



Biological Studies Technical Memorandum

MoPac (State Loop 1) Intersections, Austin District

From North of Slaughter Lane to South of La Crosse Avenue

CSJ: 3136-01-015

Travis County, Texas

June 2015

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 16, 2014, and executed by FHWA and TxDOT.

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TABLE OF CONTENTS

	Page
1.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES.....	3
1.1 Wildlife.....	3
1.2 Migratory Birds	4
1.3 Threatened and Endangered Species.....	4
1.4 Texas Natural Diversity Database (TXNDD)	29
2.0 CONCLUSIONS	30
3.0 REFERENCES	33

FIGURES

Figure 1: Karst Zones and Karst Fauna Regions.....	18
Figure 2: Edwards Aquifer Zones	23
Figure 3: Morrison et al. Golden-cheeked Warbler Habitat.....	25
Figure 4: Balcones Canyonlands Conservation Plan - Golden-cheeked Warbler Habitat.....	26

TABLES

Table 1: State and Federally Listed Threatened and Endangered Species and Species of Greatest Conservation Need, Travis County	6
Table 2: Caves, Sinkholes and Solution Cavities in the Vicinity of the MoPac Intersections	20
Table 3: Texas Parks and Wildlife Department Natural Diversity Database Search Results	30

APPENDICES

A	Site Photographs
B	Biological Evaluation Form (including TPWD-TxDOT MOU Tier I Site Assessment)
C	USFWS and TPWD Lists of Rare, Threatened, and Endangered Species

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1.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

1.1 WILDLIFE

A high diversity of wildlife species is known to exist in Central Texas and Travis County. At least 60 species of mammals have been documented to occur in this region of Texas (Schmidly 1994). Commonly occurring mammal species that would be expected within urbanized habitats including the project area are the Virginia opossum (*Didelphis virginiana*), fox squirrel (*Sciurus niger*), cotton rat (*Sigmodon hispidus*), eastern cottontail (*Sylvilagus floridanus*), and raccoon (*Procyon lotor*).

According to Dixon (2013), amphibians and reptiles occurring in Travis County are represented by 5 species of salamanders, 19 species of frogs and toads, 10 species of turtles, 16 species of skinks and lizards, 35 species of snakes and the American alligator. Commonly occurring species include the green anole (*Anolis carolinensis*), Mediterranean gecko (*Hemidactylus turcicus*), Texas spiny lizard (*Sceloporus olivaceus*), Gulf Coast toad (*Bufo valliceps*), and checkered garter snake (*Thamnophis marcianus*).

Frequently observed bird species would include the Northern Mockingbird (*Mimus polyglottos*), Northern Cardinal (*Cardinalis cardinalis*), Blue Jay (*Cyanocitta cristata*), House Sparrow (*Passer domesticus*), House Finch (*Carpodacus mexicanus*), White-winged Dove (*Zenaida asiatica*), Mourning Dove (*Zenaida macroura*), Rock Dove (*Columba livia*), Great-tailed Grackle (*Quiscalus mexicanus*), Red-Tailed Hawk (*Buteo jamaicensis*), Turkey Vulture (*Cathartes aura*), and Black Vulture (*Coragyps atratus*). Given the location of the project area, only species typical of suburban settings would likely be affected by the project.

Build Alternative

The proposed improvements would involve grade separating the cross streets of Slaughter Lane and La Crosse Avenue such that new MoPac main lanes would be constructed under the existing cross streets. The portion of the project which would impact wildlife the most would be associated with vegetation clearing during construction and the permanent conversion of existing habitat to a transportation facility. This should be considered in light of the fact that the habitat areas that will be impacted occur primarily within upland areas in the median of a heavily travelled roadway.

Trombulak and Frissell (2000) categorize roadway impacts to terrestrial and aquatic ecosystems into seven general areas: 1) increased mortality from road construction; 2) increased mortality from collision with vehicles; 3) modification of animal behavior; 4) alteration of the physical environment; 5) alteration of the chemical environment; 6) spread of exotic species; and 7) increased alteration and use of habitats by humans.

Construction phase activities would directly or indirectly affect most wildlife species present. Some sessile and/or slow moving species could be killed by heavy machinery during right of way clearing. Impacts to wildlife within the proposed project would also occur in conjunction with the removal and disturbance of vegetation. Habitat types mapped by the Ecological Management Systems of Texas (EMST) that would be impacted by the proposed project include Edwards Plateau: Ashe Juniper Motte and Woodland; Edwards Plateau: Deciduous Oak/Evergreen Motte and Woodland; Edwards Plateau: Floodplain Hardwood/Ashe Juniper Forest; Edwards Plateau: Live Oak Motte and Woodland; Edwards Plateau: Oak/Hardwood Motte and Woodland; Edwards Plateau: Post Oak Motte and Woodland; Edwards Plateau:

Riparian Hardwood/Ashe Juniper Forest; Edwards Plateau: Savanna Grassland; Native Invasive: Mesquite Shrubland; Urban Low Intensity and Urban High Intensity (TPWD 2010). Wooded areas provide cover, food, and habitat for many resident and migratory species. Direct mortality of wildlife species from vehicle collisions (road kill), especially to invertebrates such as insects, is well documented and would likely be an effect.

No-Build Alternative

The No-Build Alternative would not impact existing wildlife or their habitat.

1.2 MIGRATORY BIRDS

The Migratory Bird Treaty Act states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, young, feather, or egg in part or in whole, without a federal permit issued in accordance with the Act's policies and regulations.

Build Alternative

Migratory birds were observed during August 28, 2013, field investigations and spring 2014 Golden-cheeked Warbler surveys and may arrive in the project area to breed during construction of the proposed project. One Cliff Swallow (*Petrochelidon pyrrhonota*) and an Eastern Phoebe (*Sayornis phoebe*) were observed nesting within the project area beneath the bridged (southern) crossing of Slaughter Creek. Additionally, 21 active Cliff Swallow nests were observed in the box culverts just north of the Slaughter Creek bridges. In addition to the those observed at bridges and culverts, numerous avian species subject to the protections of the Migratory Bird Treaty Act would be expected to be breeding within oak-juniper savannah vegetation areas within existing median areas. Appropriate measures would be taken to avoid adverse impacts on migratory birds and would include the following:

- Disturbing, destroying, or removing active migratory bird nests, including ground nesting birds, will be prohibited during the February 15 through October 1 nesting season;
- The removal of unoccupied, inactive nests, will be avoided, where practicable;
- The establishment of active nests during the nesting season on TxDOT owned and operated facilities and structures proposed for replacement or repair will be prevented; and
- The collection, capture, relocation, or transportation of birds, eggs, young, or active nests without a permit will be prohibited.

No-Build Alternative

The No-Build Alternative would not impact migratory birds.

1.3 THREATENED AND ENDANGERED SPECIES

Databases of sensitive species maintained by the U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD) identified 22 federally-listed threatened, endangered, or candidate species that may occur or have historically occurred in Travis County, including one plant, five mollusks, two insects, four spiders, one fish, three amphibians, five birds, and one mammal species. Additionally, four state-listed threatened species that are not

federally-listed could potentially occur in Travis County. These include one mollusk, one reptile and two bird species. USFWS and TPWD County lists are provided in **Appendix C**.

Table 1 presents the federally and state-listed threatened and endangered species that could occur within Travis County. **Table 1** also lists species with no regulatory status that are considered species of greatest conservation need (SGCN) in Texas and could occur within Travis County. SGCN are species that, due to limited distributions and/or declining populations, face the threat of extirpation or extinction but lack legal protection (TPWD 2014). The current status and habitat requirements for each of the species are also included as well as a determination as to whether the proposed project could potentially impact or have an effect upon them. “Effect” determinations apply to federally-listed species while “impact” determinations apply to state-listed threatened species and SGCN. While both “effect” and “impact” meanings are the same and only used to differentiate between federally-listed and non-federally listed species, “effect” determinations are specific. The following “effect” determinations and their definitions, as applied to the federally-listed species in **Table 1**, are from the Endangered Species Consultation Handbook (USFWS and NMFS 1998).

- **No effect** - the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or designated critical habitat.
- **May affect, not likely to adversely affect**- the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.
- **May affect, likely to adversely affect**- the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (see definition of "is not likely to adversely affect"). In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made. An "is likely to adversely affect" determination requires the initiation of formal section 7 consultation.

Table 1: State and Federally Listed Threatened and Endangered Species and Species of Greatest Conservation Need, Travis County

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Plants						
Basin bellflower	<i>Campanula reverchonii</i>	NL	SGCN	Texas endemic; among scattered vegetation on loose gravel, gravelly sand, and rock outcrops on open slopes with exposures of igneous and metamorphic rocks; may also occur on sandbars and other alluvial deposits along major rivers; flowering May-July.	No	Suitable habitat does not occur within the project area; therefore, the project would have no impact on this species.
Boerne bean	<i>Phaseolus texensis</i>	NL	SGCN	Narrowly endemic to rocky canyons in eastern and southern Edwards Plateau occurring on limestone soils in mixed woodlands, on limestone cliffs and outcrops, frequently along creeks.	No	Vegetation and soils within the proposed project area have been disturbed due to road development and maintenance; therefore, suitable habitat for this species does not occur in the vicinity of the proposed project. The project would have no impact on this species.
Bracted twistflower	<i>Steptanthus bracteatus</i>	C	SGCN	Texas endemic; shallow, well-drained gravelly clays and clay loams over limestone in oak-juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut geologic formations.	No	Vegetation and soils within the proposed project area have been disturbed due to road development and maintenance; therefore, suitable habitat for this species does not occur in the vicinity of the proposed project. The project would have no impact on this species.
Correll's false dragon-head	<i>Physostegia correllii</i>	NL	SGCN	Wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in Central Texas.	No	Suitable habitat does not occur within the project area; therefore, the project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Texabama croton	<i>Croton alabamensis</i> var. <i>texensis</i>	NL	SGCN	Texas endemic; in duff-covered loamy clay soils on rocky slopes in forested, mesic limestone canyons; locally abundant on deeper soils on small terraces in canyon bottoms, often forming large colonies and dominating the shrub layer; scattered individuals are occasionally on sunny margins of such forests; also found in contrasting habitat of deep, friable soils of limestone uplands, mostly in the shade of evergreen woodland mottes.	No	Vegetation and soils within the proposed project area have been disturbed due to road development and maintenance; therefore, suitable habitat for this species does not occur in the vicinity of the proposed project. The project would have no impact on this species.
Warnock's coral-root	<i>Hexalectris warnockii</i>	NL	SGCN	In leaf litter and humus in oak-juniper woodlands on shaded slopes and intermittent, rocky creekbeds in canyons; in the Trans Pecos in oak-pinyon-juniper woodlands in higher mesic canyons (to 2000 m [6,550 feet]), primarily on igneous substrates; in Terrell County under <i>Quercus fusiformis</i> mottes on terraces of spring-fed perennial streams, draining an otherwise rather xeric limestone landscape; on the Callahan Divide (Taylor County), the White Rock Escarpment (Dallas County), and the Edwards Plateau in oak-juniper woodlands on limestone slopes; in Gillespie County on igneous substrates of the Llano Uplift.	No	Vegetation and soils within the proposed project area have been disturbed due to road development and maintenance; therefore, suitable habitat for this species does not occur in the vicinity of the proposed project. The project would have no impact on this species.
Mollusks						
Creeper (squawfoot)	<i>Strophitus undulatus</i>	NL	SGCN	Small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins.	No	Slaughter Creek is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
False Spike Mussel	<i>Quadrula mitchelli</i>	NL	T	Possible extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; one study indicated water lilies were present at the site; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins.	No	Slaughter Creek is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Golden Orb	<i>Quadrula aurea</i>	C	T	Almost exclusively in flowing waters in moderate-size streams and rivers; intolerant of impoundment, shells collected on mud, sand and gravel, Brazos (historic), Colorado, San Marcos, Guadalupe, San Antonio, Frio, and Nueces river basins.	No	Slaughter Creek is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Smooth Pimpleback	<i>Quadrula houstonensis</i>	C	T	Small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins.	No	Slaughter Creek is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Texas Fatmucket	<i>Lampsilis bracteata</i>	C	T	Streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and coarse gravel or sand in moderately flowing water; Colorado and Guadalupe River basins.	No	Slaughter Creek is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Texas Fawnsfoot	<i>Truncilla macrodon</i>	C	T	Little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins.	No	Slaughter Creek is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Texas Pimpleback	<i>Quadrula petrina</i>	C	T	Mud, gravel, and sand substrates, generally in areas with slow flow rates; Colorado and Guadalupe River basins.	No	Slaughter Creek is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Crustaceans						
An amphipod	<i>Stygobromus russelli</i>	NL	SGCN	Subterranean waters, usually in caves and limestone aquifers; resident of numerous caves in ca. 10 counties of the Edwards Plateau.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no impact on this species.
Balcones Cave amphipod	<i>Stygobromus balconis</i>	NL	SGCN	Subaquatic, subterranean obligate amphipod.	No	No habitat was encountered within the right of way; however, karst invertebrate habitat occurs within the review area. The proposed project is within the known range of this species; therefore, due to the potential to intersect karst voids underlying the right of way, the project may impact this species.
Bifurcated Cave amphipod	<i>Stygobromus bifurcatus</i>	NL	SGCN	Found in cave pools.	No	No habitat was encountered within the right of way; however, karst invertebrate habitat occurs within the review area. Known habitat for this species occurs downstream within the aquifer; therefore, due to the potential to intersect karst voids underlying the right of way, the project may impact this species.
Arachnids						
Bandit Cave spider	<i>Cicurina bandida</i>	NL	SGCN	Very small, subterrestrial, subterranean obligate.	No	No habitat was encountered within the right of way; however, this species is known from a cave within the review area. Due to the potential to intersect karst voids underlying the right of way, the project may impact this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Bee Creek Cave harvestman	<i>Texella reddelli</i>	E	E	Small, blind, cave-adapted harvestman endemic to a few caves in Travis and Williamson counties.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no effect on this species.
Bone Cave harvestman	<i>Texella reyesi</i>	E	E	Small, blind, cave-adapted harvestman endemic to a few caves in Travis and Williamson counties.	No	No habitat was encountered within the right of way; however, karst invertebrate habitat occurs within the review area. Based on recent taxonomic determinations, the proposed project is considered to be outside the range of this species; therefore, the project would have no effect on this species.
Tooth Cave pseudoscorpion	<i>Tartarocreagris texana</i>	E	E	Small, cave-adapted pseudoscorpion known from small limestone caves of the Edwards Plateau.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no effect on this species.
Tooth Cave spider	<i>Tayshaneta myopica</i>	E	E	Very small, cave-adapted, sedentary spider.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no effect on this species.
Wharton's cave meshweaver	<i>Cicurina wartoni</i>	NL	SGCN	Very small, cave-adapted spider.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Insects						
Kretschmarr Cave mold beetle	<i>Texamaurops reddelli</i>	E	E	Small, cave-adapted beetle found under rocks buried in silt; small, Edwards Limestone caves in of the Jollyville Plateau, a division of the Edwards Plateau.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no effect on this species.
Leonora's dancer damselfly	<i>Argia leonorae</i>	NL	SGCN	South central and western Texas; small streams and seepages.	Yes	One stream, Slaughter Creek, occurs in the vicinity of the proposed project; however, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Rawson's metalmark	<i>Calephelis rawsoni</i>	NL	SGCN	Moist areas in shaded limestone outcrops in central Texas, desert scrub or oak woodland in foothills, or along rivers elsewhere; larval hosts are <i>Eupatorium havanense</i> , <i>E. greggii</i> .	No	Suitable habitat does not occur within the project area; therefore, the project would have no impact on this species.
Tooth Cave blind rove beetle	<i>Cylindropsis</i> sp. 1	NL	SGCN	One specimen collected from Tooth Cave; only known North American collection of this genus.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no impact on this species.
Tooth Cave ground beetle	<i>Rhadine persephone</i>	E	E	Resident, small, cave-adapted beetle found in small Edwards Limestone caves in Travis and Williamson counties.	No	While karst invertebrate habitat occurs within the review area, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no effect on this species.
Fishes						
Guadalupe bass	<i>Micropterus treculii</i>	NL	SGCN	Endemic to perennial streams of the Edward's Plateau region; introduced in Nueces River system.	No	Project area stream, Slaughter Creek, is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Smalleye shiner	<i>Notropis buccula</i>	C	SGCN	Endemic to upper Brazos River system and its tributaries (Clear Fork and Bosque); apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water.	No	Project area stream, Slaughter Creek, is intermittent and does not retain the constant water levels required to support this species. Additionally, this stream would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Amphibians						
Austin blind salamander	<i>Eurycea waterlooensis</i>	E	E	Mostly restricted to subterranean cavities of the Edwards Aquifer; dependent upon water flow/quality from the Barton Springs segment of the Edwards Aquifer; only known from the outlets of Barton Springs.	No	No habitat was encountered within the right of way; however, cave salamander habitat occurs within the vicinity of the proposed project. Known habitat for this species occurs downstream within the aquifer; however the project will not impact water quality outside of the immediate project area. Therefore the project would have no effect on this species.
Barton Springs salamander	<i>Eurycea sosorum</i>	E	E	Dependent upon water flow/quality from the Barton Springs segment of the Edwards Aquifer; only known from the outlets of Barton Springs; spring dweller, but ranges into subterranean water-filled caverns.	No	No habitat was encountered within the right of way; however, cave salamander habitat occurs within the vicinity of the proposed project. Known habitat for this species occurs downstream within the aquifer; however the project will not impact water quality outside of the immediate project area. Therefore the project would have no effect on this species.
Jollyville Plateau salamander	<i>Eurycea tonkawae</i>	T	T	Known from springs and waters of some caves north of the Colorado River.	No	While cave salamander habitat occurs within the vicinity of the proposed project, no habitat was encountered within the right of way. The proposed project is outside of the known range of this species; therefore, the project would have no effect on this species.
Pedernales River springs salamander	<i>Eurycea</i> sp 6	NL	SGCN	Endemic; known only from springs.	No	The proposed project is outside of the known range of this species; therefore, the project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Reptiles						
Spot-tailed earless lizard	<i>Holbrookia lacerata</i>	NL	SGCN	Associated with central and south Texas and adjacent Mexico in moderately open prairie-brushland and fairly flat areas free of vegetation or other obstructions, including disturbed areas. Feeds on small invertebrates and lays eggs underground.	No	Suitable habitat for this species does not occur in the vicinity of the proposed project. The project would have no impact on this species.
Texas garter snake	<i>Thamnophis sirtalis annectens</i>	NL	SGCN	Wet or moist microhabitats are conducive to the species occurrence but this species is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August.	Yes	Suitable habitat for this species may occur along Slaughter Creek; however, this area would not be impacted by the proposed project. Therefore, the project would have no impact on this species.
Texas horned lizard	<i>Phrynosoma cornutum</i>	NL	T	Open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September.	No	Suitable habitat for this species does not occur in the vicinity of the proposed project. Additionally, harvester ant mounds, this species primary food source, were not observed during field investigations. The project would have no impact on this species.
Birds						
Bald Eagle	<i>Haliaeetus leucocephalus</i>	DL	T	Found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter.	No	Suitable habitat for this species does not occur within the project area. The project would have no impact on this species.
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	DL	T	Nests in tall cliff eyries in West Texas; migrant across state from more northern breeding areas in U.S. and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban.	No	Potential migrant through the project area, but any use would be considered temporary. Therefore, the project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	DL	SGCN	Nests in tundra regions; migrates through Texas; winter inhabitant of coastlines and mountains from Florida to South America. Occupies wide range of habitats during migration, including urban; stopovers at leading landscape edges, usually near water.	No	Potential migrant through the project area, but any use would be considered temporary. Therefore, the project would have no impact on this species.
Peregrine falcon	<i>Falco peregrinus</i>	DL	T	See subspecies for habitat descriptions.	No	Potential migrant through the project area, but any use would be considered temporary. Therefore, the project would have no impact on this species.
Whooping Crane	<i>Grus americana</i>	E	E	Potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties.	No	Potential migrant through the project area, but any use would be considered temporary. Therefore, the project would have no effect on this species.
Mountain Plover	<i>Charadrius montanus</i>	NL	SGCN	Associated with shortgrass plains and plowed fields; nests on the ground in shallow depressions on high plains or shortgrass prairie.	No	Potential migrant through the project area to and from coastal wintering grounds, but any use would be considered temporary. Therefore, the project would have no impact on this species.
Interior Least Tern	<i>Sterna antillarum athalassos</i>	E	E	Nests along sand and gravel bars within braided streams, rivers, and occasionally man-made structures such as gravel mines, inland beaches, etc. Feeds on small fish and crustaceans and when breeding forages within a few hundred feet of the colony.	No	Sand and gravel bars within braided streams and rivers as well as suitable man-made structures do not occur in the vicinity of the proposed project. Therefore, the project would have no effect on this species.
Western Burrowing Owl	<i>Athene cunicularia hypugaea</i>	NL	SGCN	Prairies, pastures, agricultural areas, savannas, open areas, vacant lots near human habitation.	No	No suitable habitat exists within the project area due to rocky terrain unsuitable for burrowing. The project would have no impact on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Black-capped Vireo	<i>Vireo atricapilla</i>	E	E	Found in oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous and broad-leaved shrubs and trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer.	No	Habitat of suitable structure and patch size for this species does not occur in the immediate vicinity of the proposed project. Therefore the project would have no effect on this species.
Sprague's Pipit	<i>Anthus spragueii</i>	C	SGCN	Wintering migrant in Texas; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size, avoids edges.	No	Native upland prairie does not occur within the project area. The project would have no impact on this species.
Golden-cheeked Warbler	<i>Setophaga chrysoparia</i>	E	E	Found in juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer.	Yes	This species has been documented by the TXNDD to occur approximately 1.46 miles from the proposed project (EO ID# 908). Juniper-oak woodlands occur within the vicinity of the proposed project. Presence/absence surveys were conducted during the 2014 breeding season and no birds were detected. The project would have no effect on this species.

Common Name	Scientific Name	Federal Status	State Status	Habitat Description	Habitat Present	Effect/Impact
Mammals						
Cave myotis bat	<i>Myotis velifer</i>	NL	SGCN	Colonial and cave-dwelling; also roost in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (<i>Hirundo pyrrhonota</i>) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum caves of Panhandle during winter; opportunistic insectivore.	No	Suitable roosting habitat would not be impacted by the proposed project. Therefore, the proposed project would have no impact on this species.
Plains spotted skunk	<i>Spilogale putorius interrupta</i>	NL	SGCN	Habitat generalist; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie.	Yes	Suitable habitat including woody, brushy areas occurs within the vicinity of the proposed project. The project may impact this species.
Red wolf	<i>Canis rufus</i>	E	E	Extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies.	No	This species is considered extirpated. The project would have no effect on this species.
E – Endangered; T – Threatened; C – Candidate for Listing; DL – Delisted; DL, M – Delisted, Monitoring; T/SA – Threatened by Similarity of Appearance; SGCN – Species of Greatest Conservation Need; rare, but with no current regulatory protection; NL – Not Listed						

Note: Based on recent published literature, *Neoleptoneta myopica* is changed to *Tayshaneta myopica* (Ledford 2012).

Sources:

U.S. Fish and Wildlife Service. 2013a. Endangered Species List. List of Species by County for Texas: Travis County, .

<http://ecos.fws.gov/ipac/wizard/chooseLocation!prepare.action;jsessionid=EBDAF61626874939BB2BB0B9F222F7-B5> , accessed February 24, 2015. See **Appendix C**.

Texas Parks and Wildlife Department. Annotated County Lists of Rare Species: Travis County, last revision December 5, 2014. <http://tpwd.texas.gov/gis/rtest/>, accessed February 24, 2015. See **Appendix C**.

Texas Department of Transportation, 2013. Best Management Practices Programmatic Agreement between Texas Department of Transportation and Texas Parks and Wildlife Department under the 2013 MOU.

Federally-Listed Species

Desktop analysis and field investigations conducted in August 2013 indicate that potential habitat for three federally-listed endangered species occurs in the vicinity of the proposed project. These include two amphibians, the Austin blind salamander (*Eurycea waterlooensis*) and the Barton Springs salamander (*Eurycea sosorum*), and one bird, the Golden-cheeked Warbler (*Setophaga chrysoparia*). One karst invertebrate from a locality near the proposed project that was previously considered to be the endangered the Bone Cave harvestman (*Texella reyesi*) has recently been assigned to a non-endangered species (Ubick 2014). These species and their impact scenarios are discussed in further detail below.

Karst Invertebrates

Five karst invertebrate species known to occur in Travis County were federally-listed as endangered species under the Endangered Species Act (ESA) by the USFWS on 16 September 1988 (USFWS 1988). These species were the Bee Creek Cave harvestman (*Texella reddelli*), Tooth Cave pseudoscorpion (*Tartarocreagris texana*, formerly *Microcreagris texana*), Tooth Cave spider (*Tayshaneta myopica*, formerly *Neoleptoneta myopica*), Tooth Cave ground beetle (*Rhadine persephone*), and the Kretschmarr Cave mold beetle (*Texamaurops reddelli*). An additional species, the Bone Cave harvestman (*Texella reyesi*) was federally-listed as an endangered species due to taxonomic revisions on 18 August 1993 (USFWS 1993). Management areas for these species have been established by USFWS that are known as Karst Fauna Regions (KFRs) (George Veni & Associates 2007) (**Figure 1**). This project area falls within the South Travis County KFR. One suspect record for the Bone Cave harvestman (*T. reyesi*) was recorded in the South Travis County KFR, (USFWS 2009). This specimen was found in Barker Ranch Cave No. 1, approximately 8,000 feet south of the proposed project. This record is a geographic outlier for the species, as noted in the USFWS 5-year status (2009): “Considering the geographic distance between northern (North Williamson, Georgetown, McNeil/Round Rock, Cedar Park, Jollyville Plateau, Central Austin KFRs) and southern (South Travis KFR) caves where this species occurs, the fact that they are separated by a major hydrologic divide (Colorado River), and that some northern caves overlap with the range of the closely related Bee Creek Cave harvestman (*Texella reddelli*), genetic analyses to confirm the presence of *T. reyesi* are needed.” On July 22, 2014, a second specimen, also juvenile, was obtained from the cave with the goal of clarifying the identity of the *Texella* population at the site. Taxonomic specialist Dr. Darrell Ubick compared both specimens from Barker Ranch Cave No. 1 to confirmed juvenile specimens of *T. reyesi* and *T. mulaiki*, and concluded that specimens from the cave were not *T. reyesi*, but were probably *T. mulaiki* (Ubick 2014). In a revision of the karst species zones, doubts about the identity of *Texella* specimens from this cave resulted in no areas of Karst Zone 1 being established for the South Travis County KFR (George Veni & Associates 2007) (**Figure 2**). The proposed project lies in Karst Zone 3. Karst zones are established by USFWS to show where endangered species habitat determinations need to be made prior to development projects. The zones in the Austin area are defined as follows:

- Zone 1: Areas known to contain endangered karst invertebrate species;
- Zone 2: Areas having a high probability of containing suitable habitat for endangered karst invertebrate species;
- Zone 3: Areas that probably do not contain endangered karst invertebrate species; and,
- Zone 4: Areas, both cavernous and non-cavernous, that do not contain endangered karst invertebrate species.

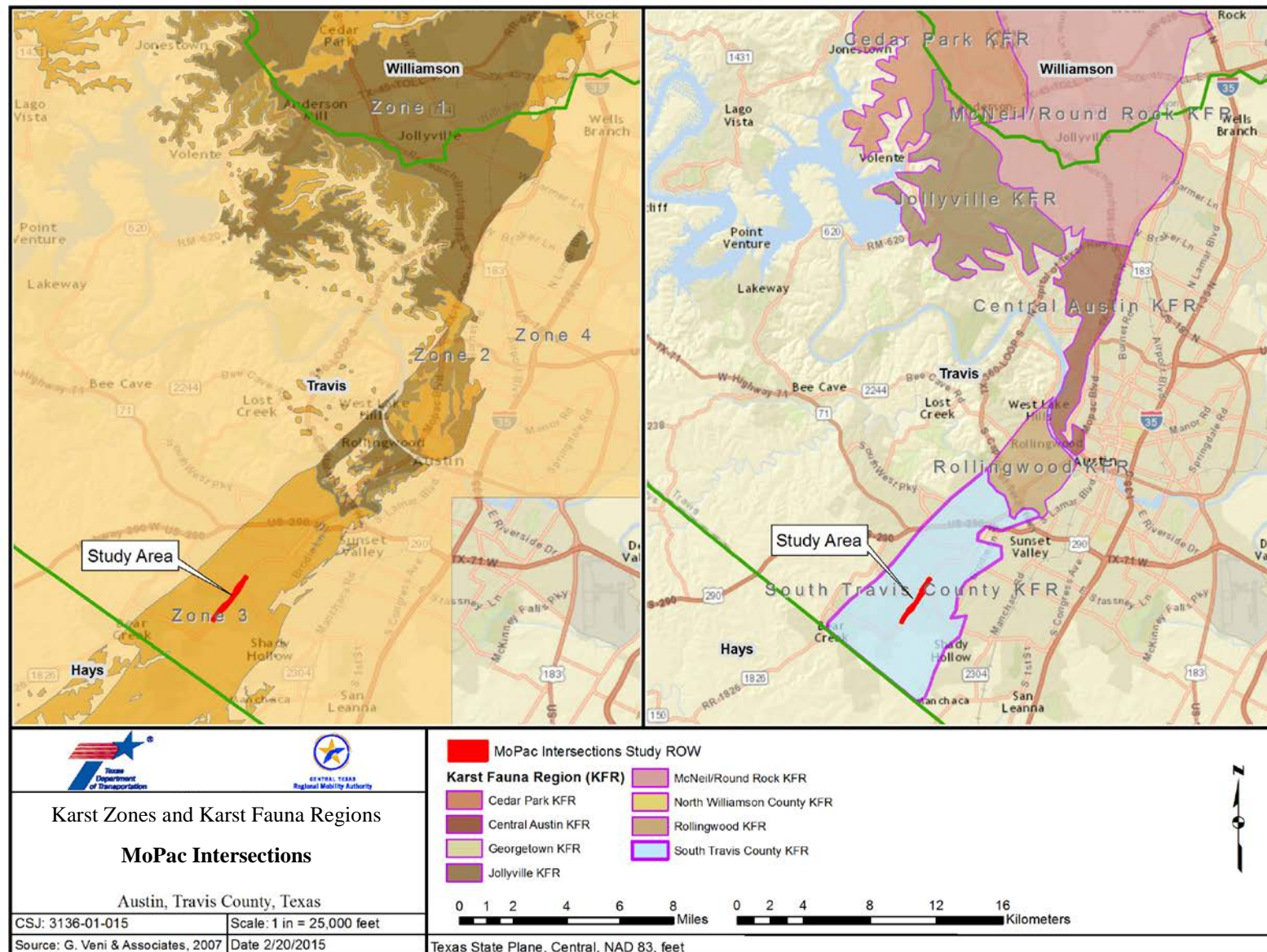


Figure 1: Karst Zones and Karst Fauna Regions

Rare, but not federally-listed, species also occur in this KFR and are therefore likely to occur within the proposed project area. These include the spiders *Cicurina bandida* and *Cicurina cueva*, the pseudoscorpion *Tartarocreagris proserpina*, the harvestman *Texella spinoperca*, the millipedes *Speodesmus* n. sp. and *Speodesmus bicornorus*, the springtails *Oncopodura fenestra* and *Arrhopalites texensis*, and the beetle *Rhadine austinica* (George Veni & Associates 2007, TSS 2013). Three of these, *Rhadine austinica*, *Speodesmus* n. sp., and *Texella spinoperca* are species of concern (SOC) covered in the Balcones Canyonlands Conservation Plan (BCCP) (BCP 2007). Although these three species do not have state or federal protection, they must be considered in actions taken by any entity choosing to participate in the BCCP to mitigate for take of covered SOC, or federally-listed karst invertebrates and songbirds. The BCCP included 62 caves to be protected by the plan that were known to contain federally-listed species or SOC. A number of these caves are in the vicinity of the proposed project area.

Background research was conducted in the vicinity of the project in order to identify known protected karst species localities and assess potential impacts. Caves can extend laterally for a significant distance from their entrances. Hovorka (2004) analyzed maps of 236 caves in the Edwards Group limestones of Central Texas and determined that 90 percent of cave footprints are contained within a 250-foot circle of the cave entrance. The Edwards Aquifer Rules of the TCEQ calls for protection considerations to extend up to 200 feet beyond the cave footprint (TCEQ 2012). For the purposes of this study, all available information on caves and karst features to a distance of 500 feet of the ROW was collected (review area). The 500 foot review area was included to capture disturbance from construction activities that have the potential to extend beyond the project footprint. In addition, BCCP-protected SOC caves within 0.25 miles of the project right of way and BCCP-protected SOC caves beyond 0.25 miles whose surface or subsurface drainage basins were known to extend into the review area were also reviewed. The 0.25 miles distance was used as that is the distance required to be considered for BCCP-protected SOC caves in case of BCCP participation. Background research revealed the existence of seven caves, two sinkholes, and one solution cavity within the review area. These are listed in **Table 2**.

Of these seven caves, three of them, District Park Cave, Slaughter Creek Cave, and Pipeline Cave, are protected under the BCCP. District Park Cave contains *Cicurina bandida*, the ground beetle *Rhadine austinica*, and the millipede *Speodesmus* n. sp. Slaughter Creek Cave contains *Cicurina bandida*, and Pipeline Cave contains *Speodesmus* n. sp. In addition to these three caves, Get Down Cave is a BCCP cave located within a 0.25-mile distance of the proposed project area. Get Down Cave contains the millipede *Speodesmus* n. sp. and the ground beetle *Rhadine austinica*. Preliminary basin delineations by the City of Austin indicate that the proposed project boundary is not within the surface drainage basin for these caves (Hauwert 2012). The subsurface drainage basins for these caves may include areas within the proposed project area, but those basins have not yet been delineated.

Additional surface and subsurface drainage basin delineations have been conducted by the City of Austin at three BCCP-protected caves farther beyond the review area, to the east along Deer Lane (Hauwert 2012). These caves are Blowing Sink Cave, Goat Cave, and Maple Run Cave. Goat Cave and Maple Run Cave are within the Goat Cave Karst Preserve on the north side of Deer Lane. Blowing Sink Cave is on the Blowing Sink Tract, which is located on the south side of Deer Lane. Both preserves are managed by the City of Austin for the protection of karst invertebrate species and groundwater recharge. The Blowing Sink tract is also part of the Balcones Canyonlands Preserve system. All three of these caves contain BCCP SOC. Improvements to Deer Lane, which passes between these two preserves to align and connect it to Davis Lane east of Brodie Lane, prompted the City of Austin to undertake a hydrogeologic

study of existing impacts to these three caves (Hauwert 2012). Deer/Davis Lane are on the surface drainage divide between Williamson Creek to the north and Slaughter Creek to the south. Under pre-existing conditions stormwater drained both to the south to potentially enter Blowing Sink Cave and to the north in a stormwater channel to a retention pond. The channel and pond were shown via dye tracing tests to leak into both Goat and Maple Run caves. As a result of this study, the design of the improved Davis Lane will divert surface runoff to a new stormwater retention pond situated in a location with less permeable geology (Hauwert 2012).

Table 2: Caves, Sinkholes and Solution Cavities in the Vicinity of the MoPac Intersections

BCCP Cave Name	Surface Basin Delineated?	Subsurface Basin Delineated?	Species of Concern	Specific Issues	Distance from Right of Way (ft)
Another Cave	Yes; not in MoPac right of way	No	—	—	174
Arrow Cave	Yes; not in MoPac right of way	No	<i>Rhadine austinica</i>	—	1,738
Buddy's Vault	No	No	—	Cave discovered during sewer trenching; now sealed	170
Confusion Cave	Yes; not in MoPac right of way	No	—	—	446
Blowing Sink Cave	Yes; not in MoPac right of way	Not fully, portion delineated extends into MoPac right of way	<i>Eurycea</i> prob. <i>sosorum</i> *; <i>Cicurina bandida</i> ; <i>Rhadine austinica</i>	BCCP protected; receives subsurface drainage from Wildflower Cave, which does not receive surface drainage from right of way	5,800
District Park Cave	Yes, not in MoPac right of way	No	<i>Cicurina bandida</i> , <i>Rhadine austinica</i> , <i>Speodesmus</i> n.s.	BCCP protected	410
Get Down Cave	Yes; not in MoPac right of way	No	—	—	1,115
Goat Cave	Yes; not in MoPac right of way	Yes; not in MoPac right of way	<i>Speodesmus</i> n. sp.	BCCP protected	5,300
La Crosse Cave	Yes; in MoPac ROW	No	—	—	780
Little Deer Cave	Yes; not in MoPac right of way	No	—	—	65

BCCP Cave Name	Surface Basin Delineated?	Subsurface Basin Delineated?	Species of Concern	Specific Issues	Distance from Right of Way (ft)
Maple Run Cave	Yes; not in MoPac right of way	Yes; not in MoPac right of way	<i>Rhadine austinica</i>	BCCP protected	5,300
Pipeline Cave	Yes; not in MoPac right of way	No	<i>Speodesmus</i> n. sp.	BCCP protected	500
Slaughter Creek	Yes; not in MoPac right of way	No	<i>Cicurina bandida</i> ; <i>Rhadine austinica</i>	BCCP protected	440
Wildflower Cave	Yes; in MoPac ROW	No	—	Connected to Blowing Sink Cave by dye trace	715

Dye tracing also demonstrated that groundwater flowing from the Goat Cave Karst Preserve on the north side of Deer/Davis Lane flows southward underneath Deer/Davis Lane and emerges in passageways within Blowing Sink Cave, a distance of approximately 3,000 feet. Additionally, a dye trace conducted in 2010 showed that water from Wildflower Cave, a non-BCCP cave located south of La Crosse Avenue and 780 feet east of the project right of way, reaches the stream in the lower section of Blowing Sink Cave (Hauwert 2012). The surface drainage basin of Wildflower Cave extends into the project right of way, thus extending the subsurface drainage basin for Blowing Sink Cave into that area. Utilizing data from these traces, Hauwert (2012) outlined an overall subsurface drainage basin for Blowing Sink Cave that includes Goat Cave, Maple Run Cave, and Wildflower Cave, and extends across a portion of the project right of way; however, whether the subsurface drainage basin for the cave actually reaches or crosses MoPac has not been confirmed by tracing tests.

The primary threat to karst invertebrate species in Central Texas is habitat loss and degradation due to increased urbanization. Threats include filling in and collapsing of caves, alteration of drainage patterns, alteration of surface plant and animal communities, contamination, and vandalism (USFWS 2011, USFWS 2012). In addition, the continued spread of non-native, invasive species, such as the red-imported fire ant (*Solenopsis invicta*), poses a serious threat to karst invertebrates through direct predation and competition with native species (Taylor et al. 2004, USFWS 2011). This is a particularly important issue for listed karst invertebrates in central Texas because many of the caves in this region are shallow and provide refuge to red-imported fire ants during temperature extremes. Red-imported fire ants have also been observed directly attacking and carrying off cave crickets, a species that serves an integral role in the karst ecosystem (Elliott 2000). A similar emerging threat in the area is the presence of invasive tawny crazy ants (*Nylanderia fulva*), which have been documented in nearby Whirlpool Cave.

Eurycea Salamanders

The proposed project lies within the recharge zone for Barton Springs (**Figure 2**), which is habitat for two federally-listed salamanders, the Barton Springs salamander (*Eurycea sosorum*), listed on 30 April 1997, and the Austin blind salamander (*Eurycea waterlooensis*), listed on 20 August 2013. Both salamanders rely on clean, well oxygenated spring water with substrates

that are free of sediment (USFWS 2005, USFWS 2012). One Critical Habitat Unit (CHU) totaling 120 acres has been proposed in and around the Barton Springs complex that includes 300 meters (984 feet) around each spring (USFWS 2012). The Barton Springs complex is located approximately 8 miles northeast of the project area. While these two species are currently recognized by USFWS as only occurring at the Barton Springs complex, *Eurycea* salamanders commonly inhabit cave streams such as those likely to be feeding the springs. In designating critical habitat for *E. waterlooensis*, USFWS listed rocky spring substrates with minimal sediment as an essential physical component for the species, while also acknowledging access for the species to the aquifer as essential (USFWS 2013b); however, in delineating critical habitat the USFWS only utilized the distance between inhabited spring outlets (984 feet) to establish polygons around the springs. Their justification was that this is the greatest distance the species has been documented to travel underground; however, this may be a reflection of how few sites are available to humans for accessing the aquifer to detect salamanders. The next humanly accessible site upstream from Barton Springs within the aquifer is Blowing Sink Cave. Blowing Sink Cave is the deepest cave in Travis County at 253 feet and the only cave in Travis County where it is humanly possible to descend to the water table of the Edwards Aquifer (Hauwert 2012). Blowing Sink Cave is located approximately 7 miles southwest of Barton Springs and 5,800 feet east of the proposed project right of way. Chippendale (2014) concludes that the *Eurycea* populations in Blowing Sink Cave and at other sites in the watershed are *E. sosorum*, although this has not yet been accepted by USFWS. He also concludes that there are high levels of gene flow between Blowing Sink Cave, Cold Springs, and Barton Springs *Eurycea* populations. This assessment is supported by hydrogeologic studies showing groundwater flow in the Barton Springs segment of the Edwards Aquifer trends northeast towards Barton and Cold springs (Hauwert et al. 2004). In listing the Barton Springs and Austin blind salamanders as endangered and at risk of extinction, USFWS cited very limited range, impacted habitat, and future increase in threats, such as decreased water quality from urbanization, as reasons for the listings (USFWS 1997, 2013a). The population in Blowing Sink Cave relies on clean, well oxygenated spring water with substrates that are free of sediment and likely faces the same threats as other *Eurycea* species (USFWS 2005, 2013a).

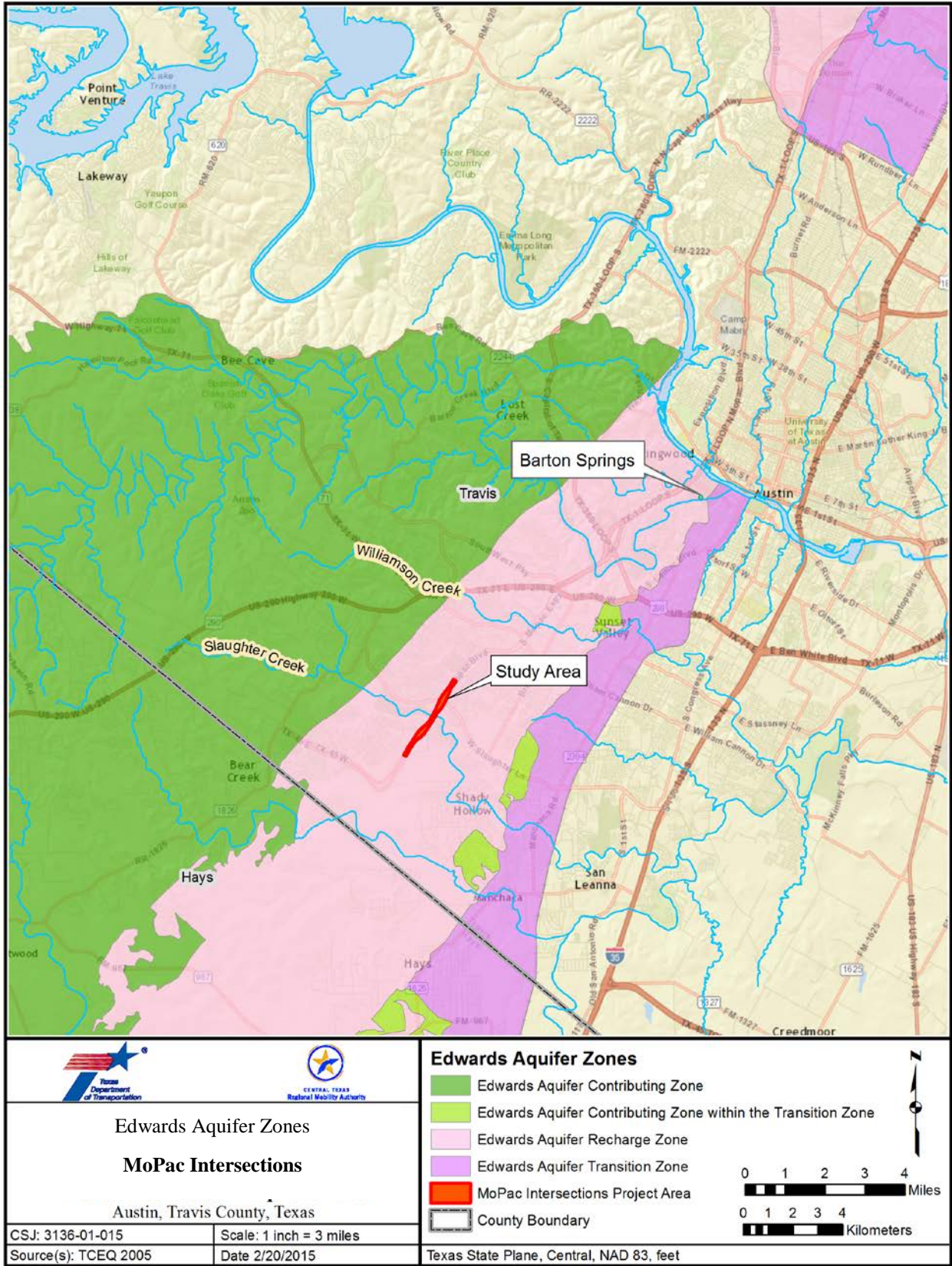


Figure 2: Edwards Aquifer Zones

Golden-cheeked Warbler

The state and federally endangered Golden-cheeked Warbler is a small insectivorous neotropical migratory songbird. Males have a black back, throat, upper breast, and crown, white belly, black-streaked sides, white wing bars, and a black line through the eye with large yellow patches both above and below the eye. Females and immature males are duller, with olive upperparts with dark streaks and a yellowish or white chin (NatureServe 2014). This songbird nests only in the mixed juniper-oak woodlands of the Balconian biotic province of central Texas. This species, which winters in southern Mexico and the Central American countries of Guatemala, Honduras, and Nicaragua, is the only Texas species whose breeding range is entirely confined to the state's boundaries. The known breeding range of the Golden-cheeked Warbler includes 37 Texas counties on the Lampasas Cut Plain, Edwards Plateau and Llano Uplift regions of the state (USFWS 1991). They breed in woodlands characterized by a mix of Ashe juniper (*Juniperus ashei*) and various deciduous trees including Texas oak (*Quercus buckleyi*), plateau live oak (*Quercus fusiformis*), cedar elm (*Ulmus crassifolia*), Texas persimmon (*Diospyros texana*), hackberry (*Celtis* spp.), evergreen sumac (*Rhus virens*), Texas ash (*Fraxinus texensis*), redbud (*Cercis canadensis*), and escarpment black cherry (*Prunus serotina*) (USFWS 1991). Ashe juniper is often the dominant woody plant and occurs at all sites occupied by the bird. Females construct nests from Ashe juniper bark, which exfoliates in the form of strips, especially in more mature trees (Pulich 1976).

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

While no habitat for the Golden-cheeked Warbler was identified within the existing median areas, a review of habitat mapping data associated with Morrison et al. (2010) concluded that low- and medium-quality habitat occurs in the vicinity of the proposed project (primarily in the Slaughter Creek Greenbelt) (**Figure 3**). Additionally, a review of shape files associated with the BCCP habitat zone map (Oak Hill Quadrangle) concluded that Zone 2 Golden-cheeked Warbler habitat occurs within the project area and surrounding areas. Zone 2 is defined in the BCCP as "unconfirmed habitat." Approximately 7.4 acres of Zone 2 Golden-cheeked Warbler habitat occur within the footprint of the proposed project (**Figure 4**). It should be noted that the BCCP zone maps were created in 1996, but are referenced because they are still used today for mitigation purposes.

The habitat assessment conducted for this project determined that 19.6 acres of isolated oak-juniper savannah vegetation within the median are of insufficient canopy cover and patch size to provide habitat for the Golden-cheeked Warbler; however, these areas were included in the presence-absence survey in the interest of completeness.

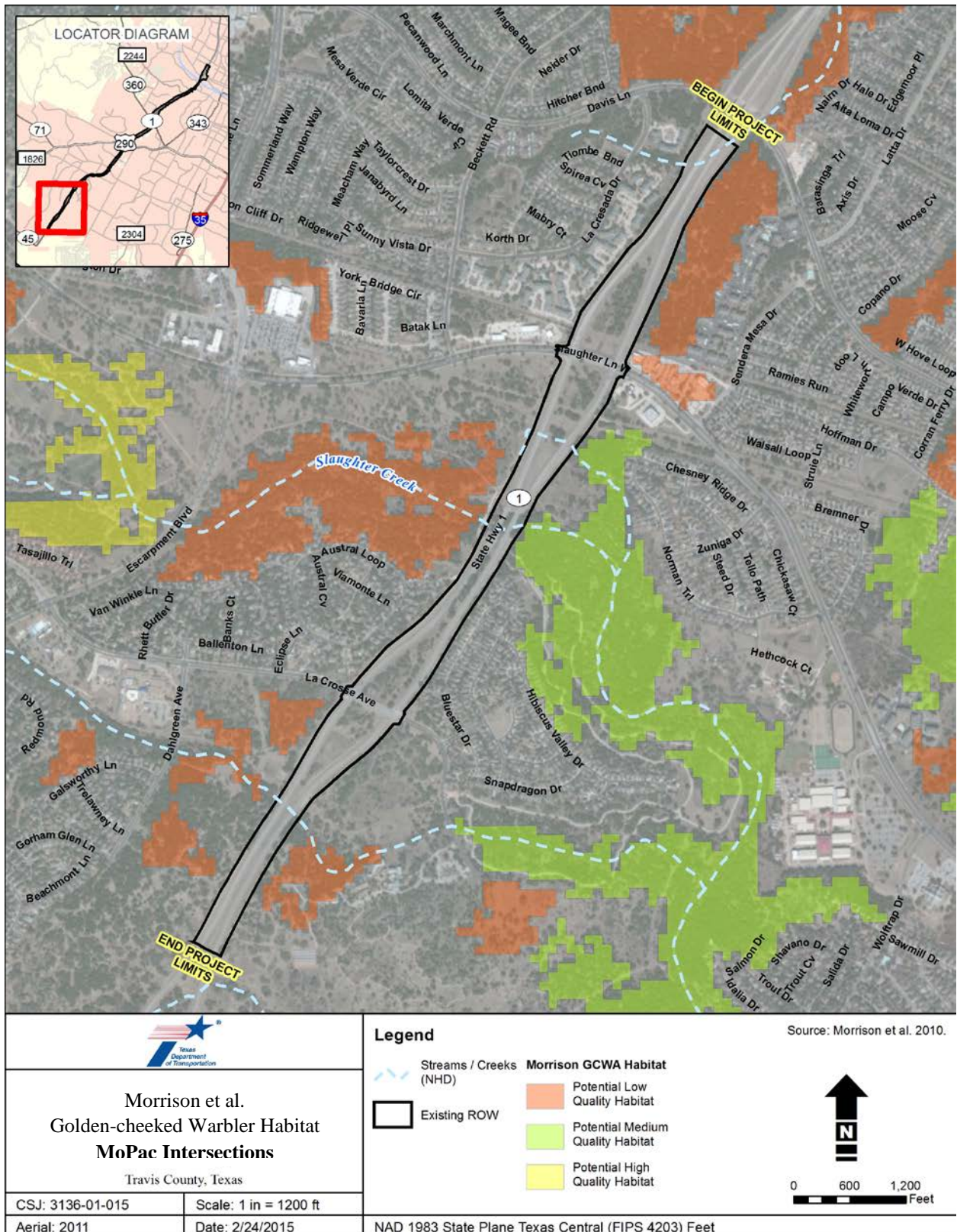


Figure 3: Morrison et al. Golden-cheeked Warbler Habitat

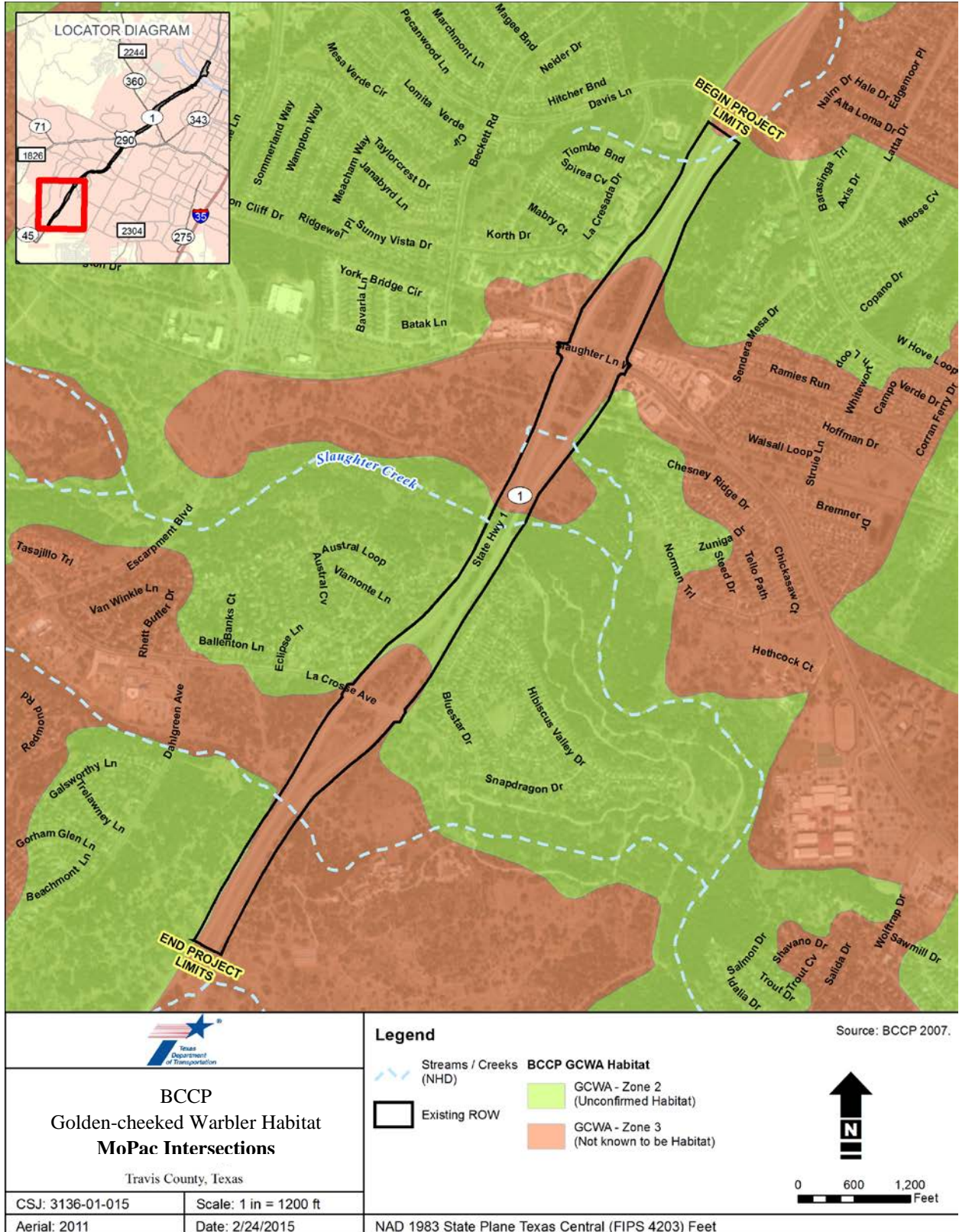


Figure 4: Balcones Canyonlands Conservation Plan - Golden-cheeked Warbler Habitat

State-Listed Threatened and Species of Greatest Conservation Need (SGCN)

In addition to the species described above, desktop analysis and field investigations indicate that no potential habitat for state-listed threatened species occurs in the vicinity of the proposed project. Potential habitat for six SGCN, Balcones Cave amphipod (*Stygobromus balconis*), Bifurcated Cave amphipod (*Stygobromus bifurcatus*), Bandit Cave spider (*Cicurina bandida*), Leonora's dancer damselfly (*Argia leonora*), the Texas garter snake (*Thamnophis sirtalis annectens*), plains spotted skunk (*Spilogale putorius interrupta*), occurs in the vicinity of the proposed project. No habitat for the two amphipods and spider was encountered within the right of way during karst feature surveys; however, karst invertebrate habitat occurs within the review area. The project is within the known range of the Balcones Cave amphipod and known habitat for the Bifurcated Cave amphipod occurs downstream of the proposed project within the aquifer. Additionally, the Bandit cave spider is known from a cave within the review area. The project has the potential to intersect karst voids and therefore may impact potential habitat for these species. Though suitable habitat for the damselfly and snake occurs along Slaughter Creek, this area would not be impacted by the proposed project; therefore, no impacts to these species would be expected to occur. The spotted skunk is a habitat generalist and could occur throughout the proposed project area, especially in areas of wooded, brushy vegetation. Because of this, the project may impact this species.

Build Alternative

Karst Invertebrates and Eurycea Salamanders

Background research showed the existence of six caves, two sinkholes, and one solution cavity within the review area. Five potential karst features were identified within the proposed project right of way during pedestrian karst feature surveys. Subsequent excavation demonstrated that four of these were the result of human disturbance likely related to previous roadway construction. The fifth feature is a zone of solution enlarged fractures in the bed of Slaughter Creek; however, the fractures are filled with compact material and are not karst invertebrate habitat. No habitat for karst invertebrates or salamander species was identified within the right of way and no occurrences of *Eurycea* salamanders have been documented within the project area. However, the right of way is a graded and humanly altered landscape which may obscure naturally occurring ground features; therefore, there is potential for features containing karst invertebrate habitat or recharge potential to be encountered during excavation activities. Although no subterranean species habitat was found within the project right of way during karst feature surveys, there are caves and karst features known on both sides of the existing roadway and the project area is within the known range of several BCCP-protected caves with SOCs, and the project area lies within Karst Zone 3. It is possible that karst features or caves may be revealed where excavation occurs below the current grade during construction of the proposed project. If this were to occur, work should cease in the immediate vicinity of the feature, the feature should be protected, and a section 10(A)(1)(a) permitted scientist should inspect the site as soon as possible in order to evaluate the feature for potential habitat. As provided in **Table 1**, the proposed project may impact several BCCP karst SOC and will have **no effect** on any of the federally listed karst invertebrates.

No *Eurycea* species habitat was identified within the project right of way during karst feature surveys; however, two recharge features and one sinkhole were identified within the review area during desktop analyses. The proposed project occurs over an area that recharges directly to Barton Springs. The *Water Resources Technical Memorandum* for the MoPac Intersections project indicated that, "the proposed project would result in minimal and discountable impacts to water quantity and possible, but negligible impacts to water quality". An *Additional Geologic*

Studies Memorandum prepared to evaluate the potential for a significant hydrogeological connection between the MoPac Intersections Project area and known area caves that could affect water quality, quantity, and protected species. That memo concluded, "Potential impacts to federally-listed *Eurycea* sp. salamanders in Blowing Sink Cave or Barton Springs are highly unlikely due to existing and proposed water quality BMPs that will treat any surface water flowing from the project area before it recharges the Barton Springs Segment of the Edwards Aquifer". The *Water Resources Technical Memorandum* and the *Additional Geologic Studies Memorandum* are on file at the TxDOT Austin District and Central Texas Regional Mobility Authority offices and at www.MoPacSouth.com.

Because of this, the remaining risks to listed salamander species would occur during the construction phase when a void is encountered during downcutting of grade, drilling for piers and geotechnical boreholes. Typical BMPs such as berming and silt fencing can be overwhelmed by floodwaters in excavation areas that constitute man-made depressions due to the manner in which grade excavation occurs, resulting in possible introduction of silt and construction equipment fuels and lubricants to the subsurface. To avoid such occurrences, excavation will be planned in such a way as to avoid closed depressions, maintaining drainage away from the project area at all times. Without the artificial "head" created by a closed topographic depression, berms or sandbags can be erected around accidentally discovered voids that cannot be overtopped by floodwaters, eliminating the possibility that silt and contaminants from the surrounding area will enter the feature. These protections will remain in place until the feature is biologically assessed and a void closure plan is implemented.

The project would have **no effect** on the Barton Springs salamander (*Eurycea sosorum*). Likewise, while dye tracing studies have shown that water flowing through Blowing Sink Cave also reaches Barton Springs (Hauwert 2004), the project would have **no effect** on the Austin Blind salamander (*Eurycea waterlooensis*). This conclusion is reached for the following reasons:

- In compliance with the Edwards Aquifer Rules, water quality controls and BMPs will remove 80 percent of total suspended solids from stormwater runoff. More detail will be provided on these controls and BMPs during the development of *Plans, Specifications and Estimates* (PS&E) in the TCEQ-approved Water Pollution Abatement Plan (WPAP).
- Existing hazardous materials traps will be maintained, repaired, or replaced as a result of the proposed project.
- The highest risk for negative groundwater impacts is associated with the intersection of voids during the down-cutting of grade. Downcutting of grade will occur in a carefully considered sequence to avoid closed depressions that could concentrate drainage into accidentally discovered voids. Strict monitoring for void encounters will be maintained throughout the project, and protection measures to prevent surface flow into them will be installed immediately. Permanent protection, if applicable, will be designed to restore groundwater flow in severed conduits to the extent practicable.
- Temporary erosion and sedimentation controls will be in place during construction, in addition to the measures described above relating to downcutting of grade. More detail will be provided on these controls during the development of PS&E in the Storm Water Pollution Prevention Plan (SW3P).

Additionally, any direct or indirect encroachment-alteration effects to these species are considered unlikely to occur, particularly considering the proposed project would employ measures to avoid or minimize impacts to these and other biological resources. In addition to

the implementation of these avoidance and minimization measures, the proposed project would comply with the TCEQ Edwards Aquifer Rules regarding stormwater pollutant removal and USFWS protocols in the event of discovery of sensitive features. Given the unlikelihood for direct impacts to occur to these species, indirect encroachment-alteration effects related to excavation and other construction activities would not be anticipated to occur.

Golden-cheeked Warbler

A review of a number of published resources indicated that potential habitat for the Golden-cheeked Warbler occurs in the vicinity of the proposed project. A presence/absence survey was conducted within all wooded habitat within the existing right of way (including median) during the 2014 breeding season, according to USFWS protocol. No Golden-cheeked Warblers were detected. It is the opinion of the permitted biologist that no woodland areas to be impacted by the proposed project constitute habitat likely to be occupied by the warbler. For this reason, the project would have **no effect** on this species, by definition meaning that the proposed project would not affect this species or designated critical habitat.

Species of Greatest Conservation Need (SGCN)

The proposed project has the potential to impact four species of greatest conservation need, the Balcones Cave amphipod, Bifurcated Cave amphipod, Bandit Cave spider and plains spotted skunk. In accordance with the BMPs Programmatic Agreement between the TxDOT and TPWD, contractors would be advised of the potential occurrence of this species in the project area and to avoid harming the species if encountered. Additionally, contractors would be advised to avoid unnecessary impacts to dens if also encountered. Because there are no approved BMPs for the two amphipods and spider listed in the Programmatic Agreement, coordination with TPWD would be required for these species.

No-Build Alternative

The No-Build Alternative would not impact SGCN, threatened or endangered species.

1.4 TEXAS NATURAL DIVERSITY DATABASE (TXNDD)

The TPWD's Texas Natural Diversity Database (TXNDD) maintains a record of observations of tracked rare, threatened or endangered species and assemblages throughout the state. These observances are called Element of Occurrence Records (EORs), and are defined as an area of land and/or water where a species or ecological community is or was present that has practical conservation value (NatureServe 2002). Considered collectively, the TXNDD results and TPWD and USFWS county lists identify several species that have historically occurred in Travis County. It should be noted that information from the TXNDD cannot be used for presence/absence determinations. The TXNDD was searched for EORs on February 24, 2015, to determine whether any reports of species have occurred within a 1.5-mile radius of the proposed project (**Table 3**).

**Table 3: Texas Parks and Wildlife Department
Natural Diversity Database Search Results**

EO ID ¹	Common/Scientific Name	Listing Status ²	Distance From Project Area (miles)
8968	Barton Springs salamander/ <i>Eurycea sosorum</i>	LE	0.69
11983	Vertisol Blackland Prairie	NL	1.27
908	Golden-cheeked Warbler/ <i>Setophaga chrysoparia</i>	LE	1.46

¹EO ID – Element of Occurrence Record Identification Number for species or feature observed

²LE, LT – Listed Endangered/Threatened; NL– Not Listed

As noted in **Table 3**, this database search indicated that two species federally listed as endangered have been documented to occur in the vicinity of the proposed project. The Barton Springs salamander (*Eurycea sosorum*) and the Golden-cheeked warbler (*Setophaga chrysoparia*) have been documented to occur approximately 0.69 and 1.46 miles from the proposed project, respectively. Both species are discussed in detail above in **Section 2.3**. Vertisol blackland prairie, a remnant vegetation series, is documented to occur approximately 1.27 miles from the proposed project. No managed areas (areas federally or state owned and operated) occur in close proximity to the proposed project.

2.0 CONCLUSIONS

Wildlife

Construction phase activities would directly or indirectly affect most wildlife species present. Some sessile and/or slow moving species could be killed by heavy machinery during right of way clearing. Impacts to wildlife within the proposed project would also occur in conjunction with the removal and disturbance of vegetation. Habitat types mapped by the Ecological Management Systems of Texas (EMST) that would be impacted by the proposed project include Edwards Plateau: Ashe Juniper Motte and Woodland; Edwards Plateau: Deciduous Oak/Evergreen Motte and Woodland; Edwards Plateau: Floodplain Hardwood/Ashe Juniper Forest; Edwards Plateau: Live Oak Motte and Woodland; Edwards Plateau: Oak/Hardwood Motte and Woodland; Edwards Plateau: Post Oak Motte and Woodland; Edwards Plateau: Riparian Hardwood/Ashe Juniper Forest; Edwards Plateau: Savanna Grassland; Native Invasive: Mesquite Shrubland; Urban Low Intensity and Urban High Intensity. Wooded areas provide cover, food, and habitat for many resident and migratory species. Direct mortality of wildlife species from vehicle collisions (road kill), especially to invertebrates such as insects, is well documented and would likely be an effect.

Migratory Birds

Migratory birds were observed during August 28, 2013, field investigations and spring 2014 Golden-cheeked Warbler surveys and may arrive in the project area to breed during construction of the proposed project. One Cliff Swallow (*Petrochelidon pyrrhonota*) and an Eastern Phoebe (*Sayornis phoebe*) were observed nesting within the project area beneath the bridged (southern) crossing of Slaughter Creek. Additionally, 21 active Cliff Swallow nests were observed in the box culverts just north of the Slaughter Creek bridges. In addition to the those observed at bridges and culverts, numerous avian species subject to the protections of the Migratory Bird Treaty Act would be expected to be breeding within oak-juniper savannah vegetation areas within existing median areas. Appropriate measures would be taken to avoid adverse impacts on migratory birds and would include the following:

- Disturbing, destroying, or removing active migratory bird nests, including ground nesting birds, will be prohibited during the February 15 through October 1 nesting season;
- The removal of unoccupied, inactive nests, will be avoided, where practicable;
- The establishment of active nests during the nesting season on TxDOT owned-and-operated facilities and structures proposed for replacement or repair will be prevented; and
- The collection, capture, relocation, or transportation of birds, eggs, young, or active nests without a permit will be prohibited.

Threatened and Endangered Species

Federally-Listed Species

Desktop analysis and field investigations conducted in August 2013 indicate that potential habitat for three federally-listed endangered species occurs in the vicinity of the proposed project. These include two amphibians, the Austin blind salamander (*Eurycea waterlooensis*) and the Barton Springs salamander (*Eurycea sosorum*), and one bird, the Golden-cheeked Warbler (*Setophaga chrysoparia*).

No *Eurycea* species habitat was identified within the project right of way during karst feature surveys; however, two recharge features and one sinkhole were identified within the review area during desktop analyses. While the proposed project occurs over an area that recharges directly to Barton Springs, temporary and permanent BMPs would prevent introduction of silt and contaminants generated by the project to the subsurface. Therefore, the project would have **no effect** on the Barton Springs salamander or the Austin Blind salamander.

A presence/absence survey for Golden-cheeked Warblers was conducted during the 2014 breeding season according to USFWS protocol. No Golden-cheeked Warblers were detected. It is the opinion of the permitted biologist that no woodland areas to be impacted by the proposed project constitute habitat likely to be occupied by the warbler. For this reason, the project would have **no effect** on this species.

This project would have no effect on Federally-listed species. Consultation with USFWS is not required.

State-Listed Threatened Species and Species of Greatest Conservation Need (SGCN)

Additionally, desktop analysis and field investigations indicate that no potential habitat for state-listed threatened species occurs in the vicinity of the proposed project. The proposed project has the potential to impact four SGCN: the Balcones Cave amphipod, Bifurcated Cave amphipod, Bandit Cave spider and plains spotted skunk. In accordance with the BMPs Programmatic Agreement between the TxDOT and TPWD, contractors would be advised of the potential occurrence of these species in the project area and to avoid harming the species if encountered. Additionally, contractors would be advised to avoid unnecessary impacts to dens if also encountered. Because there are no approved BMPs for the two amphipods and spider listed in the Programmatic Agreement, coordination with TPWD would be required for these species. Please see the TPWD Analysis Section in **Appendix B** for more information.

Coordination with TPWD was initiated on March 3, 2015 and concluded on June 12, 2015.

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Appendix A
Site Photographs

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Photo 1. Intersection of MoPac and La Crosse, looking north



Photo 2. Along the median, north of Slaughter Lane, looking northeast



Photo 3. Within the median south of Slaughter Lane, looking north



Photo 4. Within the median north of Slaughter Lane, looking north



Photo 3. West of Slaughter Creek Bridge, looking east

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Appendix B

Biological Evaluation Form (including TPWD-TxDOT MOU Tier I Site Assessment)

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Biological Evaluation Form

CSJ: 3136-01-015

MoPac Intersections Project
From North of Slaughter Lane to
South of La Crosse Avenue

CSJ: 3136-01-015

Project has no Federal nexus.

Date of Evaluation: February 24, 2015

Proposed Letting Date:

County: Travis

Roadway Name: MoPac Intersections Project

Project Limits: From North of Slaughter Lane to South of La Crosse Avenue

Project Description: The project would provide needed operational improvements to two heavily used intersections—Slaughter Lane and La Crosse Avenue. The project is approximately two miles long and would include grade separations at the two intersections.

Endangered Species Act (ESA)

1. Yes Is the action area of the proposed project within the range and in suitable habitat of federally protected species?

Date [USFWS County List](#) Accessed: February 24, 2015

- 1.1 No Would the proposed project affect protected species and/or their habitat?

*Explain:

As detailed in the Biological Studies Technical Memorandum, desktop analysis and field investigations conducted in August 2013 indicate that potential habitat for three federally listed endangered species occurs in the vicinity of the proposed project. These include two amphibians, the Austin blind salamander (*Eurycea waterlooensis*) and the Barton Springs salamander (*Eurycea sosorum*); and one bird, the Golden-cheeked Warbler (*Setophaga chrysoparia*).

A pedestrian karst feature survey was conducted in the existing ROW. No *Eurycea* species habitat was identified within the project right of way during karst feature surveys; however, two recharge features and one sinkhole were identified within the review area during desktop analyses. The proposed project occurs over an area that recharges directly to Barton Springs. The Water Resources Technical Memorandum for the MoPac Intersections project indicated that, "the proposed project would result in minimal and discountable impacts to water quantity and possible, but negligible impacts to water quality". An Additional Geologic Studies Memorandum prepared to evaluate the potential for a significant hydrogeological connection between the MoPac Intersections Project area and known area caves that could affect water quality, quantity, and protected species. That memo concluded, "Potential impacts to federally-listed *Eurycea* sp. salamanders in Blowing Sink Cave or Barton Springs are highly unlikely due to existing and proposed water quality BMPs that will treat any surface water flowing from the project area before it recharges the Barton Springs Segment of the Edwards Aquifer". The Water Resources Technical Memorandum and the Additional Geologic Studies

Memorandum are on file at the TxDOT Austin District and Central Texas Regional Mobility Authority offices and at www.MoPacSouth.com.

Because of this, the remaining risks to listed salamander species would occur during the construction phase when a void is encountered during downcutting of grade, drilling for piers and geotechnical boreholes. Typical BMPs such as berming and silt fencing can be overwhelmed by floodwaters in excavation areas that constitute man-made depressions due to the manner in which grade excavation occurs, resulting in possible introduction of silt and construction equipment fuels and lubricants to the subsurface. To avoid such occurrences, excavation will be planned in such a way as to avoid closed depressions, maintaining drainage away from the project area at all times. Without the artificial "head" created by a closed topographic depression, berms or sandbags can be erected around accidentally discovered voids that cannot be overtopped by floodwaters, eliminating the possibility that silt and contaminants from the surrounding area will enter the feature. These protections will remain in place until the feature is biologically assessed and a void closure plan is implemented.

The project would have **no effect** on the Barton Springs salamander (*Eurycea sosorum*). Likewise, while dye tracing studies have shown that water flowing through Blowing Sink Cave also reaches Barton Springs, the project would have **no effect** on the Austin Blind salamander (*Eurycea waterlooensis*). This conclusion is reached for the following reasons: In compliance with the Edwards Aquifer Rules, water quality controls and Best Management Practices (BMPs) will remove 80 percent of total suspended solids from stormwater runoff. More detail will be provided on these controls and BMPs during the development of Plans, Specifications and Estimates (PS&E) in the Water Pollution Abatement Plan (WPAP); existing hazardous materials traps will be maintained, repaired, or replaced as a result of the proposed project; the highest risk for negative groundwater impacts is associated with the intersection of voids during the down-cutting of grade. Downcutting of grade will occur in a carefully considered sequence to avoid closed depressions that could concentrate drainage into accidentally discovered voids. Strict monitoring for void encounters will be maintained throughout the project, and protection measures to prevent surface flow into them will be installed immediately. Permanent protection, if applicable, will be designed to restore groundwater flow in severed conduits to the extent practicable; and temporary erosion and sedimentation controls will be in place during construction, in addition to the measures described above relating to downcutting of grade. More detail will be provided on these controls during the development of Plans, Specifications and Estimates (PS&E) in the Storm Water Pollution Prevention Plan (SW3P).

Additionally, any direct or indirect encroachment-alteration effects to these species are considered unlikely to occur, particularly considering the proposed project would employ measures to avoid or minimize impacts to these and other biological resources. In addition to the implementation of these avoidance and minimization measures, the proposed project would comply with the TCEQ Edwards Aquifer Rules regarding stormwater pollutant removal and USFWS protocols in the event of discovery of sensitive features. Given the unlikelihood for direct impacts to occur to these species, indirect encroachment-alteration effects related to excavation and

other construction activities would not be anticipated to occur.

While no habitat for the Golden-cheeked Warbler was identified within the project footprint (within median areas), a review of habitat mapping data associated with Morrison et al. (2010) concluded that low and medium quality habitat occurs in the vicinity of the proposed project but not within median areas; primarily in the Slaughter Creek Greenbelt. Additionally, a review of shape files associated with the Balcones Canyonlands Conservation Plan (BCCP) habitat zone map (Oak Hill Quadrangle) concluded that Zone 2 Golden-cheeked Warbler habitat occurs within the project footprint and surrounding areas. Zone 2 is defined in the BCCP as “unconfirmed habitat.” Approximately 7.4 acres of Zone 2 Golden-cheeked Warbler habitat occur within the footprint of the proposed project. It should be noted that the BCCP zone maps were created in 1996 but are referenced because they are still used today for mitigation purposes. A presence/absence survey was conducted in 2014 and resulted in negative findings. The habitat assessment conducted for this project determined that 19.6 acres of isolated oak-juniper savannah vegetation within the median are of insufficient canopy cover and patch size to provide habitat for the Golden-cheeked Warbler; however, these areas were included in the presence-absence survey in the interest of completeness.

Comments:

Resources consulted or activities conducted to make effect determination (if applicable):

- TPWD County List USFWS Critical Habitat Maps Species Expert Consulted
- Aerial Photography Coastal Areas Maps Site Visit
- Topographic Map Species Study Conducted Karst Zone Maps
- Ecological Mapping System of Texas (EMST) Natural Diversity Database (NDD)

Other:

Migratory Bird Treaty Act (MBTA)

1. Yes Is there potential for nesting birds to be present in the project action area during construction?
 - 1.1 Yes Were active nests identified during the site survey?
2. Yes Will BMPs will be incorporated to protect migratory bird nests?

Comments:

Disturbing, destroying, or removing active migratory bird nests, including ground nesting birds, will be prohibited during the February 15 through October 1 nesting season;

The removal of unoccupied, inactive nests, will be avoided, where practicable;

The establishment of active nests during the nesting season on TxDOT owned and operated facilities and structures proposed for replacement or repair will be prevented; and

The collection, capture, relocation, or transportation of birds, eggs, young, or active nests without a permit will be prohibited.

Bald and Golden Eagle Protection Act (BGEPA)

1. No Does the proposed project have the potential to impact Bald or Golden Eagles?

Comments:

Suitable habitat for Bald or Golden Eagles does not occur in the vicinity of the proposed project.

Fish and Wildlife Coordination Act (FWCA)

1. No Does the project have impacts on one or more Waters of the U.S. or wetlands?

Comments:

The proposed project would not require authorization under a United States Army Corps of Engineers (USACE) individual permit; therefore, coordination under the FWCA is not required.

Executive Order 13112 on Invasive Species

1. Yes Would the proposed project be in compliance with EO 13112?

Comments

Upon completion of earthwork operations, disturbed areas would be restored and reseeded in accordance with TxDOT's Vegetation Management Guidelines and in compliance with the intent of Executive Order 13112 on Invasive Species.

Executive Memorandum on Beneficial Landscaping

1. Yes Would landscaping be included in the proposed projects?

Describe landscaping activities:

Upon completion of earthwork operations, disturbed areas would be restored and reseeded in accordance with TxDOT's Vegetation Management Guidelines and in compliance with the FHWA Executive Memorandum on Environmentally and Economically Beneficial Landscape Practices.

2. Yes Would the proposed project be in compliance with the Executive Memorandum on Beneficial Landscaping?

Comments

Same as above.

Farmland Protection Policy Act (FPPA)

1. No Would the project require new ROW or permanent easements (*Do not include temporary easements*)?

Comments:

The proposed project area falls within the U.S. Census Bureau 2010 Urbanized Area (UA) for Austin and is therefore exempt from the FPPA.

General Comments

TPWD Analysis Section

Coordination Conditions

1. No Is the project limited to a maintenance activity exempt from coordination?
https://ftp.dot.state.tx.us/pub/txdot-info/env/env_assessment.pdf
2. No Has the project previously completed coordination with TPWD?

Tier I Site Assessment

MOU-Triggers

1. Yes Is the project within range of a state threatened or endangered species or SGCN and suitable habitat is present?

***Explanation:**

Desktop analysis and field investigations indicate that potential habitat for two species that are federally and state-listed endangered occurs in the vicinity of the proposed project. These include the Barton Springs salamander and the Golden-cheeked Warbler. Additionally, potential habitat for the Austin blind salamander (federally listed as endangered and a state-listed SGCN) occurs in the vicinity of the proposed project. These findings are detailed in the Biological Studies Technical Memorandum and summarized below.

A pedestrian karst feature survey was conducted in the existing ROW. No *Eurycea* species habitat was identified within the project right of way during karst feature surveys; however, two recharge features and one sinkhole were identified within the review area during desktop analyses. The proposed project occurs over an area that recharges directly to Barton Springs. The Water Resources Technical Memorandum for the MoPac Intersections project indicated that, "the proposed project would result in minimal and discountable impacts to water quantity and possible, but negligible impacts to water quality". An Additional Geologic Studies Memorandum prepared to evaluate the potential for a significant hydrogeological connection between the MoPac Intersections Project area and known area caves that could affect water quality, quantity, and protected species. That memo concluded, "Potential impacts to federally-listed *Eurycea* sp. salamanders in Blowing Sink Cave or Barton Springs are highly unlikely due to existing and proposed water quality BMPs that will treat any surface water flowing from the project area before it recharges the Barton Springs Segment of the Edwards Aquifer". The Water Resources Technical Memorandum and the Additional Geologic Studies Memorandum are on file at the TxDOT Austin District and Central Texas Regional Mobility Authority offices and at www.MoPacSouth.com.

Because of this, the remaining risks to listed salamander species would occur during the construction phase when a void is encountered during downcutting of grade, drilling for piers and geotechnical boreholes. Typical BMPs such as berming and silt fencing can be overwhelmed by floodwaters in excavation areas that constitute man-made depressions due to the manner in which grade excavation occurs, resulting in possible introduction of silt and construction equipment fuels and lubricants to the subsurface. To avoid such occurrences, excavation will be planned in such a way as to avoid closed depressions, maintaining drainage

away from the project area at all times. Without the artificial “head” created by a closed topographic depression, berms or sandbags can be erected around accidentally discovered voids that cannot be overtopped by floodwaters, eliminating the possibility that silt and contaminants from the surrounding area will enter the feature. These protections will remain in place until the feature is biologically assessed and a void closure plan is implemented.

The project would have *no effect* on the Barton Springs salamander (*Eurycea sosorum*). Likewise, while dye tracing studies have shown that water flowing through Blowing Sink Cave also reaches Barton Springs, the project would have *no effect* on the Austin Blind salamander (*Eurycea waterlooensis*). This conclusion is reached for the following reasons: In compliance with the Edwards Aquifer Rules, water quality controls and Best Management Practices (BMPs) will remove 80 percent of total suspended solids from stormwater runoff. More detail will be provided on these controls and BMPs during the development of Plans, Specifications and Estimates (PS&E) in the Water Pollution Abatement Plan (WPAP); existing hazardous materials traps will be maintained, repaired, or replaced as a result of the proposed project; the highest risk for negative groundwater impacts is associated with the intersection of voids during the down-cutting of grade. Downcutting of grade will occur in a carefully considered sequence to avoid closed depressions that could concentrate drainage into accidentally discovered voids. Strict monitoring for void encounters will be maintained throughout the project, and protection measures to prevent surface flow into them will be installed immediately. Permanent protection, if applicable, will be designed to restore groundwater flow in severed conduits to the extent practicable; and temporary erosion and sedimentation controls will be in place during construction, in addition to the measures described above relating to downcutting of grade. More detail will be provided on these controls during the development of Plans, Specifications and Estimates (PS&E) in the Storm Water Pollution Prevention Plan (SW3P).

Additionally, any direct or indirect encroachment-alteration effects to these species are considered unlikely to occur, particularly considering the proposed project would employ measures to avoid or minimize impacts to these and other biological resources. In addition to the implementation of these avoidance and minimization measures, the proposed project would comply with the TCEQ Edwards Aquifer Rules regarding stormwater pollutant removal and USFWS protocols in the event of discovery of sensitive features. Given the unlikelihood for direct impacts to occur to these species, indirect encroachment-alteration effects related to excavation and other construction activities would not be anticipated to occur.

While no habitat for the Golden-cheeked Warbler was identified within the project footprint (within median areas), a review of habitat mapping data associated with Morrison et al. (2010) concluded that low and medium quality habitat occurs in the vicinity of the proposed project but not within median areas; primarily in the Slaughter Creek Greenbelt. Additionally, a review of shape files associated with the Balcones Canyonlands Conservation Plan (BCCP) habitat zone map (Oak Hill Quadrangle) concluded that Zone 2 Golden-cheeked Warbler habitat occurs within the project footprint and surrounding areas. Zone 2 is defined in the BCCP as “unconfirmed habitat.” Approximately 7.4 acres of Zone 2 Golden-cheeked Warbler habitat occur within the footprint of the proposed project. It should be noted that the BCCP zone maps were created in 1996 but are referenced because they are still used today for mitigation purposes. A presence/absence survey was conducted in 2014 and resulted in negative findings. The habitat assessment conducted for this project determined that 19.6 acres of isolated oak-juniper savannah vegetation within the median are of insufficient canopy cover

and patch size to provide habitat for the Golden-cheeked Warbler; however, these areas were included in the presence-absence survey in the interest of completeness.

Additionally, as detailed in the Biological Studies Technical Memorandum, potential habitat for six SGCN, Balcones Cave amphipod (*Stygobromus balconis*), Bifurcated Cave amphipod (*Stygobromus bifurcatus*), Bandit Cave spider (*Cicurina bandida*), Leonora's dancer damselfly (*Argia leonorae*), the Texas garter snake (*Thamnophis sirtalis annectens*), plains spotted skunk (*Spilogale putorius interrupta*), occur in the vicinity of the proposed project. No habitat for the two amphipods and spider was encountered within the right of way during karst invertebrate surveys; however, karst invertebrate habitat occurs within 500 feet of the proposed project. The project is within the known range of the Balcones Cave amphipod and known habitat for the Bifurcated Cave amphipod occurs downstream of the proposed project within the aquifer. Additionally, the Bandit cave spider is known from a cave within 500 feet of the proposed project. The project has the potential to intersect karst voids and therefore may impact potential habitat for these species. Though suitable habitat for the damselfly and snake occurs along Slaughter Creek, this area would not be impacted by the proposed project; therefore, no impacts to these species would be expected to occur. The spotted skunk is a habitat generalist and could occur throughout the proposed project area, especially in areas of wooded, brushy vegetation. Because of this, the project may impact this species.

Date [TPWD County](#) List Accessed: February 24, 2015

Date that the NDD was accessed: February 24, 2015

What agency performed the NDD search? TPWD

NDD Search Results for EOIDs and Tracked Managed Areas

EOID Number	Common Name	Scientific Name	Listing Status	Buffer Zone
8968	Barton Springs Salamander	<i>Eurycea sosorum</i>	Federally listed endangered	1.5 Mile
11983	Vertisol Blackland Prairie	NA	Not Listed	1.5 Mile
908	Golden-cheeked Warbler	<i>Setophaga chrysoparia</i>	Federally listed endangered	1.5 Mile

1.1 No Does the BMP PA eliminate the requirement to coordinate for species?

Comments:

There are no BMPs for the Balcones Cave amphipod, Bifurcated Cave amphipod and Bandit cave spider listed in the BMP PA; therefore, coordination for these species would be required.

In accordance with the Best Management Practices Programmatic Agreement between the TxDOT and TPWD, contractors would be advised of the potential occurrence of the plains spotted skunk in the project area and to avoid harming the species if encountered.

Additionally, contractors would be advised to avoid unnecessary impacts to dens if also

encountered.

2. No NDD and TCAP review indicates adverse impacts to remnant vegetation?

Comments:

The proposed project area does not include undisturbed rare communities listed in the 2012 TCAP for the Edwards Plateau, though elements of the Little bluestem-Tall dropseed-Cusp gayfeather herbaceous vegetation community (S-Rank S3) are found infrequently. Remnant species include scattered little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*) and Indiangrass (*Sorghastrum nutans*). However, remnant short and midgrass grassland/savanna communities do exist within the proposed project area, which are listed as suitable habitat for several species included within the 2012 list of Species of Greatest Conservation Need (SGCN). These species can be found in the accompanying spreadsheet, TPWD_SPGN_2011-1_MoPac intersections. Mixedgrass savanna will be used here to denote midgrass dominated areas with scattered tall or shortgrass species. Lastly, several large trees (dbh 48.26 cm/19 inches or greater) are scattered within these savanna communities which cannot be replaced once lost.

In general, remnant mixed and shortgrass communities occur with increasing frequency south of Slaughter Lane. Frequently mown areas adjacent to the roadway are dominated by the invasive species King Ranch bluestem (*Bothriochloa ischaemum*) with frequent occurrences of bastard cabbage (*Rapistrum rugosum*) and Malta star thistle (*Centaurea melitensis*) and would not be considered remnant communities. However, within median several communities dominated by natives exist, though King Ranch bluestem is common throughout.

This remnant vegetation was determined by qualified biologists not to be of significant importance since it exists within a previously and continually disturbed transportation corridor. The remnant vegetation within the project area has been disturbed in the past, and has re-established following disturbance. The anticipated impacts to remnant vegetation would not be adverse and the impacted vegetation would be allowed to re-establish. Coordination would therefore not be required.

3. No Does the project require a NWP with PCN or IP by USACE?

Comments:

A NWP 14 is anticipated at tributary to Slaughter Creek, the impact to a potential waters of the U.S. is estimated at 0.04 acre. A PCN would not be required.

4. No Does the project include more than 200 linear feet of stream channel for each single and complete crossing of one or more of the following that is not already channelized or otherwise maintained:

Comments:

No impacts to streams are anticipated to occur as part of the proposed project.

5. No Does the project contain known isolated wetlands outside the TxDOT ROW that will be directly impacted by the project?

Comments:

No isolated wetlands were identified outside of the TxDOT right of way that would be directly impacted by the project.

6. No Would the project impact at least 0.10 acre of riparian vegetation?

Comments:

The riparian vegetation near Slaughter Creek is not anticipated to be impacted by the proposed project. There is approximately 2 acres of riparian vegetation within the existing right-of-way. Switchgrass, little bluestem and tall dropseed (*Sporobolus compositus*) are present. The overstory is mixed hardwood and juniper woodland. The dominant tree species are juniper (*Juniperus ashei*) and red oak (*Quercus buckleyi*). Most junipers are of small dbh, however a few larger ones exist, the largest being 21 inches (53.1 cm) dbh. Very little vegetation exists under the existing MoPac bridge.

7. Yes Does project disturb a habitat type in an area equal to or greater than the area of disturbance indicated in the Threshold Table Programmatic Agreement?

*Explanation:

Explanation: 13.28 acres of EMST Type Edwards Plateau Savanna Grassland, 0.13 acres of Edwards Plateau: Ashe Juniper Motte and Woodland, 2.62 acres of Edwards Plateau: Deciduous Oak / Evergreen Motte and Woodland, 0.28 acres of Edwards Plateau: Live Oak Motte and Woodland, 0.17 acres of Edwards Plateau: Oak / Hardwood Motte and Woodland, and 2.20 acres of Edwards Plateau: Post Oak Motte and Woodland impacts are anticipated to be impacted.

Per the Threshold Table PA Crosswalk Table and the TPWD EMST File Descriptions and Update Information, these six EMST Types convert to the MOU Type Edwards Plateau Savannah, Woodland, and Shrubland Threshold Table PA which has an impact threshold of 3 acres. The total impact to this MOU Type is anticipated to be (total of above) 18.68 acres which exceeds the 3 acre PA impact threshold by 15.68 acres.

*Attach associated file of EMST output (Mapper Report or other Excel File which includes MOU Type, Ecosystem Name, Common/Vegetation Type Name) in ECOS

Excel File Name:

MoPac Intersections EMST Clip.xls and MoPac Intersections EMST Clip Revised.xls

- 7.1 Yes Is there a discrepancy between actual habitat(s) and EMST mapped habitat(s)?

*Explanation:

There is a discrepancy between EMST mapped habitats and on the ground habitats. Much of the upland area within the median, south of Slaughter Lane can be considered mixed/mid/shortgrass savanna, Edwards Plateau Savannah (EMST Type) or Edwards Plateau Savannah, Woodland, and Shrubland (MOU Type). These areas were mapped by the EMST as either Urban Low Intensity, Native Invasive: Mesquite Shrubland or Edwards Plateau: Post Oak Motte and Woodland. Dominant native midgrass species include silver bluestem (*Bothriochloa laguroides*), sideoats grama (*Bouteloua curtipendula*), and purple threeawn (*Aristida purpurea*). Shortgrass species include buffalograss (*Bouteloua dactyloides*), curly mesquite (*Hilaria belangeri*) and Texas grama (*Bouteloua rigidiseta*). Scattered tallgrass species include little bluestem, switchgrass and Indiangrass. Common native forbs include Indian blanket (*Gaillardia pulchella*), and coreopsis (*Coreopsis tinctoria*). Blazing star (*Liatris sp.*) is uncommon but present. The invasive King Ranch Bluestem is common, but several areas are dominated by natives.

There is also a discrepancy where the EMST mapped an area that was found on ground to be Edwards Plateau: Riparian Hardwood/Ashe Juniper Forest. This area was mapped by the EMST as Urban Low Intensity and Edwards Plateau: Floodplain Hardwood/Ashe Juniper Forest. Slaughter Creek does run under existing MoPac South, which does contain some riparian vegetation. Switchgrass, little bluestem and tall dropseed (*Sporobolus compositus*) are present. The overstory is mixed hardwood and juniper woodland. The dominant tree species are juniper (*Juniperus ashei*) and red oak (*Quercus buckleyi*). Most junipers are of small dbh, however a few larger ones exist, the largest being 21 inches (53.1 cm) dbh. Very little vegetation exists under existing MoPac South.

Please see attached maps depicting the EMST mapped habitats and the actual EMST habitat types found during field reconnaissance.

Attach file showing discrepancy between actual and EMST mapped habitat(s).

File Name:

Is TPWD Coordination Required?

Yes

Early Coordination

Administrated Coordination

BMPs Implemented or EPICs included (as necessary):

Disturbing, destroying, or removing active migratory bird nests, including ground nesting birds, will be prohibited during the February 15 through October 1 nesting season; The removal of unoccupied, inactive nests, will be avoided, where practicable; The establishment of active nests during the nesting season on TxDOT owned and operated

facilities and structures proposed for replacement or repair will be prevented; and
The collection, capture, relocation, or transportation of birds, eggs, young, or active nests
without a permit will be prohibited.

Upon completion of earthwork operations, disturbed areas will be restored and reseeded in
accordance with TxDOT's Vegetation Management Guidelines and in compliance with the
intent of Executive Order 13112 and the FHWA Executive Memorandum on Environmentally
and Economically Beneficial Landscape Practices.

In accordance with the Best Management Practices Programmatic Agreement between the
TxDOT and TPWD, contractors will be advised of the potential occurrence of the plains
spotted skunk in the project area and to avoid harming the species if encountered.
Additionally, contractors will be advised to avoid unnecessary impacts to dens if also
encountered.

TxDOT initiated coordination with TPWD on March 3, 2015. Coordination was completed on
June 12, 2015.

TxDOT Contact Information

Name: Jon Geiselbrecht

Phone Number: 512-832-7218

E-mail: Jon.Geiselbrecht@txdot.gov

Findings

Endangered Species Act (ESA)

According to the USFWS and TPWD, the project action area is within the range and in suitable habitat of a federally protected species. Based on the following information, the proposed project will not affect protected species and/or their habitat and will not impact areas that have been designated as critical habitat by the USFWS.

As detailed in the Biological Studies Technical Memorandum, desktop analysis and field investigations conducted in August 2013 indicate that potential habitat for three federally listed endangered species occurs in the vicinity of the proposed project. These include two amphibians, the Austin blind salamander (*Eurycea waterlooensis*) and the Barton Springs salamander (*Eurycea sosorum*); and one bird, the Golden-cheeked Warbler (*Setophaga chrysoparia*).

A pedestrian karst feature survey was conducted in the existing ROW. No *Eurycea* species habitat was identified within the project right of way during karst feature surveys; however, two recharge features and one sinkhole were identified within the review area during desktop analyses. The proposed project occurs over an area that recharges directly to Barton Springs. The Water Resources Technical Memorandum for the MoPac Intersections project indicated that, "the proposed project would result in minimal and discountable impacts to water quantity and possible, but negligible impacts to water quality". An Additional Geologic Studies Memorandum prepared to evaluate the potential for a significant hydrogeological connection between the MoPac Intersections Project area and known area caves that could affect water quality, quantity, and protected species. That memo concluded, "Potential impacts to federally-listed *Eurycea* sp. salamanders in Blowing Sink Cave or Barton Springs are highly unlikely due to existing and proposed water quality BMPs that will treat any surface water flowing from the project area before it recharges the Barton Springs Segment of the Edwards Aquifer". The Water Resources Technical Memorandum and the Additional Geologic Studies Memorandum are on file at the TxDOT Austin District and Central Texas Regional Mobility Authority offices and at www.MoPacSouth.com.

Because of this, the remaining risks to listed salamander species would occur during the construction phase when a void is encountered during downcutting of grade, drilling for piers and geotechnical boreholes. Typical BMPs such as berming and silt fencing can be overwhelmed by floodwaters in excavation areas that constitute man-made depressions due to the manner in which grade excavation occurs, resulting in possible introduction of silt and construction equipment fuels and lubricants to the subsurface. To avoid such occurrences, excavation will be planned in such a way as to avoid closed depressions, maintaining drainage away from the project area at all times. Without the artificial "head" created by a closed topographic depression, berms or sandbags can be erected around accidentally discovered voids that cannot be overtopped by floodwaters, eliminating the possibility that silt and contaminants from the surrounding area will enter the feature. These protections will remain in place until the feature is biologically assessed and a void closure plan is implemented.

The project would have no effect on the Barton Springs salamander (*Eurycea sosorum*). Likewise, while dye tracing studies have shown that water flowing through Blowing Sink Cave also reaches Barton Springs, the project would have no effect on the Austin Blind salamander (*Eurycea waterlooensis*). This conclusion is reached for the following reasons: In compliance with the Edwards Aquifer Rules, water quality controls and Best Management Practices (BMPs) will remove 80 percent of total suspended solids from stormwater runoff. More detail will be provided on these controls and BMPs during the development of Plans, Specifications and Estimates (PS&E) in the Water Pollution Abatement Plan (WPAP); existing hazardous materials traps will be maintained, repaired, or replaced as a result of the proposed project; the highest risk for negative groundwater impacts is associated with the intersection of voids during the down-cutting of grade. Downcutting of grade will occur in a carefully

considered sequence to avoid closed depressions that could concentrate drainage into accidentally discovered voids. Strict monitoring for void encounters will be maintained throughout the project, and protection measures to prevent surface flow into them will be installed immediately. Permanent protection, if applicable, will be designed to restore groundwater flow in severed conduits to the extent practicable; and temporary erosion and sedimentation controls will be in place during construction, in addition to the measures described above relating to downcutting of grade. More detail will be provided on these controls during the development of Plans, Specifications and Estimates (PS&E) in the Storm Water Pollution Prevention Plan (SW3P).

Additionally, any direct or indirect encroachment-alteration effects to these species are considered unlikely to occur, particularly considering the proposed project would employ measures to avoid or minimize impacts to these and other biological resources. In addition to the implementation of these avoidance and minimization measures, the proposed project would comply with the TCEQ Edwards Aquifer Rules regarding stormwater pollutant removal and USFWS protocols in the event of discovery of sensitive features. Given the unlikelihood for direct impacts to occur to these species, indirect encroachment-alteration effects related to excavation and other construction activities would not be anticipated to occur.

While no habitat for the Golden-cheeked Warbler was identified within the project footprint (within median areas), a review of habitat mapping data associated with Morrison et al. (2010) concluded that low and medium quality habitat occurs in the vicinity of the proposed project but not within median areas; primarily in the Slaughter Creek Greenbelt. Additionally, a review of shape files associated with the Balcones Canyonlands Conservation Plan (BCCP) habitat zone map (Oak Hill Quadrangle) concluded that Zone 2 Golden-cheeked Warbler habitat occurs within the project footprint and surrounding areas. Zone 2 is defined in the BCCP as “unconfirmed habitat.” Approximately 7.4 acres of Zone 2 Golden-cheeked Warbler habitat occur within the footprint of the proposed project. It should be noted that the BCCP zone maps were created in 1996 but are referenced because they are still used today for mitigation purposes. A presence/absence survey was conducted in 2014 and resulted in negative findings. The habitat assessment conducted for this project determined that 19.6 acres of isolated oak-juniper savannah vegetation within the median are of insufficient canopy cover and patch size to provide habitat for the Golden-cheeked Warbler; however, these areas were included in the presence-absence survey in the interest of completeness.

Consultation with the USFWS will not be required. The USFWS County list was accessed on February 24, 2015.

Essential Fish Habitat (EFH)

Essential fish habitat is defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Tidally influenced waters do not occur within the project action area. Coordination with National Marine Fisheries Service (NMFS) is not required.

Coastal Barrier Resources Act (CBRA)

The Coastal Barrier Resources Act (CBRA) established the Coastal Barrier Resources System (CBRS) to protect a defined set of geographic units along the coast of the U.S.

This project is not located within a designated CBRA map unit. Coordination with the USFWS is not required.

Marine Mammal Protection Act (MMPA)

Marine mammals are protected under the Marine Mammal Protection Act (MMPA). The Texas coast provides suitable habitat and is within range of several marine mammals including the West Indian Manatee (*Trichechus manatus*), and bottlenose dolphin (*Tursiops truncatus*).

The project action area does not contain suitable habitat for marine mammals. Coordination with NMFS is not required.

Migratory Bird Treaty Act (MBTA)

The Migratory Bird Treaty Act (MBTA) states that it is unlawful to kill, capture, collect, possess, buy, sell, trade, or transport any migratory bird, nest, young, feather, or egg in part or in whole, without a federal permit issued in accordance within the Act's policies and regulations.

A site survey identified active nests within the project action area. TxDOT will take all appropriate actions to prevent the take of migratory birds, their active nests, eggs, or young by the use of proper phasing of the project or other appropriate actions. A MBTA appropriate EPIC will be included in the PS&E.

Bald and Golden Eagle Protection Act (BGEPA)

The proposed project does not have the potential to impact Bald or Golden Eagles.

Executive Order 13112 on Invasive Species

Re-vegetation of disturbed areas would be in compliance with the Executive Order on Invasive Species (EO 13112). Regionally native and non-invasive plants will be used to the extent practicable in landscaping and re-vegetation.

Executive Memorandum on Beneficial Landscaping

Landscaping would be a part of the proposed project activities. Re-vegetation of disturbed areas would be in compliance with the Executive Memorandum on Beneficial Landscaping (26Apr94). Regionally native and non-invasive plants will be used to the extent practicable in landscaping and re-vegetation.

Upon completion of earthwork operations, disturbed areas would be restored and reseeded in accordance with TxDOT's Vegetation Management Guidelines and in compliance with the FHWA Executive Memorandum on Environmentally and Economically Beneficial Landscape Practices.

Farmland Protection Policy Act (FPPA)

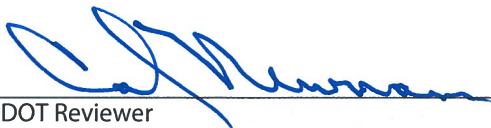
The purpose of the Farmland Protection Policy Act (FPPA) is to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. Coordination with the National Resources Conservation Service (NRCS) for FPPA would not be required because the project requires no additional ROW or permanent easements.


Fish and Wildlife Coordination Act (FWCA)

The Fish and Wildlife Coordination Act (FWCA) of 1958 requires that federal agencies obtain comments from USFWS and TPWD. This coordination is required whenever a project involves

impounding, diverting, or deepening a stream channel or other body of water.

The proposed project would have no impact to Waters of the U.S. or wetlands and no Section 404 permit is required; therefore, no review by the U.S. Fish and Wildlife Service (USFWS).


TxDOT Reviewer


Date

Suggested Attachments

Aerial Map (with delineated project boundaries)

USFWS T&E List

TPWD T&E List

Species Impact Table

NDD EOID List and Tracked Managed Areas (Required for TPWD Coordination)

NOAA EFH Mapper Printout

USFWS CBRA Mapper Printout

EMST Project MOU Summary Table (Required for TPWD Coordination)

TPWD SGCN List

FPPA Documentation

Landscaping Plans

Photos (Required for TPWD Coordination)

Previous TPWD Coordination Documentation (if applicable)

The following table shows the revision history for this guidance document.

Revision History	
Effective Date Month, Year	Reason for and Description of Change

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Appendix C

USFWS and TPWD Lists of Rare, Threatened, and Endangered Species

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U.S. Fish and Wildlife Service

Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Austin Ecological Services Field Office
10711 BURNET ROAD, SUITE 200
AUSTIN, TX 78758
(512) 490-0057
<http://www.fws.gov/southwest/es/AustinTexas/>
<http://www.fws.gov/southwest/es/EndangeredSpecies/lists/>

Project Counties:

Travis, TX

Project Type:

Transportation

Endangered Species Act Species List ([USFWS Endangered Species Program](#))

There are a total of 21 threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fishes may appear on the species list because a project could cause downstream effects on the species. Note that 3 of these species should be considered only under certain conditions. See the second table below for a list of these species and the conditions under which effects should be considered. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section below for critical habitat that lies within your project area. Please contact the designated FWS office if you have questions.

Species that should be considered in an effects analysis for your project:

Amphibians	Status		Has Critical Habitat	Contact
Austin Blind Salamander (<i>Eurycea waterlooensis</i>)	Endangered	species info	Final designated critical habitat	Austin Ecological Services Field Office



Trust Resources List

Barton Springs salamander (<i>Eurycea sosorum</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
Jollyville Plateau Salamander (<i>Eurycea tonkawae</i>) Population:	Threatened	species info	Final designated critical habitat	Austin Ecological Services Field Office
Arachnids				
Bee Creek Cave harvestman (<i>Texella reddelli</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
Bone Cave harvestman (<i>Texella reyesi</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
Tooth Cave Spider (<i>Leptoneta myopica</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
Tooth Cave pseudoscorpion (<i>Tartarocreagris texana</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
Birds				
Black-Capped Vireo (<i>Vireo atricapilla</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
golden-cheeked warbler (<i>Dendroica chrysoparia</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
Whooping crane (<i>Grus americana</i>) Population: except where EXPN	Endangered	species info	Final designated critical habitat	Austin Ecological Services Field Office
Clams				
golden orb (<i>Quadrula aurea</i>)	Candidate	species info		Austin Ecological Services Field Office
Smooth Pimpleback (<i>Quadrula houstonensis</i>)	Candidate	species info		Austin Ecological Services Field Office



Trust Resources List

Texas Fatmucket (<i>Lampsilis bracteata</i>)	Candidate	species info		Austin Ecological Services Field Office
Texas Fawnsfoot (<i>Truncilla macrodon</i>)	Candidate	species info		Austin Ecological Services Field Office
Texas Pimpleback (<i>Quadrula petrina</i>) Population:	Candidate	species info		Austin Ecological Services Field Office
Flowering Plants				
Bracted twistflower (<i>Streptanthus bracteatus</i>)	Candidate	species info		Austin Ecological Services Field Office
Insects				
Kretschmarr Cave Mold beetle (<i>Texamaurops reddelli</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office
Tooth Cave Ground beetle (<i>Rhadine persephone</i>) Population: Entire	Endangered	species info		Austin Ecological Services Field Office

Species that should be considered in an effects analysis for your project under specified conditions:

Birds					
Least tern (<i>Sterna antillarum</i>) Population: interior pop.	Endangered	species info	condition info		Austin Ecological Services Field Office
Piping Plover (<i>Charadrius melodus</i>) Population: except Great Lakes watershed	Threatened	species info	condition info	Final designated critical habitat Final designated critical habitat	Austin Ecological Services Field Office
Red Knot (<i>Calidris canutus</i>) Population:	Threatened	species info	condition info		Austin Ecological Services Field Office

Critical habitats within your project area: [\(View all critical habitats within your project area on one map\)](#)



Trust Resources List

The following critical habitats lie fully or partially within your project area.

Amphibians	Critical Habitat Type
Austin Blind Salamander (<i>Eurycea waterlooensis</i>)	Final designated critical habitat
Jollyville Plateau Salamander (<i>Eurycea tonkawae</i>) Population:	Final designated critical habitat

FWS National Wildlife Refuges ([USFWS National Wildlife Refuges Program](#))

There is 1 refuge in your refuge list

Balcones Canyonlands National Wildlife Refuge (512) 339-9432 24518 FM 1431 MARBLE FALLS, TX78654	refuge profile
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FWS Migratory Birds ([USFWS Migratory Bird Program](#))

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see: <http://www.fws.gov/migratorybirds/RegulationsandPolicies.html>.

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to:

<http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html>.

To search and view summaries of year-round bird occurrence data within your project area, go to the Avian Knowledge Network Histogram Tool links in the Bird Conservation Tools section at: <http://www.fws.gov/migratorybirds/CCMB2.htm>.



Trust Resources List

For information about conservation measures that help avoid or minimize impacts to birds, please visit: <http://www.fws.gov/migratorybirds/CCMB2.htm>.

Migratory birds of concern that may be affected by your project:

There are **28** birds on your Migratory birds of concern list. The underlying data layers used to generate the migratory bird list of concern will continue to be updated regularly as new and better information is obtained. User feedback is one method of identifying any needed improvements. Therefore, users are encouraged to submit comments about any questions regarding species ranges (e.g., a bird on the USFWS BCC list you know does not occur in the specified location appears on the list, or a BCC species that you know does occur there is not appearing on the list). Comments should be sent to [the ECOS Help Desk](#).

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
Audubon's Oriole (<i>Icterus graduacauda</i>)	Yes	species info	Year-round
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Yes	species info	Wintering
Bell's Vireo (<i>Vireo bellii</i>)	Yes	species info	Breeding
Burrowing Owl (<i>Athene cunicularia</i>)	Yes	species info	Wintering, Year-round
Chestnut-collared Longspur (<i>Calcarius ornatus</i>)	Yes	species info	Wintering
Dickcissel (<i>Spiza americana</i>)	Yes	species info	Breeding
Fox Sparrow (<i>Passerella iliaca</i>)	Yes	species info	Wintering
Harris's Sparrow (<i>Zonotrichia querula</i>)	Yes	species info	Wintering
Hudsonian Godwit (<i>Limosa haemastica</i>)	Yes	species info	Migrating
Lark Bunting (<i>Calamospiza melanocorys</i>)	Yes	species info	Wintering
Le Conte's Sparrow (<i>Ammodramus leconteii</i>)	Yes	species info	Wintering
Least Bittern (<i>Ixobrychus exilis</i>)	Yes	species info	Breeding
Lesser Yellowlegs (<i>Tringa flavipes</i>)	Yes	species info	Wintering
Little Blue Heron (<i>Egretta caerulea</i>)	Yes	species info	Breeding



Trust Resources List

Loggerhead Shrike (<i>Lanius ludovicianus</i>)	Yes	species info	Year-round
Long-Billed curlew (<i>Numenius americanus</i>)	Yes	species info	Wintering
McCown's Longspur (<i>Calcarius mccownii</i>)	Yes	species info	Wintering
Mississippi Kite (<i>Ictinia mississippiensis</i>)	Yes	species info	Breeding
Orchard Oriole (<i>Icterus spurius</i>)	Yes	species info	Breeding
Painted Bunting (<i>Passerina ciris</i>)	Yes	species info	Breeding
Prothonotary Warbler (<i>Protonotaria citrea</i>)	Yes	species info	Breeding
Red-headed Woodpecker (<i>Melanerpes erythrocephalus</i>)	Yes	species info	Year-round
Rufous-crowned Sparrow (<i>Aimophila ruficeps</i>)	Yes	species info	Year-round
Rusty Blackbird (<i>Euphagus carolinus</i>)	Yes	species info	Wintering
Scissor-tailed Flycatcher (<i>Tyrannus forficatus</i>)	Yes	species info	Breeding
Short-eared Owl (<i>Asio flammeus</i>)	Yes	species info	Wintering
Sprague's Pipit (<i>Anthus spragueii</i>)	Yes	species info	Wintering
Varied Bunting (<i>Passerina versicolor</i>)	Yes	species info	Breeding

[NWI Wetlands \(USFWS National Wetlands Inventory\)](#)

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to



Trust Resources List

wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate [U.S. Army Corps of Engineers District](#).

Data Limitations, Exclusions and Precautions

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The following wetland types intersect your project area in one or more locations:

Wetland Types	NWI Classification Code	Total Acres
Freshwater Emergent Wetland	PEM1Ah	12.5179



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Freshwater Emergent Wetland	PEM1Fh	0.2069
Freshwater Emergent Wetland	PEM1C	10.9444
Freshwater Emergent Wetland	PEM1A	21.0344
Freshwater Emergent Wetland	PEM1Ch	8.5161
Freshwater Forested/Shrub Wetland	PFO1Ah	2.2336
Freshwater Forested/Shrub Wetland	PSS1Ah	2.484
Freshwater Forested/Shrub Wetland	PFO/EM1A	11.7004
Freshwater Forested/Shrub Wetland	PSS1A	10.3663
Freshwater Forested/Shrub Wetland	PFO1A	130.1001
Freshwater Pond	PUBFx	0.2792
Freshwater Pond	PUBHx	5.0305
Freshwater Pond	PAB3Fh	1.8105
Freshwater Pond	PUSAh	11.2937
Freshwater Pond	PUSCh	21.7542
Freshwater Pond	PUSCx	1.9856
Freshwater Pond	PUBH	0.4704
Freshwater Pond	PUBF	0.1772
Freshwater Pond	PUBHh	372.1972
Freshwater Pond	PUBFh	40.8101
Lake	L2USAh	441.5647
Lake	L1UBHh	17261.3796
Lake	L2USCh	35.4978
Riverine	R2UBH	7054.0725
Riverine	R2USC	10.6542
Riverine	R2USA	79.5151
Riverine	R2UBHh	37.0311



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Trust Resources List

Riverine	R2RSC	113.2616
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TRAVIS COUNTY

AMPHIBIANS

		Federal Status	State Status
Austin blind salamander	<i>Eurycea waterlooensis</i>	E	
mostly restricted to subterranean cavities of the Edwards Aquifer; dependent upon water flow/quality from the Barton Springs segment of the Edwards Aquifer; only known from the outlets of Barton Springs (Sunken Gardens (Old Mill) Spring, Eliza Spring, and Parthenia (Main) Spring which forms Barton Springs Pool); feeds on amphipods, ostracods, copepods, plant material, and (in captivity) a wide variety of small aquatic invertebrates			
Barton Springs salamander	<i>Eurycea sosorum</i>	LE	E
dependent upon water flow/quality from the Barton Springs pool of the Edwards Aquifer; known from the outlets of Barton Springs and subterranean water-filled caverns; found under rocks, in gravel, or among aquatic vascular plants and algae, as available; feeds primarily on amphipods			
Jollyville Plateau salamander	<i>Eurycea tonkawae</i>	T	
known from springs and waters of some caves north of the Colorado River			
Pedernales River springs salamander	<i>Eurycea sp 6</i>		
endemic; known only from springs			

ARACHNIDS

		Federal Status	State Status
Bandit Cave spider	<i>Cicurina bandida</i>		
very small, subterrestrial, subterranean obligate			
Bee Creek Cave harvestman	<i>Texella reddelli</i>	LE	
small, blind, cave-adapted harvestman endemic to a few caves in Travis and Williamson counties			
Bone Cave harvestman	<i>Texella reyesi</i>	LE	
small, blind, cave-adapted harvestman endemic to several caves in Travis and Williamson counties; weakly differentiated from <i>Texella reddelli</i>			
Tooth Cave pseudoscorpion	<i>Tartarocreagris texana</i>	LE	
small, cave-adapted pseudoscorpion known from small limestone caves of the Edwards Plateau			
Tooth Cave spider	<i>Tayshaneta myopica</i>	LE	
very small, cave-adapted, sedentary spider			
Warton's cave meshweaver	<i>Cicurina wartoni</i>		
very small, cave-adapted spider			

BIRDS

		Federal Status	State Status
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	DL	T

TRAVIS COUNTY

BIRDS

Federal Status State Status

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon *Falco peregrinus tundrius* DL

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bald Eagle *Haliaeetus leucocephalus* DL T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Black-capped Vireo *Vireo atricapilla* LE E

oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces; requires foliage reaching to ground level for nesting cover; return to same territory, or one nearby, year after year; deciduous and broad-leaved shrubs and trees provide insects for feeding; species composition less important than presence of adequate broad-leaved shrubs, foliage to ground level, and required structure; nesting season March-late summer

Golden-cheeked Warbler *Setophaga chrysoparia* LE E

juniper-oak woodlands; dependent on Ashe juniper (also known as cedar) for long fine bark strips, only available from mature trees, used in nest construction; nests are placed in various trees other than Ashe juniper; only a few mature junipers or nearby cedar brakes can provide the necessary nest material; forage for insects in broad-leaved trees and shrubs; nesting late March-early summer

Interior Least Tern *Sterna antillarum athalassos* LE E

subspecies is listed only when inland (more than 50 miles from a coastline); nests along sand and gravel bars within braided streams, rivers; also know to nest on man-made structures (inland beaches, wastewater treatment plants, gravel mines, etc); eats small fish and crustaceans, when breeding forages within a few hundred feet of colony

Mountain Plover *Charadrius montanus*

breeding: nests on high plains or shortgrass prairie, on ground in shallow depression; nonbreeding: shortgrass plains and bare, dirt (plowed) fields; primarily insectivorous

Peregrine Falcon *Falco peregrinus* DL T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

TRAVIS COUNTY

BIRDS

		Federal Status	State Status
Sprague's Pipit	<i>Anthus spragueii</i>	C	
only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.			
Western Burrowing Owl	<i>Athene cunicularia hypugaea</i>		
open grasslands, especially prairie, plains, and savanna, sometimes in open areas such as vacant lots near human habitation or airports; nests and roosts in abandoned burrows			
Whooping Crane	<i>Grus americana</i>	LE	E
potential migrant via plains throughout most of state to coast; winters in coastal marshes of Aransas, Calhoun, and Refugio counties			

CRUSTACEANS

		Federal Status	State Status
An amphipod	<i>Stygobromus russelli</i>		
subterranean waters, usually in caves and limestone aquifers; resident of numerous caves in ca. 10 counties of the Edwards Plateau			
Balcones Cave amphipod	<i>Stygobromus balconis</i>		
subaquatic, subterranean obligate amphipod			
Bifurcated cave amphipod	<i>Stygobromus bifurcatus</i>		
found in cave pools			

FISHES

		Federal Status	State Status
Guadalupe bass	<i>Micropterus treculii</i>		
endemic to perennial streams of the Edward's Plateau region; introduced in Nueces River system			
Smalleye shiner	<i>Notropis buccula</i>	E	
endemic to upper Brazos River system and its tributaries (Clear Fork and Bosque); apparently introduced into adjacent Colorado River drainage; medium to large prairie streams with sandy substrate and turbid to clear warm water; presumably eats small aquatic invertebrates			

INSECTS

		Federal Status	State Status
Kretschmarr Cave mold beetle	<i>Texamaurops reddelli</i>	LE	
small, cave-adapted beetle found under rocks buried in silt; small, Edwards Limestone caves in of the Jollyville Plateau, a division of the Edwards Plateau			
Leonora's dancer damselfly	<i>Argia leonora</i>		
south central and western Texas; small streams and seepages			

TRAVIS COUNTY

INSECTS

Federal Status State Status

Rawson's metalmark *Calephelis rawsoni*

moist areas in shaded limestone outcrops in central Texas, desert scrub or oak woodland in foothills, or along rivers elsewhere; larval hosts are *Eupatorium havanense*, *E. greggii*.

Tooth Cave blind rove beetle *Cylindropsis sp 1*

one specimen collected from Tooth Cave; only known North American collection of this genus

Tooth Cave ground beetle *Rhadine persephone* LE

resident, small, cave-adapted beetle found in small Edwards Limestone caves in Travis and Williamson counties

MAMMALS

Federal Status State Status

Cave myotis bat *Myotis velifer*

colonial and cave-dwelling; also roosts in rock crevices, old buildings, carports, under bridges, and even in abandoned Cliff Swallow (*Hirundo pyrrhonota*) nests; roosts in clusters of up to thousands of individuals; hibernates in limestone caves of Edwards Plateau and gypsum cave of Panhandle during winter; opportunistic insectivore

Plains spotted skunk *Spilogale putorius interrupta*

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Red wolf *Canis rufus* LE E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

MOLLUSKS

Federal Status State Status

Creeper (squawfoot) *Strophitus undulatus*

small to large streams, prefers gravel or gravel and mud in flowing water; Colorado, Guadalupe, San Antonio, Neches (historic), and Trinity (historic) River basins

False spike mussel *Quadrula mitchelli* T

possibly extirpated in Texas; probably medium to large rivers; substrates varying from mud through mixtures of sand, gravel and cobble; one study indicated water lilies were present at the site; Rio Grande, Brazos, Colorado, and Guadalupe (historic) river basins

Smooth pimpleback *Quadrula houstonensis* C T

small to moderate streams and rivers as well as moderate size reservoirs; mixed mud, sand, and fine gravel, tolerates very slow to moderate flow rates, appears not to tolerate dramatic water level fluctuations, scoured bedrock substrates, or shifting sand bottoms, lower Trinity (questionable), Brazos, and Colorado River basins

TRAVIS COUNTY

MOLLUSKS

		Federal Status	State Status
Texas fatmucket	<i>Lampsilis bracteata</i>	C	T
streams and rivers on sand, mud, and gravel substrates; intolerant of impoundment; broken bedrock and course gravel or sand in moderately flowing water; Colorado and Guadalupe River basins			
Texas fawnsfoot	<i>Truncilla macrodon</i>	C	T
little known; possibly rivers and larger streams, and intolerant of impoundment; flowing rice irrigation canals, possibly sand, gravel, and perhaps sandy-mud bottoms in moderate flows; Brazos and Colorado River basins			
Texas pimpleback	<i>Quadrula petrina</i>	C	T
mud, gravel and sand substrates, generally in areas with slow flow rates; Colorado and Guadalupe river basins			

REPTILES

		Federal Status	State Status
Spot-tailed earless lizard	<i>Holbrookia lacerata</i>		
central and southern Texas and adjacent Mexico; moderately open prairie-brushland; fairly flat areas free of vegetation or other obstructions, including disturbed areas; eats small invertebrates; eggs laid underground			
Texas garter snake	<i>Thamnophis sirtalis annectens</i>		
wet or moist microhabitats are conducive to the species occurrence, but is not necessarily restricted to them; hibernates underground or in or under surface cover; breeds March-August			
Texas horned lizard	<i>Phrynosoma cornutum</i>		T
open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September			

PLANTS

		Federal Status	State Status
Basin bellflower	<i>Campanula reverchonii</i>		
Texas endemic; among scattered vegetation on loose gravel, gravelly sand, and rock outcrops on open slopes with exposures of igneous and metamorphic rocks; may also occur on sandbars and other alluvial deposits along major rivers; flowering May-July			
Boerne bean	<i>Phaseolus texensis</i>		
Narrowly endemic to rocky canyons in eastern and southern Edwards Plateau occurring on limestone soils in mixed woodlands, on limestone cliffs and outcrops, frequently along creeks.			
Bracted twistflower	<i>Streptanthus bracteatus</i>	C	
Texas endemic; shallow, well-drained gravelly clays and clay loams over limestone in oak juniper woodlands and associated openings, on steep to moderate slopes and in canyon bottoms; several known soils include Tarrant, Brackett, or Speck over Edwards, Glen Rose, and Walnut geologic formations; populations fluctuate widely from year to year, depending on winter rainfall; flowering mid April-late May, fruit matures and foliage withers by early summer			

TRAVIS COUNTY

PLANTS

Federal Status

State Status

Correll's false dragon-head *Physostegia correllii*

wet, silty clay loams on streamsides, in creek beds, irrigation channels and roadside drainage ditches; or seepy, mucky, sometimes gravelly soils along riverbanks or small islands in the Rio Grande; or underlain by Austin Chalk limestone along gently flowing spring-fed creek in central Texas; flowering May-September

Texabama croton *Croton alabamensis var texensis*

Texas endemic; in duff-covered loamy clay soils on rocky slopes in forested, mesic limestone canyons; locally abundant on deeper soils on small terraces in canyon bottoms, often forming large colonies and dominating the shrub layer; scattered individuals are occasionally on sunny margins of such forests; also found in contrasting habitat of deep, friable soils of limestone uplands, mostly in the shade of evergreen woodland mottes; flowering late February-March; fruit maturing and dehiscing by early June

Warnock's coral-root *Hexalectris warnockii*

in leaf litter and humus in oak-juniper woodlands on shaded slopes and intermittent, rocky creekbeds in canyons; in the Trans Pecos in oak-pinyon-juniper woodlands in higher mesic canyons (to 2000 m [6550 ft]), primarily on igneous substrates; in Terrell County under *Quercus fusiformis* mottes on terraces of spring-fed perennial streams, draining an otherwise rather xeric limestone landscape; on the Callahan Divide (Taylor County), the White Rock Escarpment (Dallas County), and the Edwards Plateau in oak-juniper woodlands on limestone slopes; in Gillespie County on igneous substrates of the Llano Uplift; flowering June-September; individual plants do not usually bloom in successive years

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