formal consultations on BCVIs. The action area these consultations covered was over 61,818,294 acres. One consultation covered almost half of Texas at 60 million acres. Three of these consultations were on Fort Hood; therefore, we've only counted that action area once in the total area covered by formal consultations. Over 68,761 acres of BCVI habitat were authorized to be effected by these consultations. Of this acreage 52,900 acres were associated with brush management/prescribed fire consultations. An additional 15,460 acres were associated with activities on Fort Hood. These consultations resulted in over 23,000 acres of habitat managed/maintained specifically for the BCVI and an expectation of a net benefit of over 1.5 million acres in BCVI habitat creation from the brush management/prescribed fire consultations.

Additionally, we have issued three individual 10(a)(1)(B) incidental take permits covering more than 879,248 acres (note: this is the permit area, not the actual acres of effected habitat). The majority of this acreage is attributed to two Regional HCPs: the BCP at 561,000 acres, and Williamson County at 316,883 acres. In total these three permits authorize over 5,400 acres of effects to BCVI habitat and have currently resulted in 1,000 acres of mitigation and $1,000,000 given to the Texas Parks and Wildlife Foundation to perpetually manage BCVI habitat on the 4,500 acre Parrie Haynes Ranch.

Should the Service issue the ITP to LCRA TSC, such authorization would result in the loss of up to 2,446.5 acres of habitat, or an additional 0.16 percent of available habitat rangewide. Under the No Action and Maximum Take Avoidance alternatives, there would be a loss of up to

1,852.8 acres rather than 2,446.5 acres, or an additional 0.12 percent of available habitat rangewide. LCRA TSC proposes to mitigate for impacts to BCVI habitat to the maximum extent practicable by providing funding, likely through the purchase of credits from a Service-approved BCVI habitat conservation bank, for preservation and perpetual management of one or more large blocks of BCVI habitat.

Future actions that are likely to affect BCVI breeding habitat are impossible to predict with any precision. However, the Hays County and Comal County RHCPs, if approved, are expected to authorize additional impacts to BCVI habitat. The expected impacts to BCVI habitat in Hays County and Comal County are 1,300 acres and 1,000 acres, respectively, or approximately 0.16 percent of the estimated available habitat (2,300/1,450,000 x 100) (Comal County 2009, Hays County 2010). This amount, when combined with previously authorized take and that requested under the FHCP represents approximately 0.94 percent of the amount of BCVI habitat available in Texas. No take estimates are available at this time for the amount of BCVI habitat that may be authorized to be taken through the Southern Edwards Plateau RHCP.

Cumulative Impact Determination. The cumulative impacts determination is similar to that for the GCWA; however, BCVI habitat is distributed over a wider area that includes slower-growing counties in West Texas and beyond. Also, it is again important to note that the recent status review of the BCVI (Service 2007a) found that the population size and distribution of the species is significantly greater today than was thought at the time of the listing. As a result, the Service has recommended that the BCVI be downlisted from endangered to threatened. Even with continued growth in the human population within the range of the BCVI over the life of the FHCP, the focus on management of the BCVI brought by the original listing, and the long-term habitat preservation that will occur as a requirement of existing HCPs and RHCPs, and future HCPs and RHCPs will assist with the long-term viability of this species.

The Priority Projects will affect only a very small fraction of the total amount of BCVI habitat in Texas, and will not make more than a minor contribution to cumulative adverse impacts to the species. In fact, implementation of the conservation measures in the FHCP could reduce the cumulative adverse impacts on BCVI habitat.

5.2.6.4 Evaluation Species

Bald Eagle, Least Tern, Sprague's Pipit, and Whooping Crane. Future development or other changes in land use could increase or decrease the amount of breeding habitat available to bald eagle and least tern, increase or decrease the amount of wintering or stopover habitat available to all four of these species, and increase the number of collision risks to these species present on the landscape in the Permit Area. Future development could also exert influence on the distribution of nesting pairs of bald eagles.

Tobusch Fishhook Cactus. Five of the eight counties in which this species is known to occur are expected to experience population growth over the next 30 years. These are Bandera, Kerr, Kinney, Uvalde, and Val Verde. The other three counties, Edwards, Kimble, and Real, are expected to experience population declines (Texas State Data Center and Office of the State Demographer 2010). Future development and associated construction of infrastructure can reasonably be expected to result in the loss of some habitat for this species and the direct loss of

individuals to land clearing since the cactus occurs in upland, developable areas and most projects would occur on private lands where plants are not afforded protection under the Act from privately funded activities. It can be expected that some road and utility projects performed within the range of this cactus would include informal or formal consultation with the Service. Recent research on this species indicates that previously identified threats to the species remain, but its range is greater than previously known and its population is currently stable. For these reasons, the Service recommended that the cactus be downlisted to threatened (Service 2010b).

Cumulative Impact Determination. Construction of the Priority Projects under any of the three alternatives is expected to have a negligible effect on the amount of habitat available in the Permit Area for the bald eagle, least tern, Sprague's pipit, and whooping crane (see Section 4.7.4). Implementing any of the three alternatives would provide no more than a negligible contribution to the cumulative impacts to all the Evaluation Species except Tobusch fishhook cactus. Impacts to Tobusch fishhook cactus under any of the three alternatives could represent a negligible to minor contribution to the cumulative impact of land-disturbing projects on Tobusch fishhook cactus over the next 30 years. Impacts to the cactus could be offset to a minor degree by the ROW clearing, which, in some locations could improve habitat quality for the species by reducing shade cover.

5.2.6.5 State Special Status Species

Over the next 30 years and beyond, the projected population growth, land development, and associated impacts to vegetation communities in the Permit Area may result in cumulative adverse impacts to one or more of the special status species. The potential for cumulative adverse impacts to some of these species is reduced by the local, state, and Federal laws and regulations currently in place.

5.2.6.5.1 Avian and Bat Special Status Species

The avian species are the Baird's sparrow, common black-hawk, ferruginous hawk, peregrine falcon, snowy plover, western burrowing owl, and zone-tailed hawk. The bat species are the cave myotis and pale Townsend's big-eared bat. Human-caused threats to avian species include loss and degradation of habitat, poisoning by pesticides and contaminants, predation by cats and other introduced predators, and collisions with human-built structures and vehicles (Service 2002). Human-caused threats to bat species include destruction of habitat and collisions with wind turbines. All of these threats are present in the Permit Area and all will increase as the human population and development increases over the next 30 years.

Cumulative Impact Determination. Past, present, and foreseeable future actions in the Permit Area are expected to have an adverse cumulative impact on the avian and bat special status species; however, the Priority Projects are not likely to contribute to this cumulative impact to an appreciable degree. As described in Section 4.7.5, construction of the Priority Projects under any of the three alternatives is expected to cause no direct or indirect impacts, or negligible direct and indirect impacts, to habitat for the avian and bat special status species. Construction of the Priority Projects would nominally contribute to an overall expected increase with time in the number of collision risks for these species present on the landscape within the Permit Area.

5.2.6.5.2 Terrestrial Special Status Species

The terrestrial special status species addressed here include two mammals (black-tailed prairie dog and plains spotted skunk) and three reptiles (spot-tailed earless lizard, Texas horned lizard, and Texas garter snake). Changes in land use within the Permit Area over time could influence the distribution and abundance of suitable habitat for these species. In addition to loss, fragmentation, or disruption of habitat for these species, threats that currently exist and are expected to continue into the future include highway mortality; illegal collection for the pet trade; and, in the case of the black-tailed prairie dog and plains spotted skunk, deliberate extermination by poisoning and shooting (Texas Tech University 2011). The cumulative impact of these threats on the terrestrial special status species is expected to increase in those areas experiencing human population growth.

Cumulative Impact Determination. Construction of the Priority Projects under any of the three alternatives is not expected to have any effect on prairie dogs or spotted skunks following the construction phase, whereas the need to repair and maintain the transmission lines would create a periodic risk of collision mortality for Texas horned lizard, spot-tailed earless lizard, and Texas garter snake. Because LCRA TSC will conduct routine repair and maintenance activities outside of the breeding seasons for the Covered Species, it can be expected that such activities will primarily be performed during the fall and winter when reptiles are hibernating or are active for only limited parts of each day. None of the three alternatives is expected to contribute to cumulative impacts to black-tailed prairie dog in the Permit Area, but all three could contribute slightly to the cumulative impact of past, present, and future activities on plains spotted skunk and each of the terrestrial reptiles.

5.2.6.5.3 Aquatic Special Status Species

These species include Cagle's map turtle, Cascade Caverns salamander, Comal blind salamander, Valdina Farms Sinkhole salamander, Guadalupe bass, Leonora's dancer, *Allenhyphes michaeli* (a mayfly), bifurcated cave amphipod, Cascade Cave amphipod, Clear Creek amphipod, long-legged cave amphipod, Reddell's cave amphipod, and Russell stygobromid.

The cumulative impact on aquatic special status species is a function of the cumulative impact on the water resources they inhabit. Future land development, associated increased water demand, and associated impacts to surface water and groundwater resources in the Permit Area have the potential to adversely affect these species. However, several water quality and quantity-related laws, rules, regulations, and conservation efforts are in effect which reduce the potential for such development activities to adversely affect these species (see Sections 1.5.5, 1.5.7.2, and 4.6.1.1.1).

Cumulative Impact Determination. All three of the alternatives would create some potential for short-lived, temporary, negligible to minor impacts to water quality in certain stream segments during the construction phases of the Priority Projects. Because all impacts would be temporary and short-lived, each of the three alternatives would have no more than a negligible contribution to the degradation of water quality in streams of the Permit Area that is expected as a result of ongoing development and changes in land use, and so each alternative is expected to have a

negligible contribution to the cumulative impact of past, current, and future actions on the aquatic special status species.

5.2.6.5.4 Rawson's Metalmark and Sage Sphinx.

Future land development within the Permit Area could reduce the amount of habitat available for these species, although it is possible that both species could utilize landscape vegetation planted in yards within the Hill Country if those yards are provided with appropriate species of native xeriscape vegetation.

Cumulative Impact Determination. Loss of woodland as a result of ROW clearing and clearing of access roads under any of the three alternatives has potential to contribute to loss of habitat for Rawson's metalmark over time, if the woodland that would be cleared is utilized by this species. Any of the three alternatives could provide a minor contribution to the cumulative loss of habitat for Rawson's metalmark in the Permit Area, with this contribution slightly less under Alternative B because less woodland would be cleared from the ROW under that alternative. None of the three alternatives is considered likely to have more than a negligible contribution to cumulative impacts on sage sphinx because this species uses open habitats and the clearing of ROW could increase the amount of habitat available to this species on the landscape.

5.2.6.5.5 Plant Special Status Species

The plant special status species include big red sage, broadpod rushpea, canyon rattlesnake-root, Hill Country wild-mercury, Texas mock-orange, and Warnock's coral root. Future land development in the Permit Area can be expected to result in the direct loss of habitat for some of these species, especially broadpod rushpea and Hill Country wild-mercury since, unlike the other species which occur on slopes, these two species occur in upland, developable areas. Because plants are not afforded protection against take under the Act for private actions occurring on private lands, any future listing of these species as threatened or endangered is not expected to appreciably decrease the threats faced by these species.

Cumulative Impact Determination. Habitat for broadpod rushpea and Hill Country wild-mercury could be directly impacted by construction of the Priority Projects under any of the three alternatives, with such impact then contributing to the cumulative loss of habitat for these species that is expected to occur over time.

Most impacts to plants caused by the Priority Projects are expected to be temporary because most plants are expected to grow back into the ROW if present and disturbed during vegetation clearing activities. Clearing of woodland for the ROW and access roads under any of the alternatives could result in the permanent loss of a small amount of habitat for Warnock's coral root because this species occurs on shaded woodland floor. The contribution of any of the three alternatives to cumulative impacts on these plant species is expected to be negligible for those species that occur on steep slopes and minor for those species that occur in upland areas or on more gradual slopes.

5.2.6.6 Invasive Species

The status and distribution of invasive species within the Permit Area is expected to change through time primarily in response to commerce, changes in land use, and measures enacted to

control those species. The selling and transport of baled hay carries with it the potential to transport the seeds of invasive species from one property to another. Increases in the human population in the seven-county Permit Area could result in additional introductions of invasive species through ornamental plantings. The abundance of some species, such as salt cedar, may be locally reduced through eradication efforts funded through a program sponsored by the NRCS.

Cumulative Impact Determination. Each of the three alternatives would provide a minor contribution to the cumulative impact of increasing development and continued use of agricultural practices on the status of invasive species in the Permit Area.

5.2.7 Cultural Resources

Cultural resources are non-renewable and currently are not protected against privately funded actions occurring on private lands. Lands in the Permit Area are private lands and are used for a variety of purposes, including ranching, farming, residential development, parks and open space, mineral extraction (including oil and gas), wind energy, roads and transportation, natural gas pipelines, transmission and power distribution, and hunting. The background investigation of cultural resources in the Permit Area revealed that ground disturbance resulting from some past and present land uses, specifically agricultural activities, have contributed impacts to known cultural resources within the Permit Area (PBS&J 2010a, 2010b).

Over the next 30 years and beyond, population growth and associated land development in the Permit Area can be expected to result in the occasional disturbance or destruction of archeological sites on private lands and without those sites being recorded prior to their being impacted. Road projects, pipeline projects, and other infrastructure projects are also expected to result in periodic disturbance or destruction of archeological sites, although such disturbance can be expected to be conducted in coordination with the THC and not cause impact to any significant sites without those sites first being recorded and mitigated in accordance with existing state and Federal cultural resource regulations. Continuing development can also be expected to alter viewsheds through the addition of roads, buildings, towers, transmission lines and other human-made features, possibly including the alteration of views available from significant historic properties present within the Permit Area.

Given historic trends, over time some significant or potentially significant sites within the Permit Area would likely be destroyed through unauthorized looting. It is also expected that numerous people using or visiting undeveloped lands within the area will collect projectile points and other prehistoric artifacts found on those properties and place those artifacts in private collections.
Cumulative Impact Determination. Construction of the Priority Projects under all three alternatives is not expected to result in the loss or disturbance of any significant archeological sites. Consequently, the contribution of the Priority Projects to the adverse cumulative loss of cultural resources within the Permit Area is considered negligible.

5.2.8 Land Use

Land in the Permit Area is predominantly private. Although land use in the Permit Area is dominated by agriculture and grazing (PBS&J 2010a), other past and present land uses in the Permit Area include ranching, farming, residential development, parks and open space, mineral

extraction (including oil and gas), wind energy, roads and transportation, natural gas pipelines, transmission and power distribution, and hunting.

As discussed in Section 5.2.9 below, the human population within the Permit Area is expected to increase over the next 30 years, although growth is expected to be uneven, with the populations of some counties increasing while the populations of others decrease or remain relatively stable. As a result, it is expected that counties with growing populations will experience ongoing conversion of some agricultural and grazing lands to other uses, such as residential neighborhoods, roads, commercial operations, schools, and parks. Counties with stable or decreasing populations can be expected to maintain current levels of agricultural and grazing lands, or see some agricultural lands convert to woodlands or brushlands where active land management is discontinued.

Cumulative Impact Determination. Building the Priority Projects would result in some minor changes to uses of land within the Permit Area. Landowners could be constrained by provisions in their easement agreements with LCRA TSC. Given that the land included in the Priority Project ROW represents a very small percentage of the Permit Area, and the fact that the dominant land use in the Permit Area, livestock grazing, would be allowed to continue within the ROW, the contribution of the Priority Projects to the cumulative impact on land use within the Permit Area is considered negligible.

5.2.9 Socioeconomic Resources

The population within the seven-county Permit Area is expected to increase by a moderate 14.5 percent over the next 30 years (see Table 3.11). While this population growth will necessitate some growth in residential and commercial development, it is likely that the majority of the Permit Area will retain its rural, agricultural status for the foreseeable future. As indicated by the leading employers and industries of the counties within the Permit Area (see Tables 3.13 and 3.14), socioeconomic conditions across most of the area are tied to agricultural markets. The oil and gas industry and the U.S. military also contribute appreciably to socioeconomic conditions in some counties within the Permit Area. With time, increases in population in some of the counties in the area and/or changes in agricultural and oil and gas market conditions could cause a shift in order of leading industries and employers. Tourism is likely to remain strong in the Hill Country and grow in tandem with statewide population growth. Future levels and patterns of employment depend upon many unknown variables within and outside of the Permit Area and, as such, cannot be predicted.

Cumulative Impact Determination. Under all three alternatives, construction of the Priority Projects could provide minor short-term economic benefits. However, over the next 30 years, socioeconomic conditions across the Permit Area are not expected to be influenced by the Priority Projects because presence of the transmission lines is not expected to induce growth or alter the total amount of development that occurs in any particular county (see Section 4.10.1.1). Overall, the Priority Projects are expected to make a negligible contribution to cumulative change in socioeconomic conditions within the Permit Area.

5.2.10 Environmental Justice

Over the next 30 years, the expected increases in human population in some counties within the Permit Area will need to be accommodated through the construction of public infrastructure, such as roads and electrical distribution lines, and likely will also require the publicly funded construction of schools and police and fire stations. Privately funded projects can also be expected, with examples including construction of cellular phone towers, restaurants, medical clinics, gas stations, other commercial operations, and, possibly, larger scale projects such as natural gas or water pipelines. The general locations of most publicly or privately funded projects constructed in response to a growing population would be dictated by local need or demand. Any such projects requiring Federal permits would be expected to proceed under consideration of environmental justice laws and regulations, but those requiring no approval, or only local, county, and/or state approvals likely would not.

Cumulative Impact Determination. Under all three alternatives, the presence of the Priority Projects may influence the type of development or land use that occurs on properties adjacent to the Priority Project ROW. It cannot be foreseen who will own such properties in the future and whether such future development or land use might disproportionately affect lands owned by minorities or low-income persons. Nevertheless, the Priority Projects are not expected to contribute to cumulative disproportional adverse impacts to minority and low-income residents of the Permit Area.

5.2.11 Roads and Aviation

No discernible post-construction impacts to roads or traffic are expected (see Section 4.12.1.1); thus, roads and traffic are dismissed from cumulative impact analysis. However, construction of the Priority Projects does have potential to contribute to cumulative impacts to aviation in the Permit Area; therefore, potential cumulative impacts to aviation are addressed below. Collisions with tall objects constitute one of many types, although hardly a leading type, of general aviation accident (Li and Baker 2007). It is important to note that many factors other than colliding with structures are implicated in aircraft accidents, including, but not limited to, mechanical problems, weather conditions, improper operation of the aircraft, and pilot incapacitation (Li and Baker 2007). The presence of towers or transmission lines in an area does not make that area unsafe for aviation. Pilots are trained to watch for obstacles and generally do not fly at low altitudes in unfamiliar terrain in conditions of poor visibility. That said, all tall structures represent some degree of collision risk to low-flying aircraft.

Presently, many potential obstacles occur within the Permit Area, including electrical transmission and distribution lines and support structures, communication towers, meteorological evaluation towers, and wind turbines. Over the next 30 years, increasing population and associated development is expected to result in an increase in the number of such obstacles, particularly communication towers, within the Permit Area. Like the Priority Projects, any towers or transmission lines constructed within the area are expected to be set back from airports and marked in accordance with FAA regulations. These measures should reduce the risk of collision for aircraft taking off from or landing at airports within the Permit Area.

Cumulative Impact Determination. Construction of the Priority Projects would result in an addition to the cumulative number of tall structures present within the Permit Area. However,

for the reasons cited in the preceding paragraphs, the Priority Projects and other tall structures in the Permit Area are not expected to cumulatively create unsafe flying conditions within the Permit Area.

5.2.12 Human Health and Safety

As discussed in Section 5.2.9, the human population within the Permit Area is expected to increase over the next 30 years, although growth is expected to be uneven, with the populations of some counties increasing while the populations of others decrease or remain relatively stable. Increased population can reasonably be expected to result in increased risks to human health and safety in several ways. For example, areas with increasing populations can be expected to experience higher traffic rates on roads, which will increase the risk of vehicle-to-vehicle collisions for people already living within the Permit Area. Increases in the human population creates potential for decreased response time by emergency service providers for it increases the likelihood that such providers could already be responding to one emergency situation when another emergency arises. Increases in human population can also be expected to increase the risk of wildfires, for it can be expected that more people in the Permit Area will be throwing cigarettes out of car windows, burning cut brush and yard waste, building campfires, using electrical equipment that throw sparks, and setting off fireworks. Although low frequency electric and magnetic fields (ELF-EMF) may or may not pose a health risk, there is a widespread public perception that they do. Sources of ELF-EMF will undoubtedly increase in areas where the human population increases. As discussed in Section 3.13.1, ELF-EMF are a direct consequence of the generation, transmission, and use of any type of electrically producing material, including those associated with all electricity-powered devices in homes, workplaces, and commercial and public establishments. Wires transmitting electrical current within buildings, to buildings, and across country also generate ELF-EMF.

Cumulative Impact Determination. As noted in Section 4.13, the potential for the Priority Projects to result in increased risks to human health and safety is negligible to minor. Compared to all the other potential sources of health and safety risks, especially those producing wildfires, likely to be present in the Permit Area over the next 30 years, the contribution of the Priority Projects is expected to be negligible to minor.

5.2.13 Noise

Noise generated within the Permit Area originate from a variety of sources, including but not limited to operation of motor vehicles and other mechanical equipment, sirens, aircraft flyovers, operation of electrical devices, and barking dogs. With increased development in some counties within the Permit Area, it can be expected that ambient noise levels in portions of those counties will increase with time, particularly as a result of increased use of roads. Ambient noise levels can also be expected to be punctuated locally by the temporary sounds of home and road construction. Ambient noise levels in those areas that do not experience growth are likely to remain similar to current levels.

The only loud sounds expected to result from implementation of any of the three alternatives and performance of the Covered Activities would be temporary and occur during the construction phase of each transmission line. Other noises resulting from operation and maintenance of the transmission lines would be comparatively quiet and would not be heard except by noise

receptors (people/animals) that were in immediate proximity to the transmission line ROW (see Section 4.14.1).

Cumulative Impact Determination. Comparatively loud noises would be generated locally by construction of the Priority Projects under any of the three alternatives, but these noises would be temporary and are not expected to have any cumulative effect on noise within the Permit Area. Operation and maintenance of the transmission lines would contribute to the addition of sources of noise on the landscape within the Permit Area, but because these noises would be comparatively quiet and would not be able to be heard over long distances, the cumulative effect of the transmission lines on noise within the Permit Area is expected to be negligible to minor.

5.3 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are those effects that would occur following implementation of all recommended mitigation measures. These effects do not have to be avoided by the planning agency, but they must be disclosed and discussed (40 CFR 1500.2(e)). It is not always possible to avoid adverse impacts from implementation of an alternative.

Because population growth and associated development is expected within some of the counties encompassed by the Permit Area, adverse impacts to nearly all natural and human resources considered in this EA are expected over time under all three alternatives. Unavoidable adverse impacts expected under all alternatives include the clearing of woody vegetation, including some endangered species habitat, from within transmission line ROW; the deterioration of some viewsheds through construction of the Priority Projects; and some increased amount of avian collision mortality. It is important to note, however, that regardless of whether the Priority Projects are built as described in the FHCP, electric transmission lines will be built within the Permit Area. Construction of any such transmission lines would have similar effects on the resources described above, but may not result in the protection of as much Covered Species habitat as has been proposed under the FHCP.

5.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA regulations at 40 CFR 1502.16 require that the discussion of environmental consequences include “any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented.” An irreversible commitment of resources may be defined as the loss of future options. It applies primarily to non-renewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity.

Because the Priority Projects would cause minimal damage to soils and could be decommissioned and removed, few of the resources that would be impacted under the Preferred Alternative would be irreversibly and irretrievably committed. Construction of the Priority Projects would result in the consumption of natural resources such as sand, gravel, and steel and other metals, as well as fuel, water, and other materials. Much of the metal used in the construction of the lines could ultimately be salvaged and recycled upon decommissioning. Use of water resources would be temporary and largely be limited to on-site mixing of concrete for structure foundations and dust abatement activity.

Habitat for the GCWA and BCVI cleared within ROW for the transmission lines would not be irretrievably lost, although ROW maintenance activities would preclude the regrowth of such habitat for as long as the ROWs were maintained. Regrowth of GCWA habitat within a transmission line ROW would likely require decades, although regrowth of BCVI habitat could be realized over just a few to several years, depending on rainfall. Land contained within the transmission line ROW would continue to provide habitat for wildlife, although some local changes in the structure of faunal assemblages would be expected where clearing of ROW resulted in replacement of woody vegetation communities with predominantly herbaceous communities.

The integrity of any cultural resource sites disturbed during the construction process would be irretrievably lost; however, the information contained in any significant sites would have been recorded prior to disturbance.

The Priority Projects would result in few changes to existing agricultural practices because farming and grazing could continue in and around the structures and other project components. Any transmission line structures placed on farmland would prevent a small amount (approximately 625 to 900 square feet per structure) of land from being used for crop production for as long as the structures remained on the landscape. Ability to use that land could be retrieved through removal of the transmission line structures, although the utilization opportunity lost over the period of time that the structures remained on the landscape would be irretrievable.

5.5 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

NEPA requires consideration of the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). Short-term uses are generally those that determine the present quality of life for the public. The quality of life for future generations depends on long-term productivity and the ability of the environment to support that productivity on a sustainable basis.

The intent of the Priority Projects is to carry electrical power generated in West Texas to the end users located in Central Texas, North Texas, and the Houston area. An adequate and dependable supply of electrical power would maintain or improve the quality of life for present and future generations of the public. Construction of the transmission lines is expected to occur largely across non-arable grazing lands and with minimal loss of grazing opportunities, so the potential for long-term loss in agricultural productivity is expected to be negligible. Because the transmission line ROW would continue to support wildlife habitat, the Priority Projects are also expected to have a negligible effect on wildlife productivity or the ability of humans to harvest wildlife through hunting.

5.6 CUMULATIVE GROWTH-RELATED IMPACTS

The PUC mandated the construction of the CREZ transmission lines to carry renewable energy from generation sources in western Texas and the Texas Panhandle eastward to the populous eastern half of the state. As such, the CREZ transmission lines are most properly viewed as projects induced by desire on the part of the Federal government and State of Texas to increase the share that renewable energy contributes to energy consumed in the state and nationally. The CREZ transmission line projects cannot cause or induce the development of wind energy or other

types of renewable energy projects and, therefore, the impacts associated with construction of those types of projects cannot be viewed as indirect effects of construction of the CREZ transmission lines.

The extent to which any additional wind energy or other renewable energy generation projects will be constructed within the CREZ serviced by the Priority Projects is not known. The State of Texas in 2005 established a Renewable Portfolio Standard (RPS) requiring that 5,880 MW of energy produced in the state be generated from renewable sources and setting a goal of 10,000 MW of renewable energy capacity by 2025 (American Council on Renewable Energy 2011, State Energy Conservation Office 2011). The 10,000 MW goal was reached in 2009. Largely for this reason, the U.S. Energy Information Administration (USEIA) has forecast that renewable energy capacity in the ERCOT region, which contained approximately 9,400 of the 10,000 MW in 2009, will increase by approximately 7.4 percent to 10,100 MW by the year 2035 (USEIA 2011).[14] This is a modest rate of growth compared to that experienced over the past decade, and it is possible that changes to the RPS could be made by the State of Texas in the future that cause the USEIA estimate to be inaccurate.

However, if accurate, this estimate suggests that approximately 700 MW of renewable capacity will be added to the ERCOT region over the next 24 years. The largest wind generation project in Texas has a capacity of approximately 781.5 MW (American Council on Renewable Energy 2011), although most projects have a capacity less than 100 MW. This suggests that if the 700 MW estimate is accurate, the number of wind generation projects constructed in the ERCOT region over the next 24 years would be comparatively few, perhaps ranging from 10 to 14 if individual projects have capacities averaging from 50 to 70 MW. Again, whether any new wind generation projects will be built in the CREZ serviced by the Priority Projects is unknown.

Any wind generation projects built in that CREZ would be expected to transmit their generated electricity to the ERCOT high voltage transmission grid via the Priority Projects. Because it is not known where any such projects might be constructed, it is not possible to quantify the environmental and socioeconomic impacts expected to result from that construction. In general, the construction of a wind generation project results in the direct disturbance of vegetation and wildlife habitat in those areas cleared for construction of wind turbine generators, access roads, installation of collector lines, and any necessary substations. Construction of wind turbine generators creates collision hazards for birds and bats, can result in local displacement of certain wildlife species, can decrease aesthetic qualities of local viewsheds, and can increase ambient noise levels at the local scale. Impacts to geologic resources and soils resulting from the construction of wind generation projects are typically minimal given the surficial nature of the projects. Wind generation projects can also have positive socioeconomic benefits by creating temporary construction-related employment opportunities and a small number of permanent employment opportunities.

[14] Renewable energy projects located in most of the Texas Panhandle and portions of east Texas lie outside the ERCOT region (USEIA 2011).

Table 5.1. Past, Present, and Reasonably Foreseeable Future Actions That May Contribute to Cumulative Impacts

Project Name	Location	Project Type	Brief Description	Scope	Status
Gillespie County: 1,061 sq. miles					
TxDOT Projects	Gillespie County	Roads & Transportation	There were seven TxDOT projects in Gillespie County. All of these projects are east of the Priority Projects. The TxDOT projects are small in geographical area and are for road resurfacing, repair, or widening and replacement of bridges.	Countywide	Past, Present, Future
	Gillespie County	Mineral	Mineral extraction continues to contribute to the region's economy, with surface mines and quarries located throughout the Permit Area (Mine Safety & Health Administration 2009). Mineral resources include limestone, talc, gypsum, and metallic minerals. The site Radiant Red Quarry mines Dimension stone (Lat: 30.369, Long: -98.854) and Cherry Mountain Mine extracts Gypsum (Lat: 30.425. Long: -98.868).	Countywide	Present
	Gillespie County	Oil & Gas	The Gillespie maps indicated three gas or oil wells west, southwest and south of Fredericksburg.		Present
	Gillespie County	Pipelines	Three natural gas pipelines are located in Gillespie County; one in the southwest quadrant, one in the northeast quadrant, and one that bisects the county from north to south.	Countywide	Past, Present
Kendall County: 663 sq. miles					
TxDOT Projects	Kendall County	Roads & Transportation	There were seven past and current documented TxDOT projects, four of which are bridge repairs or replacements, two road repairs, and one safety barrier installation which is 11.7 miles in length and will take 116 days to complete. Five of the seven projects have been completed, one is in progress, and one not yet started.	Total: 26.3 miles	Past, Present, Future
2004 Master Plan Parks, Recreation, & Open Space	Kendall County	Parks, Recreation, & Open Space	This master plan covers 2004–2014 and will be updated every 5years after the introduction date. The plan will provide a system of parks & open spaces to meet recreational needs while being conscious of the environment and continuing need to preserve the historical character of the county. This plan includes providing access to undeveloped riparian zones for water recreation & creating/updating trails systems.	Countywide	Past, Present, Future
	Kendall County	Pipelines	Two natural gas pipelines in Kendall County include one that bisects the county east to west and one located on the southern county border.	Countywide	Past, Present
Kerr County: 1,106.12 sq. miles					
TxDOT	Kerr County	Roads & Transportation	There are 15 TxDOT past and current projects documented for Kerr County. Most projects consist of minor road projects that are over 85% complete.	Countywide	Past, Present, Future
	Kerr County	Oil & Gas	There is currently one active oil and gas field in Kerr County.		Past, Present, Future
Regional Water Plan 2011–2015	Kerr County	Water Development	Projected water need increase 2010–2060 is 627 acre-feet per year (af/y), with a municipal increase of 900 af/y and a decrease in irrigation by 273 af/y.	Countywide	Future
Salvation Army Drainage & Detention Pond	Kerrville	Stormwater detention facility	This detention facility is being built near the athletic fields at the new KROC Center. It will eliminate downstream flooding during storms, and resolve the soil deficit problems in the local landfill.	980,000 cubic feet	Past
	Kerr Coun-	Pipelines	There are four natural gas pipelines located in Kerr County, one in the southwest quadrant,	Countywide	Past, Present

Table 5.1. Past, Present, and Reasonably Foreseeable Future Actions That May Contribute to Cumulative Impacts

Project Name	Location	Project Type	Brief Description	Scope	Status
	ty		two in the area of Kerrville, and one in the northeast quadrant of the county.		
	Kerrville	Community	A Master Plan for the continual growth of the city of Kerrville was adopted July 2002 and revised in August 2008. Kerrville will most likely approach a population of around 30,000 residents by 2020. The two main goals for the Master Plan are to create "efficient land use patterns in annexation requests and to promote growth in the appropriate areas." The land use and future land use maps section in the Master Plan document state that, "the land inside Kerrville's corporate limits can meet most of the growth demands of the next two decades."	City of Kerrville	Past, Present, Future
Kimble County: 1,251 sq. miles					
TxDOT Projects	Kimble County	Roads & Transportation	There were three TxDOT projects in Kimble County. One of the projects, I.D. 246901007, is for construction of 0.6 miles of new road south of the I-10, which will connect FM 2169 to US 377 in Junction, TX. This project is 63% complete. The other projects, for road resurfacing and safety barrier upgrades, have already been completed.	0.6 mile	Past, Present, Future
	Kimble County	Oil & Gas	There are currently 23 oil and gas fields in Kimble County.	Countywide	Past, Present, Future
	Kimble County	Pipelines	Three natural gas pipelines are located in Kimble County, one in the northeast quadrant, one in the southwest quadrant, and one bisecting the county from north to south.	Countywide	Past, Present
County: Schleicher: 1,309 square miles					
TxDOT Projects	Schleicher County	Roads & Transportation	As of 30 November 2009, there were three TxDOT projects in Schleicher County. All of these projects are south and southwest of the Priority Projects route. The projects are small in geographical area and are for road resurfacing.		Past, Present, Future
	Schleicher County	Gas & Oil	Neva West is a major oil field in this county. There are currently 165 oil and gas fields in Schleicher County.		Past, Present, Future
	Schleicher County	Wind Power	The Langford Wind Farm, operated by NRG Energy, has 100 General Electric 1.5 MW turbine generators. The wind farm is located in southwestern Tom Green County, northern Schleicher County, and southeastern Irion County.	35,000 acres	Present, Future
	Schleicher County	Pipelines	Five natural gas pipelines are located throughout Schleicher County, with a majority located in the western half of the county.		Past, Present
	Schleicher County	Minerals	Mineral resources include dolomite, limestone, and industrial sand.		Past, Present, Future
Sutton County: 1,455 sq. miles					
TxDOT Projects	Sutton County	Roads & Transportation	There are three TxDOT projects in Sutton County. All of these projects are south and southwest of the Priority Projects route. The projects are small in geographical area and are for road resurfacing or repair.		Past, Present, Future
	Sutton County	Gas & Oil	Sutton's oil and gas reserves had significant production in the late 1960s and peaked in the 1970s. Crude Oil production peaked at 104,000 barrels annually.		Past, Present, Future

Table 5.1. Past, Present, and Reasonably Foreseeable Future Actions That May Contribute to Cumulative Impacts

Project Name	Location	Project Type	Brief Description	Scope	Status
	Sutton County	Pipelines	Several natural gas pipelines exist throughout Sutton County. There are at least seven pipelines and several associated offshoots.		Past, Present, Future
Tom Green County: 1,540 sq. miles					
TxDOT Projects	Tom Green County	Roads & Transportation	There are 33 TxDOT projects in Tom Green County. Project I.D. 007706085, for construction of 11.1 miles of new roadway lanes from 1.6 miles south of Loop 306 to the Iron County Line along US 67 crosses through the right of way for the Twin Buttes–Big Hill Transmission Line. This project is currently 95.1% completed.	11.1 miles	Past, Present, Future
	Tom Green County	Gas & Oil	Oil has been pumped in Tom Green County since 1940, but production is now declining. There are currently 167 oil and gas fields in Tom Green County.		Past, Present, Future
	Tom Green County	Pipelines	Two major pipelines are located in Tom Green County. The Atmos Pipeline carrying natural gas bisects the county, and the Pride Pipeline System carrying various fuels is in the northwest portion of the county.		Past, Present
	Tom Green County	Minerals	Commercial minerals extracted include caliche, limestone, and oil and gas in the south-central and northwest regions of the county.		Past, Present
Proposed Expansion of City Limits	San Angelo	Community Development	San Angelo has proposed the enlargement and extension of the boundary limits of the city to 200 acres southwest of the existing city limits. The annexed area will include Lake Nasworthy Power Station, "a 500-foot-wide strip of land occupied by parallel arrays of electric power transmission lines," and a 0.34-mile segment for Red Bluff Road.	200 acres	Present, Future
Runway Rehab	San Angelo	Runway Improvements	A bid for the additions to runway 3-21 was accepted on 25 February 2011. A new coal tar emulsion will be applied to Runway 3-21.		Present, Future
San Angelo Project	San Angelo	Dam/Reservoir Construction	The San Angelo Project is in the immediate vicinity of the City of San Angelo. Bureau of Reclamation development includes Twin Buttes Dam and Reservoir, a headworks at Nasworthy Reservoir, and an irrigation and distribution system to serve a project area of about 15,000 acres.	15,000 acres	Past
Langford Wind Farm	Tom Green County	Wind Power	The Langford Wind Farm, operated by NRG Energy, has 100 General Electric 1.5 MW turbine generators, which are expected to generate more than 525,000 MW hours of wind energy per year. The wind farm is located in southwestern Tom Green County, northern Schleicher County, and southeastern Irion County.	35,000 acres	Present, Future

LITERATURE CITED

AirNav. 2010. Airport Information (Online). Accessed June 2010 at: http://www.airnav.com/airports/.

Alldredge, M.W., J.S. Hatfield, D.D. Diamond, and C.D. True. 2002. Population viability analysis of the GCWA. U.S. Fish and Wildlife Service, Austin, Texas.

American Council on Renewable Energy. 2011. Renewable Energy in America: Markets, Economic Development and Policy in the 50 States, Spring 2011 Update (Online). Accessed October 2011 at http://www.acore.org/files/pdfs/states/reamerica_mar11.pdf.

AmphibiaWeb. 2009. *Eurycea latitans*: Cascade Caverns salamander (Online). Accessed October 2010 at: http://amphibiaweb.org.

AMS (American Meteorological Society). 2007. An Information Statement of the American Meteorological Society. (Online). Accessed August 2010 at: http://www.ametsoc.org/policy/2007climatechange.pdf.

Anaya, R. 2004. Conceptual model for the Edwards-Trinity Plateau Aquifer System, Texas. In Aquifers of the Edwards Plateau, edited by R.E. Mace, E.S. Angle, and W.F. Mullican, III, Chapter 2, Pages p. 20–61 Texas Water Development Board Report 360 (Online). Accessed in October 2010 at: http://www.twdb.state.tx.us/publications/reports/GroundWaterReports/GWReports/R360AEPC/Ch02.pdf.

APLIC (Avian Power Line Interaction Committee). 2006. Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, D.C. and Sacramento, California.

Arnold, K., C. Coldren, and M. Fink. 1996. The interaction between avian predators and GCWAs in Travis County, Texas. Sponsored by the Texas Department of Transportation. Research report 1983-2, study number 7-1983, Texas Transportation Institute, Texas A&M University, College Station.

Aspen Environmental Group. Undated. Transmission line noise: Factsheet (Online). Accessed October 2010 at: http://docs.cpuc.ca.gov/environ/tehachapi_renewables/FS7.pdf.

Atlas (Texas Archaeological Sites Atlas). 2011. Texas Archaeological Site Atlas restricted database, Texas Historical Commission (Online). Accessed August 2010 at: http://pedernales.thc. state.tx.us/.

Austin and Reichert 2001

Baccus, J.T., and M.W. Wallace. 1997. Distribution and habitat affinity of the swamp rabbit (*Sylvilagus aquaticus*: *Lagomorpha; Leporidae*) on the Edwards Plateau of Texas. Occ. Papers of Museum of Texas Tech University, No. 167.

Barnes, V.E. 1988. The Precambrian of central Texas. In Centennial field guide Volume 4: South-Central Section Geological Society of America, edited by O.T. Hayward. Boulder, Colorado.

Bayle, P. 1999. Preventing birds of prey problems at transmission lines in western Europe. Journal of Raptor Research 33(1):43–48.

Bever, M.R., and D.J. Meltzer. 2007. Exploring Variation in Paleoindian Live Ways: The Third Revised Edition of the Texas Clovis Fluted Point Survey. Bulletin of the Texas Archeological Society 78:65–99.

Blair, W.F. 1950. The biotic provinces of Texas. Texas Journal of Science 2:93–117.

Bohm, R.T. 1988. Three bald eagle nests on a Minnesota transmission line. Journal of Raptor Research 22(1):34.

Bomar, G.W. 2008. Texas climate. Chapter 2 in Texas Renewable Energy Resource Assessment. Frontier Associates, LLC., Austin, Texas (Online). Accessed October 2010 at: http://www.seco.cpa.state.tx.us/publications/renewenergy/pdf/c02-texasclimate.pdf

Bousman, C.B., M.B. Collins, P. Goldberg, T. Stafford, J. Guy, B.W. Baker, D.G. Steele, M. Kay, A. Kerr, G. Fredlund, P. Dering, V. Holliday, D. Wilson, W. Gose, S. Dial, P. Takac, R. Balinsky, M. Masson, and J. Powell. 2002. The Palaeoindian-Archaic Transition in North America: New Evidence from Texas. Antiquity 76:980–990.

Bousman, C.B., B.W. Baker, and A.C. Kerr. 2004. Paleoindian Archeology in Texas. In The Prehistory of Texas, edited by T.K. Pertulla, pp. 15–97. Texas A&M University Press, College Station.

Brown, W.M. and R.C. Drewien. 1995. Evaluation of two power line markers to reduce crane and waterfowl collision mortality. Wildlife Society Bulletin 23(2):217–227.

Bureau of Economic Geology. 1976. Geologic Atlas of Texas, Brownwood Sheet. University of Texas at Austin.

Bureau of Economic Geology. 1981a. Geologic Atlas of Texas, Sonora Sheet. University of Texas at Austin.

Bureau of Economic Geology. 1981b. Geologic Atlas of Texas, Llano Sheet. University of Texas at Austin.

Bureau of Economic Geology. 1983. Geologic Atlas of Texas, San Antonio Sheet. University of Texas at Austin.

California Department of Forestry and Fire Protection. 2006. 20 Largest California Wildland Fires (Online). Accessed December 2010 at: http://www.fire.ca.gov/communications/downloads/fact_sheets/20LACRES.pdf.

California Public Utilities Commission. 2008. Final Environmental Impact Report / Environmental Impact Statement and Proposed Land Use Amendment San Diego Gas & Electric Company Application for the Sunrise Powerlink Project. SCH #2006091071, DOI Control No. FES-08-54. Prepared for the California Public Utilities Commission and Bureau of Land Management. Prepared by Aspen Environmental Group.

Campbell, L. 2003a. Endangered and Threatened Animals of Texas–Their Life History and Management. Texas Parks and Wildlife Department, Austin.

Campbell, R.B. 2003b. Gone to Texas: A History of the Lone Star State. Oxford University Press. New York.

Chippindale, P.T., D.M. Hillis, and A.H. Price. 1994. Relationships, status, and distribution of central Texas hemidactyliine pkethodontid salamanders (*Eurycea* and *Typhlomolge*). Final Section 6 Report.

Chippindale, P.T., A.H. Price, J J. Wiens, and D.M. Hillis. 2000. Phylogenetic relationships and systematic revision of central Texas hemidactyliine plethodontid salamanders. Herpetological Monographs 14:1–80.

Cimprich, D.A. 2005. Monitoring of the BCVI during 2005 on Fort Hood, Texas. In *Endangered species monitoring and management at Fort Hood, Texas: 2005 annual report*. The Nature Conservancy, Fort Hood Project, Texas.

Cimprich, D.A. and K. Comolli. 2010. Monitoring the BCVI on Fort Hood Military Reservation. Presented at the 2010 BCVI Symposium, Austin, Texas. 28 October 2010.

City of San Angelo. 2009. San Angelo Regional Airport – Mathis Field. (Online) Accessed October 2010 at: http://www.sanangelotexas.org/.

City of Austin. 2007. Balcones Canyonlands Preserve Land Management Plan, Tier II-A, Chapter III, Oak wilt management (Online). Accessed September 2011 at: http://www.ci.austin.tx.us/water/wildland/downloads/tier2a3oakwiltmanagement.pdf.

Cohan, E.J. 2009. How should the Department of Defense approach environmental security implications of climate change. Master's thesis, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas.

Coldren, C.L. 1998. The effect of habitat fragmentation on the GCWA. Ph.D. Dissertation. Texas A&M University, College Station.

Collins, M.B. 1995. Forty Years of Archeology in Central Texas. *Bulletin of the Texas Archeological Society* 66:361–400.

Collins, M.B. 2004. Archeology in Central Texas. In *The Prehistory of Texas*, edited by T.K. Pertulla, pp. 101–126. Texas A&M University Press, College Station.

Comal County. 2009. Comal County Regional Habitat Conservation Plan: Draft Final. Prepared by SWCA Environmental Consultants; Smith Robertson, Elliott, Glen, Klein & Bell, LLP; Prime Strategies, Inc.; Capital Market Research, Inc.; and Texas Perspectives, Inc. Austin, Texas.

Comer, P., S. Menard, M. Tuffly, K. Kindscher, R. Rondeau, G. Jones, G. Steinuaer, R. Schneider, and D. Ode. 2003. Upland and Wetland Ecological Systems in Colorado, Wyoming, South Dakota, Nebraska, and Kansas. Report and Map to the National Gap Analysis Program, U.S. Geological Survey. NatureServe, Arlington, Virginia.

Conant, R., and J.T. Collins. 1998. A field guide to reptiles and amphibians: eastern and central North America. Houghton Mifflin Company, Boston, Massachusetts.

CWS (Canadian Wildlife Service) and Service (U.S. Fish and Wildlife Service). 2007. International Recovery Plan for the Whooping Crane. Ottawa: Recovery of Nationally Endangered Wildlife, and U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Dahl, T.E. 1990. Wetlands Losses in the United States 1780s to 1980s. U.S. Fish and Wildlife Service, Washington D.C.

Davis, S.D., V.H. Heywood, O. Herrera-MacBryde, J. Villa-Lobos, and A.C. Hamilton (eds.). 1997. Edwards Plateau, Texas, U.S.A. In *Centres of plant diversity, A guide and strategy for their conservation*. Volume 3: The Americas. World Wildlife Fund and IUCN (Online). Accessed October 2010 at: http://botany.si.edu/projects/cpd/na/na32.htm.

Dering, P. 2007. Assessment of Botanical and Faunal Assemblages from Paleoindian and Early Archaic Components on the Periphery of the Southern Plains. Bulletin of the Texas Archeological Society 78:177–195.

Diamond, D.D. 2007. Range-wide Modeling of GCWA Habitat. Missouri Resource Assessment Partnership. Unpublished report prepared for the Texas Parks and Wildlife Department, Wildlife Diversity Program, Austin.

Dixon, J.R. 2000. Amphibians and Reptiles of Texas, Second Edition. Texas A&M University Press, College Station:421.

DLS Associates. 1992. GCWA investigations: Lake Georgetown project, Williamson County, Texas. Unpublished report prepared for the U.S. Army Corps of Engineers, Lake Georgetown Project Office. DLS Associates Project No. 92-327.

Eckhardt, G. undated. Introduction to the Edwards Aquifer (Online). Accessed December 2010 at: http://www.edwardsaquifer.net/intro.html.

Elliott, P., and D. Wadley. 2002. The impact of transmission lines on property values: Coming to terms with stigma. Property management 20(2):137–152.

Engels, T.M. 1995. Conservation biology of the GCWA. Ph.D. Dissertation, University of Texas, Austin.

EPA (U.S. Environmental Protection Agency). 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Office of Noise Abatement and Control. EPA 550/9-79-100 (Online). Accessed October 2010 at: http://www.epa.gov/history/topics/noise/01.htm.

EPA (U.S. Environmental Protection Agency). 1997. Climate change in Texas. EPA 230-F-97-008qq. Washington, D.C (Online). Accessed October 2010 at: http://www.epa.gov/climatechange/basicinfo.html

EPA (U.S. Environmental Protection Agency). 2009. A framework for categorizing the relative vulnerability of threatened and endangered species to climate change. National Center for Environmental Assessment, Washington, D.C; EPA/600/R-09/011. Available from the National Technical Information Service, Springfield, Virginia (Online). Accessed October 2010 at: http://www.epa.gove/ncea.

EPA (U.S. Environmental Protection Agency). 2010a. Texas State Implementation Plan (Online). Accessed October 2010 at http://www.tceq.state.tx.us/implementation/air/sip/texas-sip.

EPA (U.S. Environmental Protection Agency). 2010b. National Ambient Air Quality Standards (NAAQS) (Online). Accessed October 2010 at: http://www.epa.gov/ttnnaaqs/.

EPA (U.S. Environmental Protection Agency). 2010c. Human-related sources and sinks of carbon dioxide (Online). Accessed October 2010 at: ***http://www.epa.gov/climatechange/emissions/co2_human.html***.

EPA (U.S. Environmental Protection Agency). 2010d. National Ambient Air Quality Standards for Ozone; Proposed Rule. January 19, 2010. Federal Register 75(11):2938–2987

Executive Order 13112. 1999. Invasive Species. February 8, 1999. Federal Register 64(25):6183–6186.

Faanes, C.A. 1987. Bird Behavior and Mortality in Relation to Power Lines in Prairie Habitats. General Technical Report No. 7. U.S. Fish and Wildlife Service.

Farquhar, C.C., and J.I. Gonzalez. 2005. Breeding habitat, distribution, and population status of the BCVI in northern Mexico. Draft final Section 6 Report, WER 65, Grant No. E-17, submitted to the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service, Austin.

FAA (Federal Aviation Administration). 1975. Objects affecting navigable air space. Federal Aviation Regulations, Part 77. Washington, D.C.

FAA (Federal Aviation Administration). 1979. Noise standards for helicopters in the normal, transport, and restricted categories. 14 CFR Parts 21 and 36.

FAA (Federal Aviation Administration). 2008. National Aeronautical Charting Office. San Antonio Sectional Aeronautical Chart, 82nd Edition, Effective November 20, 2008. Washington, D.C.

FAA (Federal Aviation Administration). 2009. Airport/Facility Directory (Online). Accessed March 2009 at: http://www.avn.faa.gov/index.asp?xml=naco/online/ d_afd.

Foster, W.C. 1995. Spanish expeditions into Texas, 1689–1768. University of Texas Press, Austin.

Golden, J., R.P. Onellete, S. Saari, and P.N. Cheremisinoff. 1980. *Environmental Impact Data Book*. Ann Arbor Science Publishers, Michigan. *In* U.S. Department of Energy. 2003. Tucson Electric Power Company (TEP) Sahuarita-Nogales Transmission Line Draft Environmental Impact Statement (EIS). Office of Fossil Energy, Washington, D.C.

Graber, J.W. 1961. Distribution, habitat requirement, and life history of the BCVI (*Vireo atricapilla)*. Ecological Monographs 31:313–336.

Griffith, G., S. Bryce, J. Omernik, and A. Rogers. 2007. Ecoregions of Texas. Final report prepared for the Texas Commission on Environmental Quality, Austin (Online). Accessed October 2010 at: ftp://ftp.epa.gov/wed/ecoregions/tx/TXeco_Jan08_v8_Cmprsd.pdf.

Grzybowski, J.A. 1995. BCVI (*Vireo atricapillus*). In The Birds of North America, No. 181. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.

Grzybowski, J.A., D.J. Tazik, and G.D. Schnell. 1994. Regional analysis of BCVI breeding habitats. Condor 96:512–544.

Grzybowski, J.A.,V.W. Fazio III, W. Munsterman, S. Hodge, C. Kimball, and J. Dixon. 2010. Population status of the BCVI in Oklahoma: dynamics of population size and management. Presented at the 2010 BCVI Symposium, Austin, Texas.

Guadalupe-Blanco River Authority. 2008. 2008 Basin Summary Report, Guadalupe River, Texas. Prepared in cooperation with the Handbook of Texas Online.

Hall, K.L. 2009. Out of sight, out of mind revisited: An updated study on the undergrounding of overhead power lines. Edison Electric Institute, Washington, D.C.:59 (Online). Accessed October 2010 at: http://www.eei.org/ourissues/electricitydistribution/Documents/UndergroundReport.pdf

Hartman, P.A., S. Byrne, and M.F. Dedon. 1992. Bird mortality in relation to the Mare Island 115-kV transmission line: final report 1988–1991. Prepared for the Department of the Navy, Western Division by Pacific Gas and Electric Company, Technical and Ecological Services. PG&E report no. 443-91.3. San Ramon, California.

Hays County. 2010. Hays County regional habitat conservation plan: Final. Prepared by Loomis Partners, Inc.; Smith Robertson, Elliott, Glen, Klein & Bell, LLP; Prime Strategies, Inc.; Zara Environmental, LLC; Joe Lessard; Texas Perspectives, LLC., and Capital Market Research, Inc. Austin, Texas.

Hidalgo County Birding Pages. 2010. Anzaldulas County Park (Online). Accessed December 2010 at: http://miriameaglemon.com/Birding%20Pages/Hidalgo%20County%20Birding%20Pages/By%20Site/Anzalduas.html.

Howells, R.G, R.W. Neck, and H.D. Murray. 1996. Freshwater mussels of Texas. Texas Parks and Wildlife Press. Austin.

IMPLAN. 2008. Database, version 3.0. Stillwater, Minnesota: Minnesota IMPLAN Group.

IPCC (Intergovernmental Panel on Climate Change). 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom, and New York, New York (Online). Accessed October 2010 at: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch1.html.

Irby Construction. 2011. Emergency action plan, Twin Buttes to Big Hill. Plan date April 24, 2011. 14 pp.

Janss, G., and M. Ferrer. 1998. Rate of bird collision with power lines: effects of conductor-marking and static wire-marking. Journal of Field Ornithology 69(1):8–17.

Kasner, A.C., T.C. Maxwell, and R.D. Slack. 2005. Breeding distributions of selected Charadriiforms (Charadriiformes: Charadriidae, Scolopacidae, Laridae) in interior Texas. Texas Journal of Science 57:273–288.

Kostecke, R.M., D.A. Cimprich, and S.G. Summers. 2010. The past, present, and future role of cowbird removal in the recovery and maintenance of the BCVI population at Fort Hood Military Reservation. Presented at the 2010 BCVI Symposium, Austin, Texas.

Kroll, C.A, and T. Priestly. 1992. The effects of overhead transmission lines on property values. Edison Electric Institute, Washington, D.C.

Kuhl, J. 2007. Personal communication to SWCA Environmental Consultants. Travis County Transportation and Natural Resources Department, Austin, Texas.

Laack, L.L. 1991. Ecology of the ocelot (*Felis pardalis*) in South Texas. M.S. thesis, Texas A&M University, Kingsville.

Ladd, C., and L. Gass. 1999. GCWA (*Dendroica chrysoparia*). In *The birds of North America*, The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.

Larkin, T.J., and G.W. Bomar. 1983. Climatic atlas of Texas. Texas Department of Water Resources, Austin.

LCRA. 2006. Policy – Corporate environmental title: Oak wilt prevention. Last update November 23, 2010. 3 pp.

LCRA. 2010a. LCRA and CREZ (Online). Accessed October 2010 at: http://www.lcra.org/energy/trans/crez/index.html.

LCRA. 2010b. LCRA. E-mail sent by Erik Huebner of LCRA TSC to Paul Sunby of SWCA Environmental Consultants on 2 September 2010.

LCRA. 2010c. Summary of 2000–2010 results of surveys for the GCWA and BCVI at Canyon of the Eagles Nature Park. Unpublished summary prepared by M. Pavlis/LCRA, Austin, Texas.

LCRA. 2010d. Best management practices used during construction. 24 pp.

LCRA TSC. 2009. Transmission line routing process followed by LCRA Trasmission Services Corporation (LCRA TSC). March 2009. 2 pp.

Lehman, R.N. 2001. Raptor electrocution on power lines: Current issues and outlook. Wildlife Society Bulletin 29:804–813.

Li, G., and S.P. Baker. 2007. Crash risk in general aviation. Journal of the American Medical Association 297(14):1596–1598.

Liechti, F., M. Klaassen, and B. Bruderer. 2000. Predicting migratory flight altitudes by physiological migration models. The Auk 107:205–214.

Lockwood, M.W. 2001. Birds of the Texas Hill Country. University of Texas Press, Austin.

Lockwood, M.W. 2010. Personal communication to SWCA Environmental Consultants on 29 October 2010. Texas Parks and Wildlife Department, Resources Protection Department, Ft. Davis.

Lockwood, M.W., and B. Freeman. 2004. The TOS Handbook of Texas Birds. Texas A&M University Press, College Station.

Loomis-Austin, Inc. 2008. Mapping Potential GCWA Breeding Habitat Using Remotely Sensed Forest Canopy Cover Data, LAI Project No. 051001. Unpublished report prepared for the County of Hays. Loomis-Austin, Inc., Austin, Texas.

Manville, A.M. 2005. Bird Strikes and Electrocutions at Power Lines, Communication Towers, and Wind Turbines: State of the Art and State of the Science – Next Steps Toward Mitigation. General Technical Report PSW-GTR-191. U.S. Department of Agriculture Forest Service.

Maresh, J.P. 2005. Project 61: Census and monitoring of BCVI in Texas. Draft final Section 6 report, WER 61, Grant No. E-15, submitted to the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service, Austin, Texas.

Maresh, J. and G.A. Rowell. 2000. Performance Report: Project WER61, Census and monitoring of BCVI in Texas. Submitted to Texas Parks and Wildlife as required by The Endangered Species Program, Grant No. E-1-12 Endangered and Threatened Species Conservation.

McMahan, C.A., R.G. Frye, and K.L. Brown. 1984. The Vegetation Types of Texas Including Cropland. Texas Parks and Wildlife Department, Austin (Online). Accessed October 2010 at: http://www.tpwd.state.tx.us/publications/pwdpubs/pwd_bn_w7000_0120/download_book/.

McNab, W.H., and P.E. Evers. 1994. Southwest plateau and plains dry steppe and shrub: Edwards Plateau. Chapter 37. In Ecological Subregions of the United States (Online). Accessed October 2010 at: http://www.fs.fed.us/land/pubs/ecoregions/ch37.html

Meltzer, D.J., and M.R. Bever. 1995. Paleoindians of Texas: An Update on the Texas Clovis Fluted Point Survey. Bulletin of the Texas Archeological Society 66:47–81.

Mine Safety & Health Administration. 2009. Data Retrieval System – Extended Mine Search Page. U.S. Department of Labor (Online). Accessed October 2010 at: http://www.msha.gov/drs/DRSextendedSearch.asp.

Mojica, E.K., B.D. Watts, J.T. Paul, S.T. Voss, and J. Pottie. 2009. Factors contributing to bald eagle electrocutions and line collisions on Aberdeen Proving Ground, Maryland. Journal of Raptor Research 43(1):57–61.

Morrison, M.L., R.N. Wilkins, B.A. Collier, J. Groce, H. Mathewson, T. McFarland, A. Snelgrove, T. Snelgrove, and K. Skow. 2010. GCWA population distribution and abundance. Texas A&M Institute of Renewable Natural Resources, College Station.

Moses, E. 1996. GCWA (*Dendroica chrysoparia*) habitat fragmentation in Travis County, Texas: a remote sensing and geographical information system analysis of habitat extent, pattern and condition. Master's thesis, Texas A&M University. College Station.

NASA (National Aeronautics and Space Administration). 2006. Central American fires impact U.S. air quality and climate (Online). Accessed December 2010 at: ***http://www.nasa.gov/vision/earth/environment/central_am_fires.html***.

NASS (National Agricultural Statistical Service). 2009. County Summary Highlights: 2007 (Online). Accessed October 2010 at: http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_2_County_Level/Texas/st48_2_001_001.pdf

National Audubon Society. 2010. Christmas Bird Count Historical Results (Online). Accessed September 2010 at: http://birds.audubon.org/historical-results.

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia (Online). Accessed October 2010 at: http://www.natureserve.org.

Navarro-Lopez, D. 1985. Status and distribution of the ocelot in South Texas. M.S. thesis, Texas A&M University, Kingsville.

NIEHS (National Institute of Environmental Health Sciences). 1999. NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields (Online). Accessed August 2010 at: http://www.niehs.nih.gov/health/docs/niehs-report.pdf.

NPS (National Park Service). 2009. Bat Inventory of Golden Gate National Recreation Area (Online). Accessed September 2011 at ***http://www.sfnps.org/bats/GOGA_briefing***.

NRCS (Natural Resources Conservation Service). 1999. Soil taxonomy; A basic system of soil classification for making and interpreting soil surveys. United States Department of Agriculture, Natural Resources Conservation Service, Agriculture Handbook Number 436 (Online). Accessed October 2010 at: ftp://ftp-fc.sc.egov.usda.gov/NSSC/Soil_Taxonomy/tax.pdf

NRCS (Natural Resources Conservation Service). 2009a. Prime farmland soils in Texas by county. Accessed October 2010 at http://soildatamart.nrcs.usda.gov.

NRCS (Natural Resources Conservation Service). 2009b. Soil Data Mart: Prime and other Important Farmlands, Texas. Accessed October 2010 at http://soildatamart.nrcs.usda.gov.

NRCS (Natural Resources Conservation Service). 2010. NC1022: The chemical and physical nature of particulate matter affecting air, water and soil quality. (NCR174) (Online). Accessed October 2010 at: http://nimss.umd.edu/homepages/home.cfm?trackID=5035)

Oberholser, H.C. 1974. The bird life of Texas. University of Texas Press, Austin.

Olendorff, R.R., and R.N. Lehman. 1986. Raptor collisions with utility lines: an analysis using subjective field observations. Final report. U.S. Bureau of Land Management, prepared for Pacific Gas and Electric Company, San Ramon, California.

Ortego, B., C. Gregory, D. Mabie, M. Mitchell, and D. Schmidt. 2009. Texas Bald Eagles. Bulletin of the Texas Ornithological Society 42(1–2).

PBS&J. 2010a. Environmental Assessment and Alternative Route Analysis for the Proposed McCamey D to Kendall to Gillespie 345-kV CREZ Transmission Line Project in Schleicher, Sutton, Menard, Kimble, Mason, Gillespie, Kerr, and Kendall Counties, Texas, PBS&J Job No. 100006924.. Prepared for LCRA TSC, Austin, Texas.

PBS&J. 2010b. Environmental Assessment and Alternative Route Analysis for the Proposed Twin Buttes-McCamey D 345-kV CREZ Transmission Line Project in Tom Green, Irion, and Schleicher Counties, Texas. PBS&J Job No. 100006926. Prepared for LCRA TSC, Austin, Texas.

Peak, R.G. 2003. Population trends of the GCWA on Fort Hood, Texas 1992–2003. In Endangered species monitoring and management at Fort Hood, Texas, 2003 annual report. The Nature Conservancy, Fort Hood Project, Texas.

Peak, R.G. 2007. Forest edges negatively affect GCWA nest survival. The Condor 109:628–637.

Pitts, J.M., and T.O. Jackson. 2007. Power lines and property values revisited. The Appraisal Journal 75(4):323–325 (Online). Accessed September 2011 at: ***http://www.real-analytics.com/TAJFall07p.323-325.pdf***.

Poole, J.M., W.R. Carr, D.M. Price, and J.R. Singhurst. 2007. Rare plants of Texas. Texas A&M University Press, College Station.

Powell, R.A., and R.D. Slack. 2006. Draft final report: ecology, habitat use, threats and geographic distribution of the BCVI (*Vireo atricapilla*) on the winter range. Section 6 Grand No. E-33, Interagency Cooperation Contract No. 111166, Texas A & M University, College Station.

Prewitt, E.R. 1981. Cultural chronology in central Texas. Bulletin of the Texas Archeological Society 52:65–89.

Prewitt, E. R. 1985. From Circleville to Toyah: comments on central Texas chronology. Bulletin of the Texas Archeological Society 54:201–238.

Public Service Commission of Wisconsin. 2010. EMF – Electric & Magnetic Fields (Online). Accessed October 2010 at: http://www.atcllc.com/pdf/PSCWEMFpublication.pdf.

PUC (Public Utility Commission of Texas). 2009. Commission Staff's Petition for Selection of Entities Responsible for Transmission Improvements Necessary to Deliver Renewable Energy from Competitive Renewable Energy Zones. 15 May 2009. Docket No. 35665. Item 1340:68.

PUC (Public Utility Commission of Texas). 2010. Order. Application of LCRA Transmission Services Corporation to amend its Certificate of Convenience and Necessity for the proposed Twin Buttes to McCamey D CREZ 345-kv transmission line in Tom Green, Irion, and Schleicher Counties, Texas. PUC Docket No. 37778, Item 528. SOAH Docket No. 473-10-2461.

PUC (Public Utility Commission of Texas). 2011. Order. Application of LCRA Transmission Services Corporation to Amend its Certificate of Convenience and Necessity for the Proposed Mccamey D to Kendall to Gillespie 345-kV CREZ Transmission Line In Schleicher, Sutton, Menard, Kimble, Mason, Gillespie, Kerr, and Kendall Counties. Signed at Austin Texas on the 24th day of January 2011. PUC Docket No. 38354; SOAH Docket No. 473-10-5546.

Rappole, J.H., D.I. King, and W.C. Barrow, Jr. 1999. Winter ecology of the endangered GCWA (*Dendroica chrysoparia*). Condor 101:762–770.

Rappole, J.H., D.I. King, and P. Leimgruber. 2000. Winter habitat and distribution of the endangered GCWA (*Dendroica chrysoparia*). Animal Conservation 2:45–59.

Redig, P.T., and H.B. Tordoff. 1992. Midwest peregrine falcon restoration, 1991 report. Midwest Peregrine Society (Online). Accessed December 2010 at: http://www.midwestperegrine.org/downloadpdfs/1991pf.pdf.

Rees, R.W., and A.W. Buckner. 1980. Occurrence and quality of ground water in the Edwards-Trinity (Plateau) Aquifer in the Trans-Pecos Region of Texas; Texas Water Development Board Report 255.

Reidy, J.L., M.M. Stake, and F.R. Thompson, III. 2009. Nocturnal predation of females on nests: an important source of mortality for GCWAs? Wilson Jour. of Ornith. 121(2):416–421.

RRC (Railroad Commission of Texas). 2008. Coal Mining Locations (Online). Accessed October 2010 at: http://www.rrc.state.tx.us/programs/mining/TxCoaLst.pdf.

RRC (Railroad Commission of Texas). 2009. Public GIS Map Viewer of oil/gas wells and pipelines (Online). Accessed October 2010 at http://gis2.rrc.state.tx.us/public/startit.htm.

RRC (Railroad Commission of Texas). 2010. Public GIS Map Viewer of oil/gas wells and pipelines (Online). Accessed October 2010 at: http://gis2.rrc.state.tx.us/public/.

Schmidly, D.J. 2004. The Mammals of Texas, Revised Edition. University of Texas Press, Austin.

Service (U.S. Fish and Wildlife Service). 1987. Tobusch fishhook cactus (*Ancistrocactus tobuschii*) recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Service (U.S. Fish and Wildlife Service). 1990a. Recovery plan for the interior population of the least tern (*Sterna antillarum*). U.S. Fish and Wildlife Service, Twin Cities, Minnesota.

Service (U.S. Fish and Wildlife Service).1990b. Listed cats of Texas and Arizona recovery plan (with emphasis on the ocelot). U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Service (U.S. Fish and Wildlife Service). 1990c. Chesapeake Bay Region bald eagle recovery plan: first revision. U.S. Fish and Wildlife Service, Newton Corner, Massachusetts.

Service (U.S. Fish and Wildlife Service). 1991. BCVI recovery plan. Albuquerque, New Mexico.

Service (U.S. Fish and Wildlife Service). 1992. GCWA (*Dendroica chrysoparia*) recovery plan. Austin, Texas.

Service (U.S. Fish and Wildlife Service). 1996a. GCWA population and habitat viability assessment report. Compiled and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of an Aug. 21-24, 1996 workshop arranged by the U.S. Fish and Wildlife Service in partial fulfillment of U.S. National Biological Service Grant No. 80333-1423. Austin, Texas.

Service (U.S. Fish and Wildlife Service).1996b. BCVI population and habitat viability assessment report. Compiled and edited by Carol Beardmore, Jeff Hatfield, and Jim Lewis in conjunction with workshop participants. Report of a September 18–21, 1995 workshop arranged by the Service in partial fulfillment of U.S. National Biological Service Grant NO. 80333-1423. Austin, Texas.

Service (U.S. Fish and Wildlife Service). 2002. Migratory bird mortality: Many human-caused threats afflict our bird populations.

Service (U.S. Fish and Wildlife Service). 2004a. Biological opinion for consultation no. 2-12-05-F-021 [Effect of Natural Resource Conservation Service activities associated with implementation of 2002 Farm Bill conservation programs on federally listed species]. December 17, 2004. Arlington, Texas.

Service (U.S. Fish and Wildlife Service). 2005. Biological Opinion on the Military Mission and Associated Land Management Practices and Endangered Species Management Plan (ESMP) for the U.S. Army's Camp Bullis in Bexar County, Texas. Consultation #2-15-2002-F-0315. Letter to Col. Garry F. Atkins, Department of the Army, Fort Sam Houston, Texas.

Service (U.S. Fish and Wildlife Service). 2007a. BCVI (*Vireo atricapilla*) 5-Year Review: Summary and Evaluation. June 19, 2007. Arlington, Texas.

Service (U.S. Fish and Wildlife Service). 2007b. National Bald Eagle Management Guidelines. U.S. Fish and Wildlife Service, Washington, D.C.

Service (U.S. Fish and Wildlife Service). 2007c. Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife; Final Rule. Federal Register July 9, 2007. Federal Register 72(130):37345–37372.

Service (U.S. Fish and Wildlife Service). 2009b. Electronic Library. (Online) Accessed December 2010 at: http://www.fws.gov/southwest/es/Library/.

Service (U.S. Fish and Wildlife Service). 2009c. Eagle Permits; Take Necessary to Protect Interests in Particular Localities; Final Rule. September 11, 2009. Federal Register 74(175):46835-46879.

Service (U.S. Fish and Wildlife Service). 2010a. Ocelot recovery plan (*Leopardus pardalis*). Draft first revision; original approval: August 22, 1990. Southwest Region, Albuquer-

que, New Mexico (Online). Accessed September 2011 at: http://ecos.fws.gov/docs/recovery_plan/100826.pdf.

Service (U.S. Fish and Wildlife Service). 2010b. Tobusch Fishhook Cactus (*Sclerocactus brevihamatus ssp. tobuschii*) 5-Year Review: Summary and Evaluation. January 5, 2010. Austin, Texas (Online). Accessed November 2010 at: ***http://www.fws.gov/southwest/es/Documents/R2ES/Tobusch_Fishhook_Cactus_5-Year_Review.pdf***.

Service (U.S. Fish and Wildlife Service). 2010c. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List Sprague's Pipit as Endangered or Threatened Throughout Its Range; Notice of 12-month petition finding. September 15, 2010. Federal Register 75(178):56028–56050.

Service (U.S. Fish and Wildlife Service). 2010d. Letter from J. Nicholopolous, Region 2 to M. Wolfe, State Historic Preservation Officer. October 4, 2010. Response letter from M. Wolfe to J. Nicholopolous. November 9, 2010. 4 pp.

Service (U.S. Fish and Wildlife Service) and NMFS (National Marine Fisheries Service). 1996. Endangered species habitat conservation planning handbook. November 1996.

Shindle, D.B. 1995. Habitat use of ocelots in the Tamaulipan Biotic Province. M.S. thesis, Texas A&M University-Kingsville.

Sibley, D.A. 2000. National Audubon Society: The Sibley guide to birds. Chanticleer Press, Inc., New York.

SOAH (State Office of Administrative Hearings). 2010. Proposal for Decision. SOAH Docket No. 473-10-5546. PUC Docket No. 38354.

Sovacool, B.K. 2009. Contextualizing avian mortality: a preliminary appraisal of bird and bat fatalities from wind, fossil-fuel and nuclear electricity. Energy Policy 37:2241–2248.

Spearing, D. 1991. Roadside Geology of Texas. Mountain Press Publishing Company, Missoula, Montana.

Stake, M.M., J. Faaborg, and F.R. Thompson, III. 2004. Video identification of predators at GCWA nests. Journal of Field Ornithology 75:337–344.

State Energy Conservation Office. 2011. Texas Renewable Portfolio Standard (On-line). Accessed October 2011 at http://www.seco.cpa.state.tx.us/re_rps-portfolio.htm.

Stehn, T.V., and T. Wassenich. 2008. Whooping crane collisions with power lines: an issue paper. Proceedings of the North American Crane Workshop 10:25–36.

SWCA Environmental Consultants. 2009. Results of 2009 field surveys for the GCWA on the approximately 331.5-acre Indian Springs Conservation Area, Bexar County, Texas. Unpublished report prepared for the Indian Springs Conservation Association, San Antonio, Texas. SWCA Project No. 9055.

SWCA Environmental Consultants. 2010. Results of 2010 field surveys for the GCWA on the approximately 760-acre Cibolo Canyon Conservation Area, Bexar County, Texas. Unpublished report prepared for Forestar Real Estate Group, Inc., Austin, Texas. SWCA Project No. 16375.

SWCA Environmental Consultants. 2011a. Draft LCRA Transmission Services Corporation Competitive Renewable Energy Zone Transmission Lines Habitat Conservation Plan. Prepared on behalf of LCRA Transmission Services Corporation, Austin, Texas.

SWCA Environmental Consultants. 2011b. Technical Report: Biological resources of the LCRA Transmission Services Corporation CREZ priority project Permit Areas. Prepared

for LCRA Transmission Services Corporation by SWCA Environmental Consultants. Austin, Texas.

Tewes, M.E., and D.D. Everett. 1986. Status and distribution of the endangered ocelot and jaguarundi in Texas, pp 147–158. In Cats of the world: biology, conservation, and management, edited by S.D. Miller and D.D. Everett. CaActr Kleberg Wildlife Research Institute, Texas A&M University-Kingsville.

Texas Bird Records Committee. 2010. Lists of Texas birds (Online). Accessed October 2010 at: http://www.texasbirds.org/tbrc/lists.htm.

Texas Forest Service. 2010. Pest Management (Online). Accessed December 2010 at: http://txforestservice.tamu.edu/main/article.aspx?id=1168.

Texas Oak Wilt Information Partnership. 2007. Oak wilt in Texas (Online). Accessed December 2010 at: http://www.texasoakwilt.org/index.html.

Texas Oak Wilt Information Partnership. 2011. Pruning guidelines for prevention of oak wilt in Texas. Prepared in cooperation between Texas Forest Service, Texas AgriLife Extension Service and International Society of Arboriculture Texas Chapter (Online). Accessed September 2011 at: http://www.texasoakwilt.org/Professionals/ISATTFSOakwiltpruningofficial_v2.pdf

Texas State Data Center and Office of the State Demographer. 2010. Texas Population Estimates and Projections Programs. Accessed September 2010 at http://txsdc.utsa.edu/tpepp/.

Texas State Historical Association. 2009. Handbook of Texas Online. Gillespie, Irion, Kendall,Kerr, Kimble, Mason, Menard, Schleicher, Sutton, and Tom Green Counties (Online). Accessed October 2010 at: http://www.tshaonline.org/handbook/online/browse/we.html.

Texas Tech University. 2011. Species accounts. http://www.rw.ttu.edu/sp_accounts/

THC (Texas Historical Commission). 2009. Texas Heritage Trails Program. The Texas Forts Trail Region, Texas Pecos Trail Region, and the Texas Hill Country Region (Online). Accessed October 2010 at: http://www.allacrosstexas.com/htrail.htm.

Thomas, C., T.H. Bonner, and B.G. Whiteside. 2007. Freshwater fishes of Texas: a field guide. Texas A&M University Press, College Station.

Thompson, B.C., J.A. Jackson, J. Burger, L.A. Hill, E.M. Kirsch, and J.L. Atwood. 1997. Least Tern (*Sterna antillarum*), The Birds of North America Online. Ithaca: Cornell Lab of Ornithology (Online). Accessed October 2010 at: http://bna.birds.cornell.edu/bna/species/290.

Toombs, M. 1996. Noise control on farms: Factsheet. Agdex no. 700. Ontario Ministry of Agriculture, Food and Rural Affairs (Online). Accessed October 2010 at: http://www.omafra.gov.on.ca/english/engineer/facts/96-033.htm.

TPWD (Texas Parks and Wildlife Department). 2007. Migratory flyways of North America (Online). Accessed October 2010 at: http://www.tpwd.state.tx.us/huntwild/wild/birding/migration/flyways/central/.

TPWD (Texas Parks and Wildlife Department). 2009a. Freshwater fishes of Texas (Online). Accessed September 2010 at: http://www.tpwd.state.tx.us/landwater/water/aquaticspecies/inland.phtml.

TPWD (Texas Parks and Wildlife Department). 2009b. Old Tunnel (WMA) (Online). Accessed October 2010 at: http://www.tpwd.state.tx.us/huntwild/hunt/wma/find_a_wma/list/?id=17.

TPWD (Texas Parks and Wildlife Department). 2009c. Response to request by James Huffman for technical guidance concerning development projects. Letter report from Mary H. Humphrey, Game Biologist dated 24 July 2009. Texas Parks and Wildlife Department, Sonora.

TPWD (Texas Parks and Wildlife Department). 2009d. Texas tortoise (*Gopherus berlandieri*) fact sheet (Online). Accessed November 2010 at: http://www.tpwd.state.tx.us/huntwild/wild/species/txtort/.

TPWD (Texas Parks and Wildlife Department). 2009e. News Release: 15 Texas Freshwater Mussels Placed on State Threatened List (5 November 2009) (Online). Accessed April 2010 at: ***http://www.tpwd.state.tx.us/newsmedia/releases/index.phtml?req=20091105c&print=tr***

TPWD (Texas Parks and Wildlife Department). 2010b Ecologically significant stream segments (Online). Accessed September 2010 at: http://www.tpwd.state.tx.us/landwater/water/environconcerns/water_quality/sigsegs/.

TPWD (Texas Parks and Wildlife Department). 2010c. Texas Natural Diversity Database. 22 January 2010 review of records for Burnet, Irion, Gillespie, Kendall, Kerr, Kimble, Lampasas, Llano, Mason, Menard, San Saba, Schleicher, Sutton, and Tom Green counties held in the Texas Parks and Wildlife Natural Diversity Database, Austin.

TPWD (Texas Parks and Wildlife Department). 2010d. Rare, threatened, and endangered species of Texas by county. Annotated county-by-county lists of rare species for Burnet, Gillespie, Kendall, Kerr, Kimble, Lampasas, Llano, Mason, Menard, San Saba, Schleicher, Sutton, and Tom Green counties (Last revision 19 July 2010 for Kimble and Sutton counties; last revision 14 October 2010 for remainder). (Online) Accessed November 2010 at: http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/

TPWD (Texas Parks and Wildlife Department). 2010f. Texas State Parks – Find A Park (Online). Accessed September 2010 at: http://www.tpwd.state.tx.us/spdest/findadest/parks/.

TSS (Texas Speleological Society). 2009. Electronic copy of map with locations of caves, sinkholes, and other karst features within the Kendall-Gillespie-Newton Permit Area, Austin, Texas.

TWDB (Texas Water Development Board). 1995. Aquifers of Texas. Report 345. Austin.

TWDB (Texas Water Development Board). 2006. Water for Texas, 2007. [State water plan]

TxDOT (Texas Department of Transportation). 1998. Texas Highways Magazine: Volume 45, No. 8. Scenic Overlooks and Rest Areas, Austin.

U.S. Census Bureau. 2000. American FactFinder. Social Characteristics: 2010. Accessed August 2010 at: http://www.factfinder.census.gov.

U.S. Census Bureau. 2010. International Data Base (Online). Accessed December 27 at: http://www.census.gov/ipc/www/idb/.

USDA (U.S. Department of Agriculture). 2000. Summary Report 1997 National Resources Inventory.

U.S. Department of Energy. 2003. Tucson Electric Power Company (TEP) Sahuarita-Nogales Transmission Line Draft Environmental Impact Statement (EIS). Office of Fossil Energy, Washington, D.C.

U.S. Department of Labor. 2009. Data Retrieval System – Extended Mine Search Page. Mine Safety and Health Administration, Washington D.C (Online). Accessed October 2010 at: http://www.msha.gov/drs/DRSextendedSearch.asp.

U.S. Department of Labor. 2010. Data Retrieval System – Extended Mine Search Page. Mine Safety and Health Administration, Arlington, Virginia (Online). Accessed October 2010 at: ***http://www.msha.gov/drs/DRSextendedSearch.asp***.

U.S. Department of the Interior. 2004. National Environmental Policy Act Revised Implementing Procedures; Notice. March 8, 2004. Federal Register 69(45):10865–10887.

USEIA (U.S. Energy Information Administration). 2011. Annual Energy Outlook 2011, With Projections to 2035. DOE/EIA-0383(2011). Washington, D.C. (Online). Accessed October 2011 at: ***http://www.eia.gov/forecasts/aeo/pdf/0383(2011).pdf***.

U.S. Forest Service. 2007. Climate change considerations in project level NEPA analysis (Online). Accessed September 2011 at: http://www.fs.fed.us/emc/nepa/climate_change/includes/cc_nepa_guidance.pdf.

USGS (U.S. Geological Survey). Undated. Descriptions of the Level IV Ecoregions of Texas. Denver, Colorado (Online). Accessed October 2010 at: ftp://ftp.epa.gov/wed/ecoregions/tx/tx_back.pdf.

USGS (U.S. Geological Survey). 2010a. National Hydrography Dataset (Online). Accessed August 2010 at: http://nhd.usgs.gov/.

USGS (U.S. Geological Survey). 2010b. North American Breeding Bird Survey (Online). Accessed September 2010 at: http://www.pwrc.usgs.gov/BBS/.

Wahl, R., D.D. Diamond, and D. Shaw. 1990. The GCWA: a status review, unpublished report submitted to Ecological Services, U.S. Fish and Wildlife Service, Fort Worth, Texas.

Waters, M.R., S.L. Forman, T.A. Jennings, L.C. Nordt, S.G Driese, J.M. Feinberg, J.L. Keene, J. Halligan, A. Lindquist, J. Pierson, C.T. Hallmark, M.B. Collins, and J.E. Wiederhold. 2011. The Buttermilk Creek Complex and the origins of Clovis at the Debra L. Friedkin Site, Texas. Science 2011:1599–1603.

Wilkins, N., A. Hays, D. Kubenka, and D. Steinbach. 2003. Texas Rural Lands / Trends and Conservation Implications for the 21st Century. Texas A&M University in cooperation with the American Farmland Trust. Accessed December 2010 at http://irnr.tamu.edu/Publications/List.aspx.

Wilkins, N., R.A. Powell, A.A.T. Conkey, and A.G. Snelgrove. 2006. Population Status and Threat Analysis for the BCVI. Department of Wildlife and Fisheries Sciences, Texas A&M University. Prepared for the U.S. Fish and Wildlife Service, Region 2.

Willey, G.R., and P. Phillips. 1958. Method and Theory in American Archaeology. University of Chicago Press, Chicago.