Karst Technical Report

Loop 1604 from SH 16 to I-35, Bexar County, Texas
CSJs: 2452-02-083, 2452-03-087, 2452-03-113, 0072-08-144

Prepared by: Zara Environmental LLC and JACOBS
Date: 11 March 2020

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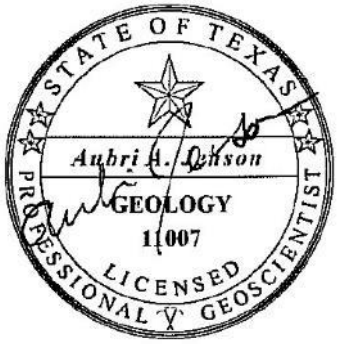
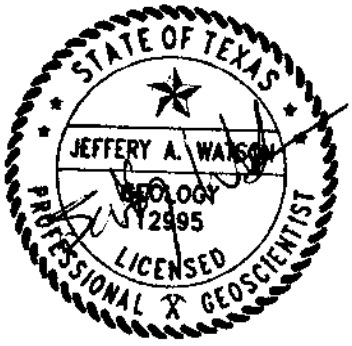
In accordance with the Texas Board of Professional Geologists rules at 22 Texas Administrative Code, Part 39, Chapter 851, Subchapter C, §851.156, this report is signed and sealed on the title page to assure the user that the work has been performed by or directly supervised by the following professional geologists who takes full responsibility for this work.

The computer-generated seals appearing on this document were authorized by Aubri Jensen, P.G. 11007 and Jeff Watson, P.G. 12995 on 11 March 2020.



11 March 2020
Aubri A. Jenson, Texas Professional Geoscientist No. 11007
Jeff Watson, Texas Professional Geoscientist No. 12995
Zara Environmental LLC, Geoscience Firm No. 50365



Abstract

Karst feature habitat surveys were conducted within the Loop 1604 right of way and easements from one mile west of State Highway 16 (SH 16) to Interstate 35 (I-35) and within the Interstate 10 (I-10) right of way and easements from Farinon Drive to Camp Bullis Road in Bexar County, Texas between May 2019 and September 2019. A literature review included the right of way, easements, and a 345-foot radius. No requests to enter private property outside of easements were made as a part of this effort.

Surveys and literature review identified 567 potential karst features (not accounting for potential synonyms), 107 of those occurring within rights of way and easements where they could be accessed for additional evaluation. Accessible features were evaluated for their potential to contain karst invertebrate habitat. Presence/absence surveys conforming to current U.S. Fish and Wildlife Service protocols were conducted in 18 features. One of those sites, feature 1604-FZ7, yielded an eyeless spider determined with mitochondrial DNA analysis to be part of the clade with the non-listed *Cicurina platypus/bullis*. No additional *Cicurina* sp. localities were discovered as a part of this effort.

Features previously documented to contain federally listed endangered karst invertebrate species include Green Mountain Road Cave (1604-E09), La Cantera Cave No. 1, and La Cantera Cave No. 2; however, only Green Mountain Road Cave occurs within the right of way. In addition to these three known localities, the 345-foot radius overlaps with Critical Habitat Unit 9; however, does not overlap with the caves and features in that unit that are known to contain listed species. No new endangered species localities were discovered as part of this effort.

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Introduction

The Texas Department of Transportation (TxDOT) is proposing improvements to Loop 1604 from State Highway 16 (SH 16) to Interstate 35 (I-35) in Bexar County, Texas. The Project Area is the TxDOT owned right of way (ROW) plus easements that encompass the project construction limits, and the Action Area is a 345 ft. radius around the Project Area. The Action Area includes the Stone Oak and UTSA Karst Fauna Regions (KFRs), occurs in karst zones 1, 2, 3, and 5, and overlaps with Critical Habitat Unit (CHU) 9 (Figure 1).

Most of the geographic area covered in this report was previously examined for its potential to provide karst invertebrate habitat (TxDOT 2015a), and a Biological Opinion with an Incidental Take Statement for *Cicurina madla, C. baronia, Rhadine exilis,* and *R. infernalis* was issued for an earlier iteration of this project (U.S. Fish and Wildlife Service [USFWS] 2016). The purpose of this study is to provide a current and comprehensive examination of karst invertebrate habitat and species in the Project Area.

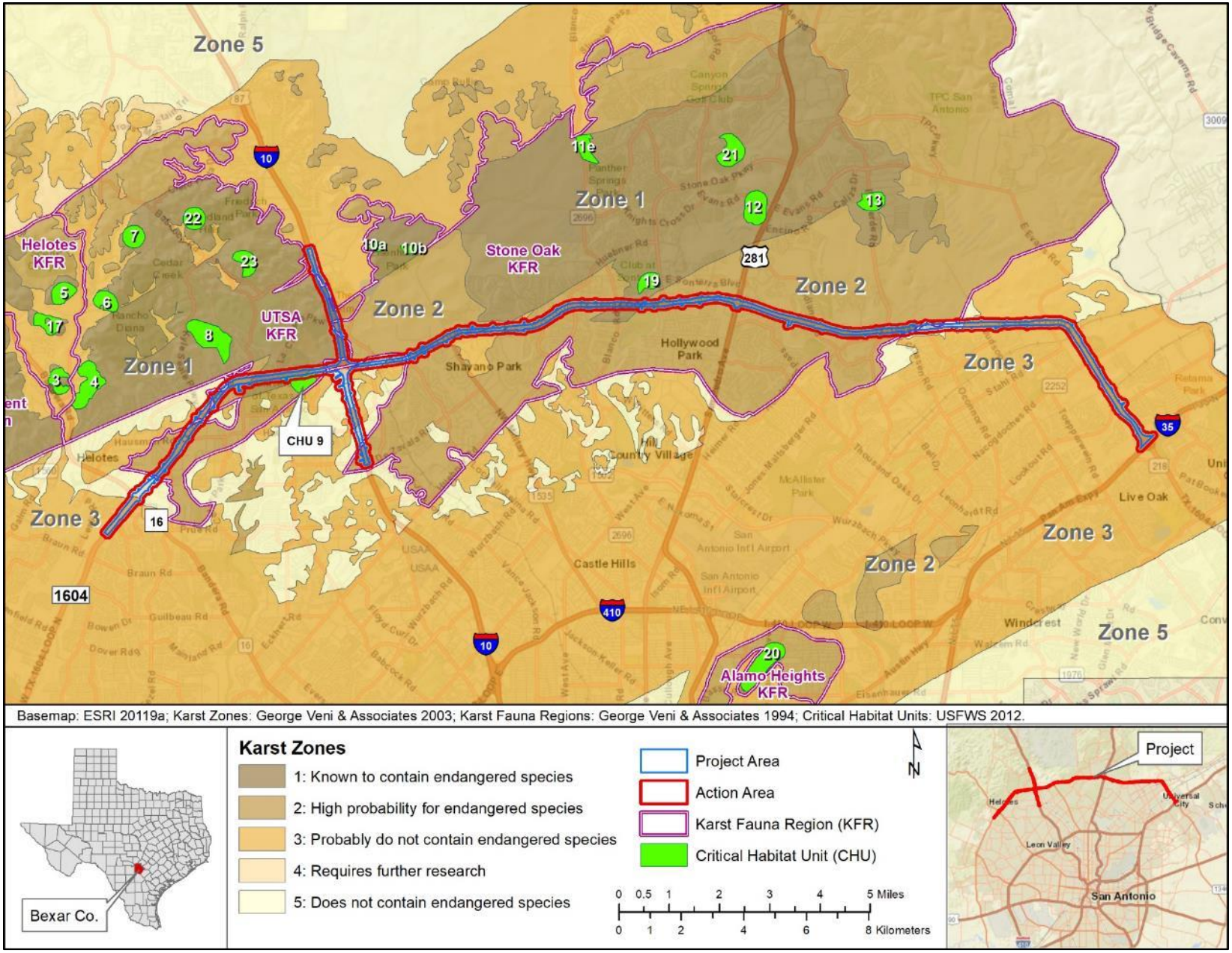

Figure 1. TxDOT is proposing improvements to Loop 1604 from SH 16 to I-35 and I-10 from Farinon Drive to Camp Bullis Road in Bexar County, Texas.

Methods

Background Data Collection

A review of karst feature and species location data from within the Action Area relied on the following sources:

- Texas Speleological Survey (TSS),
- USFWS,
- Texas Memorial Museum,
- Texas Parks and Wildlife Department, Texas Natural Diversity Database (TXNDD),
- Southern Edwards Plateau Habitat Conservation Plan (SEP HCP) administrators, and
- Completed geologic assessments (GAs) and karst technical reports from within the Action Area.

These historic data were compiled into a GIS database, and features located within the Project Area were identified for in-person evaluation.

Karst Feature Survey and Evaluation

Fieldwork for the karst survey was conducted from May 2019 through September 2019 and was supervised by USFWS permitted biologists and Professional Geoscientists. Surveys were conducted within the Project Area, except for three areas where very recent GAs were suitable for the baseline feature dataset (TxDOT 2017, TxDOT 2018a, TxDOT 2018b). Landowners were notified by mail that scientists would be conducting surveys within the easements.

Survey methods followed protocols outlined in Veni and Reddell (2002), Barrett (1999), Texas Commission on Environmental Quality (TCEQ) (2004) and USFWS (2015a), which describe surveyors walking in a formation not more than 15 m (50 ft) apart searching for depressions (both karstic and non-karstic), voids, and other indications of subterranean habitat. In addition to identifying previously undocumented features, careful effort was made to locate and re-evaluate the status of previously documented features. Positions of all features were documented using cell phone GPS or Garmin 64s GPS receivers and checked with field maps based on digital ortho-imagery. All features were mapped using ArcGIS software.

Karst features in the Project Area were evaluated by USFWS 10(a)(1)(A) permit holders. Reconnaissance excavation was performed when necessary, and features were evaluated based on USFWS (2015a) guidelines to determine whether they had the potential to contain habitat for federally listed karst invertebrate species. The evaluated features were documented and sketched on field sheets and are described in this report.

Personnel involved with field work and/or reporting included USFWS 10(a)(1)(A) permit holders (Permit No. TE85077A-0) Rachel Barlow, Brian Cowan, Jeanette Joost, Jean Krejca, William Larsen, Krista McDermid, and Peter Sprouse. Non-permitted scientists working under the direct supervision of permitted scientists to provide additional safety support and assisting with data collection and management included: Jennifer Blair, Liza Colucci,

Vanessa Curiel, Wendy Dickerson, Aubri Jenson, Jeremy Maikoetter, David McBee, Jacob Owen, Lucas Pustka, Tyler Remick, Caitlyn Wagner, Jeff Watson and John K. Young.

Presence/Absence Surveys

Features that met criteria described in USFWS (2015a) as having the potential to contain habitat were subject to presence/absence surveys, which were guided by recommendations in USFWS (2015a) and included an examination of all floors, walls, ceilings, and the undersides of rocks or loose substrate. Trapping methods were used to increase the potential for species detection, and the specific trapping regime for each feature is described as a part of each feature's results. Data loggers (Kestrel Drop D2©, Nielsen-Kellerman, 21 Creek Circle, Boothwyn, PA 19061, and SensorPush, HT1 Temperature and Humidity Smart Sensor, Garrison, NY 10524) were installed in the features and set to record in-cave temperature and relative humidity every 30 minutes. Features were insulated and covered with opaque plastic sheeting and plywood in between sampling events to buffer against surface temperature and humidity influences.

Fauna Identification

Fauna encountered were noted on field sheets and specimens were collected for confirmation when practicable. Excepting eyeless *Cicurina* spiders, commonly collected specimens were deposited with the University of Texas Biodiversity Collections at the University of Texas at Austin, unless otherwise noted. Eyeless *Cicurina* spiders were collected and sent to taxonomic specialists because they could not be identified in the field. Three legs were removed from each specimen and submitted to Dr. Caleb Phillips, Curator of Genetic Resources, Natural Science Research Laboratory, Museum of Texas Tech University. The remaining material from each specimen was sent to *Cicurina* taxonomic specialist Dr. Marshal Hedin, San Diego State University. This specimen disposition was approved by USFWS by email as an amendment to the Zara Environmental 10(a)(1)(A) permit on 20 May 2019. The results of those identifications are detailed in the results section for each feature.

The fauna observation tables in this document provide identifications down to the most convenient taxonomic level, typically order but sometimes family or genus. In all cases the taxa are epigean (surface) dwellers or trogloxenes or troglophiles unless noted in the feature description. For example, 'Araneae' and 'Coleoptera' are surface spiders and beetles, definitively not cave adapted species. Cave adapted species are identified to the genus level at a minimum and are specifically noted in the text.

Results

Background Data

Data from the following sources were found to contain pertinent information, and the details are presented in the feature descriptions section:

- Karst technical reports (Zara Environmental LLC [Zara] 2010b, Zara 2012, TxDOT 2015a, TxDOT 2019a),
- GAs (Zara 2010a, TxDOT 2015b, 2017, 2018a, 2018b, 2018c),
- The biological assessment for the Loop 1604 interchange at Blanco Road (TxDOT 2019b). A review of TxDOT 2019b (Table 3-2, pages 23-25 in that document) indicates that approximately 28 of the features described in this document are slated to be mined away as part of construction scheduled to occur between 2021 and 2025.

Data requests from USFWS, Texas Memorial Museum, TXNDD, and SEPHCP did not yield any new data relating to feature locations or endangered species localities. Data returned from TSS provided most of the information for features outside of the Project Area, but no new endangered species localities. The research on previous GAs summarized by TxDOT (2015a) provided the remainder of information for features outside of the Project Area (Appendix A).

Feature Evaluation, Excavation and Biological Surveys

Within the Action Area, 31 features have karst invertebrate habitat (Table 1), including three sites previously known to contain federally listed species: La Cantera Cave No. 1, La Cantera Cave No. 2, and Green Mountain Road Cave (Figure 2). No new endangered species localities were discovered as part of this current effort.

One hundred seven features were evaluated from the Project Area (Table 2). Presence/absence surveys conducted in 18 features resulted in the documentation of common troglobites (including *Texoreddellia* sp., *Brackenridgia* sp., *Chinquipellobunus* sp. and *Cambala* sp.), a range extension for a rare troglobite (Schizomida), and a new eyeless *Cicurina* locality in feature 1604-FZ7. Taxonomic experts used mitochondrial DNA (mtDNA) to identify the 1604-FZ7 animal as *C. platypus/bullis*, a non-listed *Cicurina* species. A previously collected eyeless *Cicurina* from feature JCT-26-NB (5) was also analyzed with mtDNA and found to be *C. puentecilla*. Results of all fauna surveys by feature and date are included in Appendix B. The genetic determination report is included in Appendix C. In-cave climate data for the features with presence/absence surveys are included as Appendix D. Detailed map views of feature locations are included as Appendix E. Vegetation sketches of surveyed features are included in Appendix F.

Features not described in this report include:

- GA-only features (e.g. faults, fractures in streambeds, and non-karst closed depressions) (Table A-1, Appendix A)
- Historic features not found and known to not contain species habitat (typically these are from previous GAs and are no longer extant),
- Features destroyed by ongoing construction projects in the area and not known to contain species habitat,
- Features located outside of the Project Area (typically these are from TSS data searches or previous GAs) (Table A-2, Appendix A).

Table 1. Summary table of 31 features that meet the criteria for karst invertebrate habitat in the Action Area.

Feature ID	Coordinates (NAD83)	Notable fauna
**1604-CE2 (filled in)	29.59086, -98.60202	*Cicurina neovespera*
1604-D07	29.60836, -98.5093	Surface fauna only
1604-D19	29.60875, -98.52154	Surface fauna only
1604-E09 (Green Mountain Road Cave)	29.60241, -98.37166	***Cicurina baronia*** Other troglobites
1604-F061 (Scottish Beard Cave)	29.60512, -98.5298	Troglobites
1604-F073 (Leopard Cave)	29.60835, -98.52063	Trogloxenes
1604-F074	29.60836, -98.52026	Surface fauna only
1604-F077 (Hubcap Cave)	29.60878, -98.51318	Troglobites
1604-F084	29.60842, -98.51075	Surface fauna only
**1604-F101 (Tally Ho Cave; filled in)	29.60644, -98.45923	*Cicurina platypus*
1604-FZ3	29.60887, -98.51017	Surface fauna only
1604-FZ4	29.60835, -98.51333	Surface fauna only
1604-FZ7	29.60806, -98.52523	*Cicurina platypus/bullis*
1604-L12	29.60311, -98.53463	Surface fauna only
1604-L13	29.60334, -98.53395	Surface fauna only
1604-L16 (12A Cave)	29.60275, -98.53431	Troglobites
**1604-M21 (Han's Grotto; filled in)	29.60253, -98.53971	Troglobites
1604-R03	29.59066, -98.60446	Trogloxenes
1604-R04	29.59077, -98.60454	Surface fauna only
1604-R05	29.59071, -98.60458	Surface fauna only
1604-R06	29.59066, -98.60469	Surface fauna only
281-117 (sealed)	29.60865, -98.46473	Troglobites
281-121 (Turnaround Cave; destroyed)	29.6091, -98.4692	Troglobites
**JCT-26-NB (5) (destroyed/sealed)	29.60897, -98.4886	*Cicurina puentecilla*
*La Cantera Cave #1	29.59033, -98.611376	***Rhadine exilis + Cicurina madla***
*La Cantera Cave #2	29.590803, -98.607406	***Rhadine exilis + Cicurina madla***
LOOP-009	29.60735, -98.46035	Troglobites
LOOP-102 (Fiesta Cave)	29.60107, -98.6012	Troglobites
LOOP-103	29.60119, -98.60129	Trogloxenes
LOOP-207	29.60118, -98.60151	Trogloxenes
LOOP-215	29.60105, -98.60126	Trogloxenes

*Feature is in Action Area but not in Project Area. ** Not surveyed to USFWS (2015a) standards (<14 times).

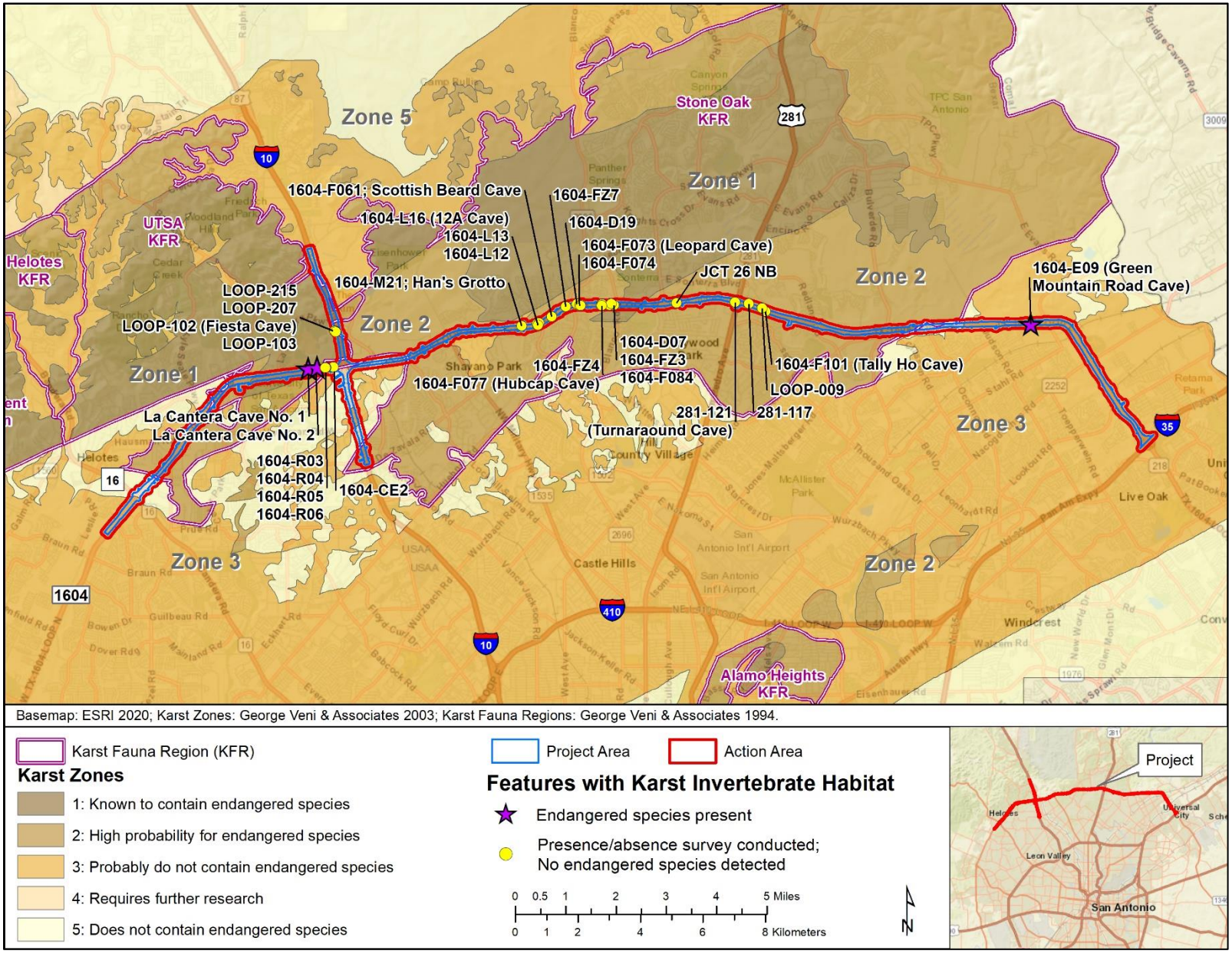

Figure 2. Location of 31 features in the Action Area that meet the criteria for karst invertebrate habitat.

Table 2. Summary of USFWS (2015a) evaluation criteria for conditions indicating potential habitat. **Feature is destroyed or not found but is included due to history of biological sampling.

Feature ID	Potential habitat if any criterion met							Potential habitat if two criteria met				Not habitat if all criteria met		
	Leaf litter, modern soil, rocks	Airflow	Channelized recharge	Collapse development	Loose fill ≥30 cm	Clean washed rocks	Cave fauna	Developed along a fracture	Extends ≥1 m	Similar to nearby caves	Enterable void	All surfaces calcite	No cave fauna	No evidence of water flow
1604-801	x							x	x				x	x
1604-CE2**														
1604-D05													x	x
1605-D06													x	x
1604-D07									x	x				
1604-D08	x												x	x
1604-D09	x								x				x	x
1604-D10													x	x
1604-D11									x				x	x
1604-D13									x					x
1604-D15	x							x					x	x
1604-D16	x							x					x	x
1604-D17	x												x	x
1604-D19	x								x				x	x
1604-D20													x	x
1604-E04	x								x				x	
1604-E05	x							x					x	x
1604-E09 (Green Mountain Road Cave)	x	x					x		x		x			
1604-F061	x						x		x	x				x

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Feature ID	Potential habitat if any criterion met							Potential habitat if two criteria met				Not habitat if all criteria met		
	Leaf litter, modern soil, rocks	Airflow	Channelized recharge	Collapse development	Loose fill ≥30 cm	Clean washed rocks	Cave fauna	Developed along a fracture	Extends ≥1 m	Similar to nearby caves	Enterable void	All surfaces calcite	No cave fauna	No evidence of water flow
1604-F063								x			x		x	
1604-F064	x								x				x	x
1604-F066	x												x	x
1604-F069	x								x				x	x
1604-F070	x							x					x	x
1604-F071	x												x	x
1604-F072	x								x		x		x	x
1604-F073	x								x	x	x		x	x
1604-F074	x							x	x	x			x	
1604-F076								x					x	x
1604-F077	x						x		x	x	x			
1604-F078	x								x				x	x
1604-F079													x	x
1604-F083	x													
1604-F084									x	x				
1604-F085						x			x				x	x
1604-F101**							x		x	x				
1604-FZ3	x								x	x			x	x
1604-FZ4	x								x				x	x

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Feature ID	Potential habitat if any criterion met							Potential habitat if two criteria met				Not habitat if all criteria met		
	Leaf litter, modern soil, rocks	Airflow	Channelized recharge	Collapse development	Loose fill ≥30 cm	Clean washed rocks	Cave fauna	Developed along a fracture	Extends ≥1 m	Similar to nearby caves	Enterable void	All surfaces calcite	No cave fauna	No evidence of water flow
1604-FZ6	x											x	x	x
1604-FZ7	x								x		x		x	x
1604-FZ8	x								x			x	x	x
1604-K41													x	x
1604-L02	x												x	x
1604-L11	x												x	x
1604-L12	x							x	x				x	x
1604-L13	x							x	x				x	x
1604-L16 (12A Cave)	x							x	x	x	x		x	
1604-M14	x												x	
1604-M21							x		x	x				
1604-M22													x	x
1604-Q48	x								x				x	x
1604-R03	x								x	x				
1604-R04									x	x				
1604-R05	x								x				x	x
1604-R06	x								x					x
281-117							x		x	x	x			
281-121							x		x	x	x			

Table 2. Summary of USFWS (2015a) evaluation criteria for conditions indicating potential habitat. **Feature is destroyed or not found but is included due to history of biological sampling.

Feature ID	Potential habitat if any criterion met							Potential habitat if two criteria met				Not habitat if all criteria met		
	Leaf litter, modern soil, rocks	Airflow	Channelized recharge	Collapse development	Loose fill ≥30 cm	Clean washed rocks	Cave fauna	Developed along a fracture	Extends ≥1 m	Similar to nearby caves	Enterable void	All surfaces calcite	No cave fauna	No evidence of water flow
G04	x												x	x
HB-007								x				x	x	x
HB-008	x			x								x	x	x
HB-009				x								x	x	x
HB-010												x	x	x
HB-013	x												x	x
HB-014	x								x				x	x
HB-016													x	x
HB-018													x	x
HB-019													x	x
HB-020	x											x	x	x
HB-021													x	x
HB-022	x			x									x	x
HB-023													x	x
HB-024	x												x	x
HB-026												x	x	x
HB-027									x				x	x
HB-029	x											x	x	x
HB-030									x			x	x	x

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Feature ID	Potential habitat if any criterion met							Potential habitat if two criteria met				Not habitat if all criteria met		
	Leaf litter, modern soil, rocks	Airflow	Channelized recharge	Collapse development	Loose fill ≥30 cm	Clean washed rocks	Cave fauna	Developed along a fracture	Extends ≥1 m	Similar to nearby caves	Enterable void	All surfaces calcite	No cave fauna	No evidence of water flow
HB-031									x				x	x
HB-032					x								x	x
HB-033												x	x	x
HB-034	x												x	x
HB-035	x				x								x	x
HB-036	x												x	
HB-037	x												x	x
HB-038	x											x	x	x
JCT 26 North B**							x	x	x					
LOOP-005	x												x	x
LOOP-009	x					x			x				x	
LOOP-010	x								x				x	x
LOOP-011	n/a													
LOOP-102	x		x						x	x	x		x	x
LOOP-103			x						x				x	
LOOP-104	x												x	
LOOP-105	x								x				x	x
LOOP-107													x	x
LOOP-110	x												x	x

Table 2. Summary of USFWS (2015a) evaluation criteria for conditions indicating potential habitat. **Feature is destroyed or not found but is included due to history of biological sampling.

Feature ID	Potential habitat if any criterion met							Potential habitat if two criteria met				Not habitat if all criteria met		
	Leaf litter, modern soil, rocks	Airflow	Channelized recharge	Collapse development	Loose fill ≥30 cm	Clean washed rocks	Cave fauna	Developed along a fracture	Extends ≥1 m	Similar to nearby caves	Enterable void	All surfaces calcite	No cave fauna	No evidence of water flow
LOOP-111	x							x					x	x
LOOP-112												x		
LOOP-202	x		x										x	x
LOOP-204	x							x					x	x
LOOP-207	x				x				x				x	x
LOOP-213	x		x	x	x			x					x	x
LOOP-214	x		x					x					x	x
LOOP-215	x							x	x	x			x	x
LOOP-217	x												x	x

Feature 1604-801; Zone of Solution-Enlarged Fractures

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 east of Huebner Road (Figure 3 - Figure 5). It was evaluated on February 2, 2010, and on March 25, 2010 excavation was performed, and the feature was found to definitively end. The feature was again field evaluated on November 29, 2017, and the original datasheets were re-evaluated in 2019 to verify the potential for karst invertebrate habitat. It was a zone of three solution-enlarged fractures within an area that was 6 m (20 ft) wide by 1.8 m (6 ft) long by 1.8 m (6 ft) high. The largest opening was 0.5 m (1.5 ft) wide by 0.6 m (2 ft) high and extends 1.8 m (6 ft) into the roadcut (Figure 5). It contained exposed bedrock and breakdown. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

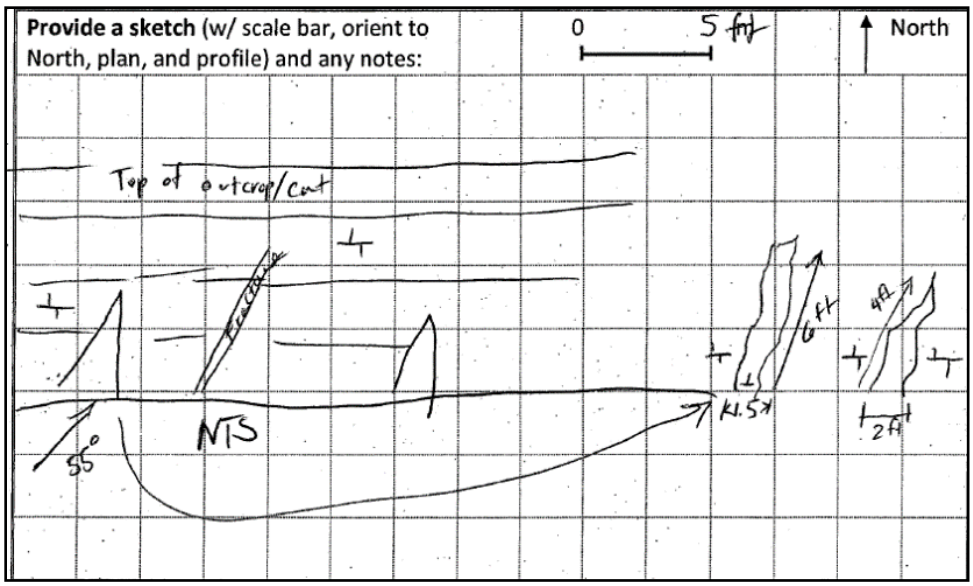

Figure 3. Field sketch of feature 1604-801.


Figure 4. Overview of feature 1604-801.

Figure 5. The largest of three solution-enlarged fractures in the zone feature 1604-801.

Feature 1604-CE2; Soil piping feature (currently backfilled)

This 0.35 m (1.15 ft) diameter by 0.35 m (1.15 ft) deep hole had a loose fill bottom that was dropping below grade due to soil piping (Figure 6 -Figure 8). This site was excavated on January 5, 2010, resulting in the removal of 3 m^3 (105.9 ft^3) of material. It was excavated to a depth of 3 m (9.8 ft). Initial digging efforts involved removing the loose fill from the piping shaft. While the vertical walls of the 0.35 m (1.15 ft) diameter shaft were composed of consolidated clay and small rocks, the piping material was sand. This sand was likely dumped in the hole at some point, but by whom or under what circumstances is unknown. As the hole deepened it was necessary to widen to continue working at the bottom, so the consolidated clay walls were peeled back to make the shaft a little over 1 m (3.3 ft) in diameter. A linear bedrock wall was found on the west side at a depth of 1.5 m (4.9 ft), and on the east side at a depth of 2 m (6.6 ft) (Figure 8). No bedrock was found on the north or south sides of the shaft. The feature began to resemble a bedrock utility trench; however, the walls exhibited a natural surface. Sand continued to be removed to a depth of 3 m (9.8 ft), where a poured concrete floor was encountered. Concrete residue could be seen on the east bedrock wall; evidence of it having been poured in to fill a natural bedrock feature. The north and south walls of the shaft, still composed of clay and small rocks but also small voids, was dug only as far as was prudent considering the risk of collapse due to unstable

overhang. Removal of this loosely consolidated material near the bottom resulted in the discovery of karst invertebrate species.

Presence/absence surveys for endangered karst invertebrates were conducted on January 6, 13, 20, and 27, and March 12 and 19, 2010. Karst invertebrate species encountered included *Cicurina neovespera* (Figure 9, Table 1)*, Mixojapyx reddelli*, *Cambala speobia, Texoreddellia media, Pseudosinella violenta,* and *Brackenridgia cavernarum.* No endangered species were found. Since this feature was in a mowed area, the feature was backfilled after surveys were completed. In karst feature surveys conducted in 2019, no surface expression of the feature could be seen. It was not re-excavated, and new presence/absence surveys were not conducted. Re-excavation, even if the exact location of the feature could be determined, would be problematic. It would require a backhoe to excavate a large hole to avoid risk of collapse. The poured concrete at the bottom of the original excavation could indicate a plugged cave entrance or could be part of an unknown utility installation.

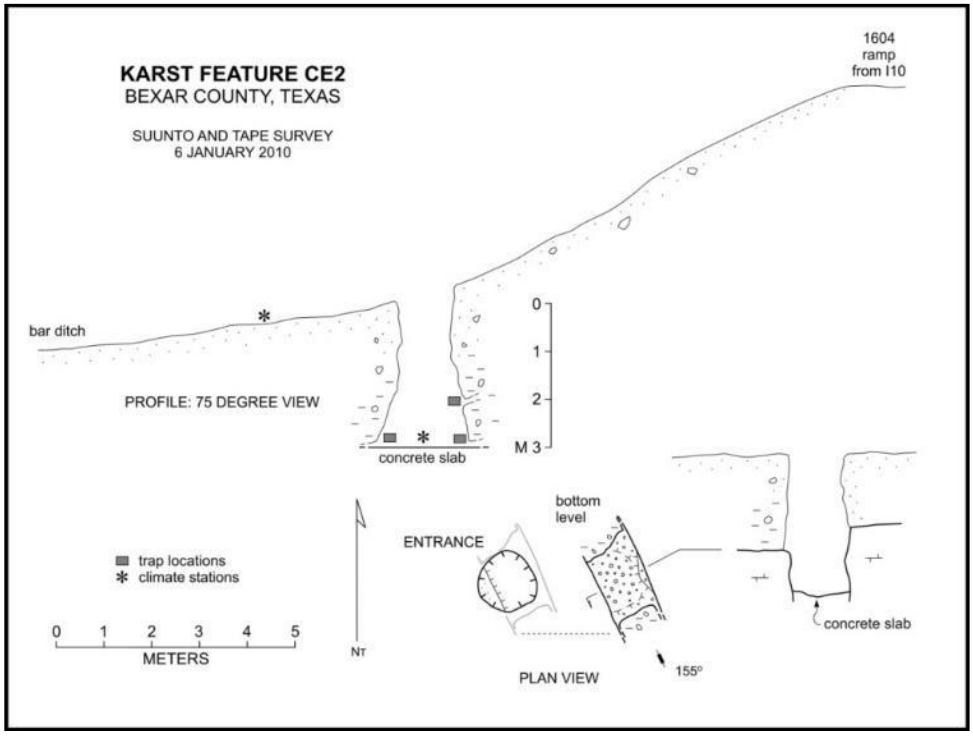

Figure 6. Map of feature CE2.

Figure 7. Overview of feature CE2 prior to excavation in 2010.

Figure 8. View down into CE2 after 2010 excavation. The bedrock walls on the east (bottom) and west (top) sides of the lower part of the feature can be seen.

Figure 9. *Cicurina neovespera* collected from feature CE2 in 2010.

Feature 1604-D05; Solution-enlarged Bedding Plane

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Blanco Road (Figure 10 - Figure 12) It was evaluated on January 12, 2010 and July 3, 2019. This solution-enlarged bedding plane measured 0.5 m (1.6 ft) wide by 0.7 m (2.3 ft) long and 0.2 m (0.7 ft) high. It was floored with bedrock. This feature had no noticeable airflow, was not humanly enterable and mesocavernous voids were present. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

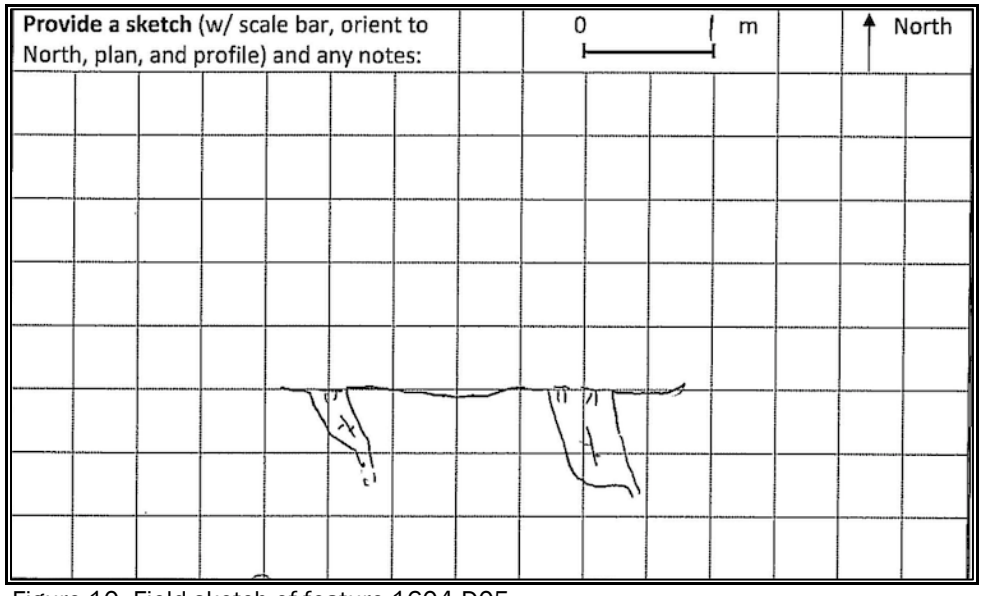

Figure 10. Field sketch of feature 1604-D05.

Figure 11. Overview of feature 1604-D05.

Figure 12. Interior of feature 1604-D05.

Feature 1604-D06; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Blanco Road (Figure 13 - Figure 16). It was evaluated on January 12, 2010 and July 3, 2019. This solution cavity measured 0.2 m (0.65 ft) wide by 0.9 m (2.9 ft) long and 0.3 m (0.98 ft) high. It was floored with bedrock. It had no airflow and a definitive terminus. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

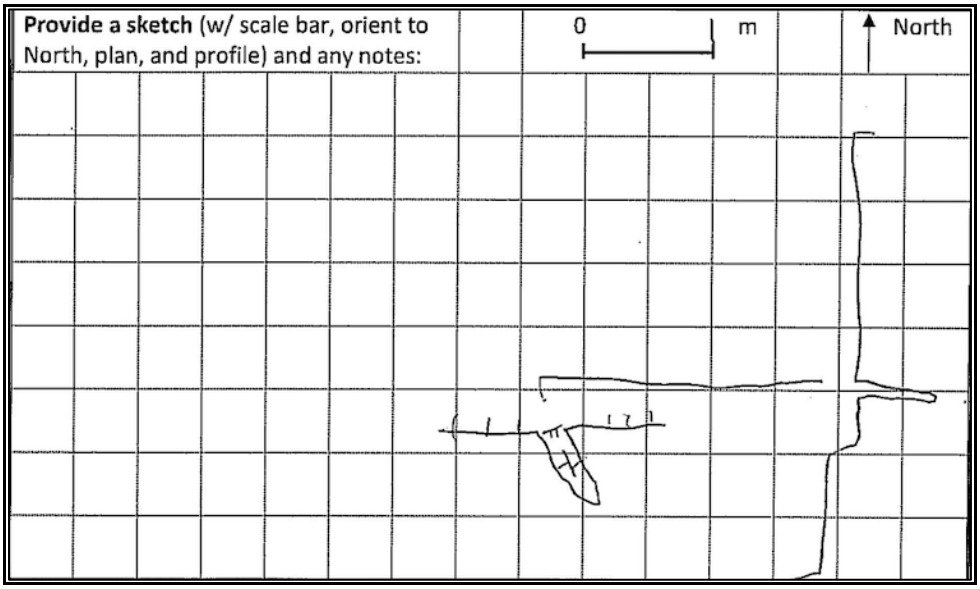

Figure 13. Field sketch of feature 1604-D06.

Figure 14. Overview of feature 1604-D06.

Figure 15. Entrance of feature 1604-D06.

Figure 16. Interior of feature 1604-D06.

Feature 1604-D07; Solution Cavity

This feature was located approximately 2 m (6.6 ft) above grade in the mainlane roadcut of eastbound Loop 1604, just west of Blanco Road. It was evaluated on January 12, 2010 and March 27, 2019 (TxDOT 2019a). It was a solution cavity 0.5 m (1.6 ft) wide by 1.5 m (4.9 ft) long by 0.3 m (1 ft) high (Figure 17). It contained bedrock and clay. During the initial evaluation in 2010, recon excavation was conducted, and no mesocavernous voids were detected. No fauna surveys were conducted. The 2019 evaluation determined that a small opening led to a new chamber in the feature. Minor rock excavation to facilitate entrance to the feature for surveys was conducted (Figure 18 - Figure 19). It was determined that this feature met criteria for potential habitat, including void size greater than or equal to 1 m (3.3 ft) and similarity to nearby caves (Table 2). Presence/absence surveys were conducted in March and April 2019; however, no troglobites were found (Table 1, Table 3) (TxDOT 2019a). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

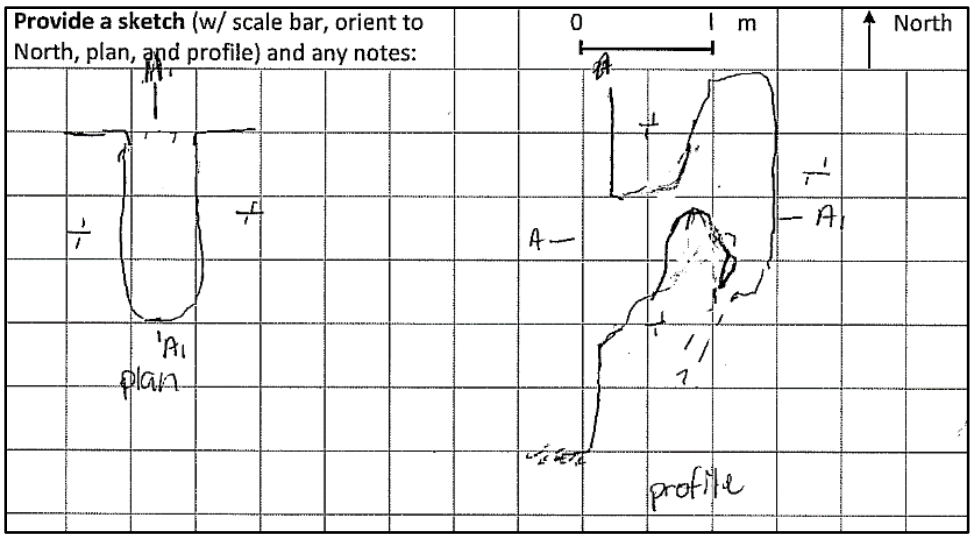

Figure 17. Field sketch of feature 1604-D07.

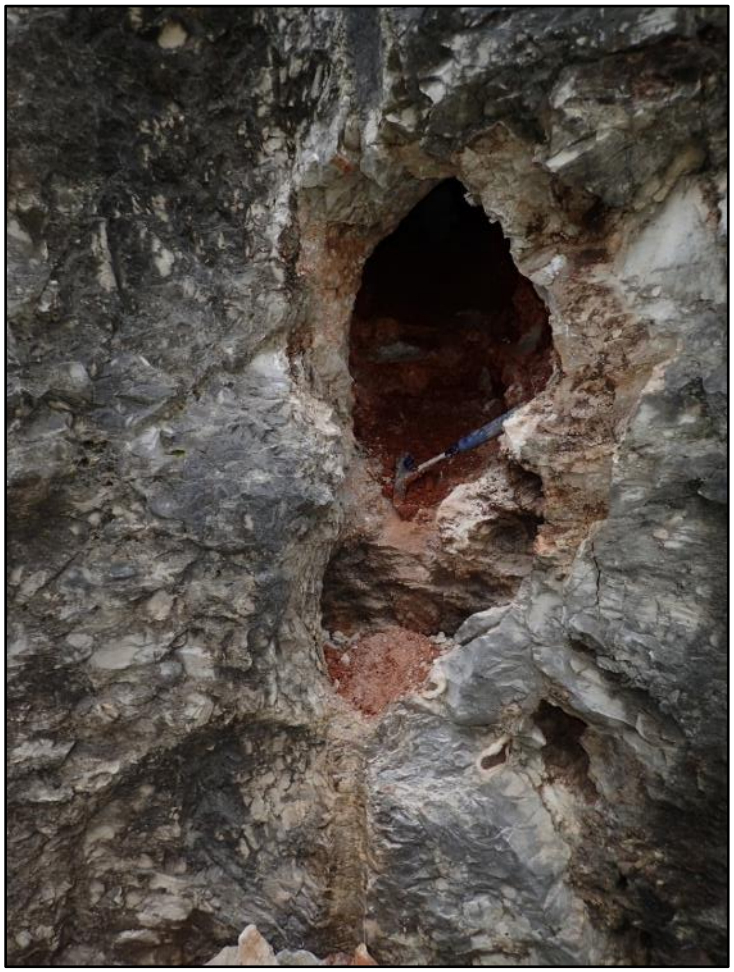
Figure 18. Overview of feature 1604-D07 following minor excavation.

Figure 19. Interior of feature 1604-D07 after minor excavation.

Table 3. Summary of fauna observations at feature 1604-D07.

Common Name	Lowest Taxonomic Identification
Woodlice	*Porcellio* sp.
Centipede	Chilopoda
Springtail	Collembola (epigean)
Cockroach	Blattaria
Ant	Formicidae
Fly / Gnat	Diptera
Frog	Anura
Mouse	*Mus* sp.

Feature 1604-D08; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, east of Blanco Road (Figure 20 - Figure 22). It was evaluated on January 12, 2010 and July 3, 2019. This solution cavity measured 0.5 m (1.6 ft) wide by 0.5 m (1.6 ft) long and 0.3 m (0.98 ft) high. This feature had no airflow or mesocavernous voids. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

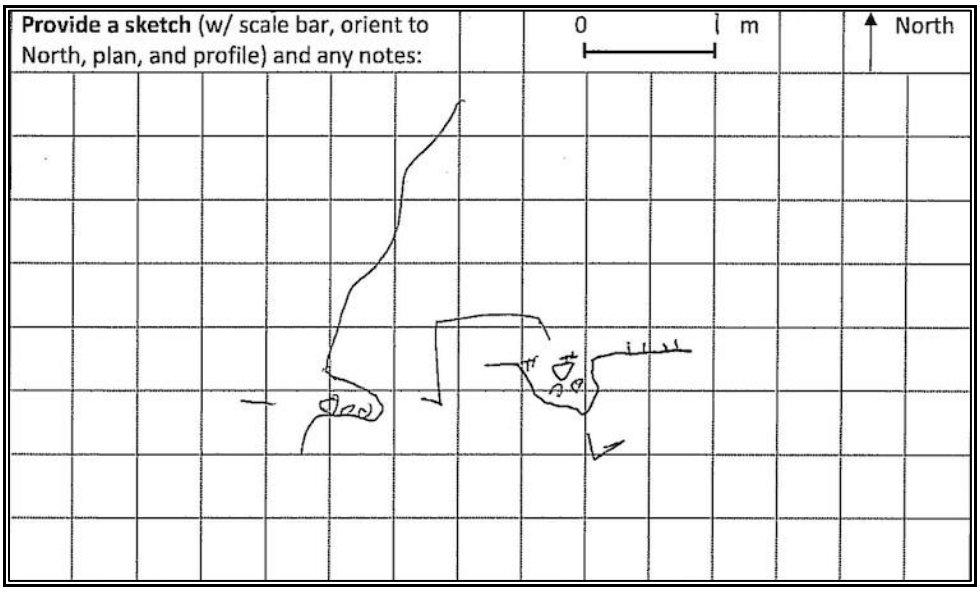

Figure 20. Field sketch of feature 1604-D08.


Figure 21. Overview of feature 1604-D08.

Figure 22. Interior of feature 1604-D08.

Feature 1604-D09; Solution Cavity

This feature was located in a roadcut north of the westbound mainlanes of Loop 1604, west of Blanco Road (Figure 23 - Figure 25). It was evaluated on January 12, 2010 and July 3, 2019. This solution cavity measured 0.6 m (1.9 ft) wide by 1.2 m (3.9) ft long and 0.5 m (1.6 ft) high. This feature was filled with fine loose soil and cobbles. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

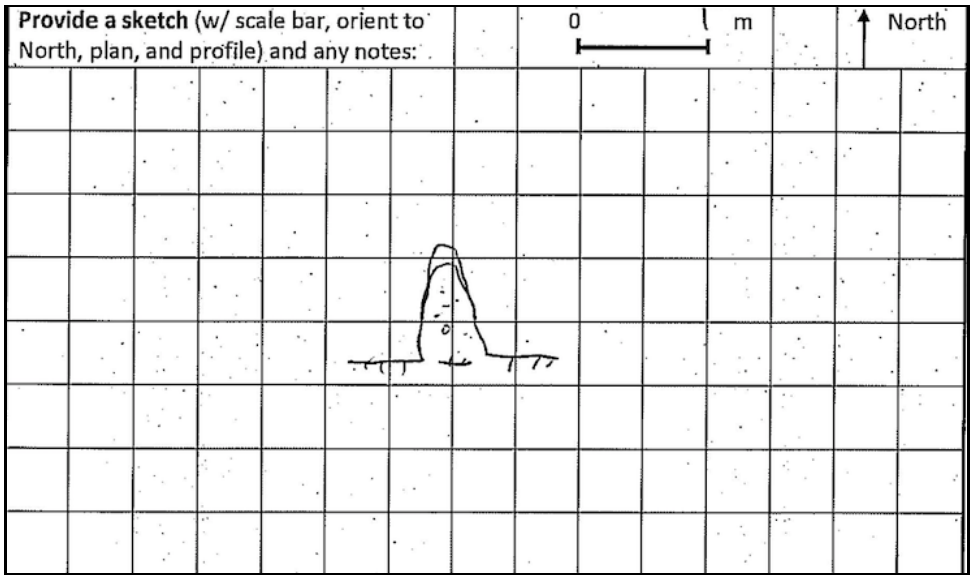

Figure 23. Field sketch of feature 1604-D09.


Figure 24. Overview of feature 1604-D09.

Figure 25. Interior of feature 1604-D09.

Feature 1604-D10; Solution Cavity

This feature was in the mainlane roadcut of westbound Loop 1604, just west of the Blanco Road overpass. It was initially evaluated on January 12, 2010, and reconnaissance excavation was conducted. It was re-evaluated on March 25, 2019 (TxDOT 2019a) (Figure 26 - Figure 29). This solution cavity measured 0.3 m (1 ft) wide by 0.3 m (1 ft) long by 0.3 m (1 ft) high. It contained bedrock. It was located approximately 2.5 m (8.2 ft) above grade in the roadcut and had two openings. Boulders and rocks were removed from the outside to evaluate it. After this minor excavation, this feature was determined to end without any mesocavernous voids. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

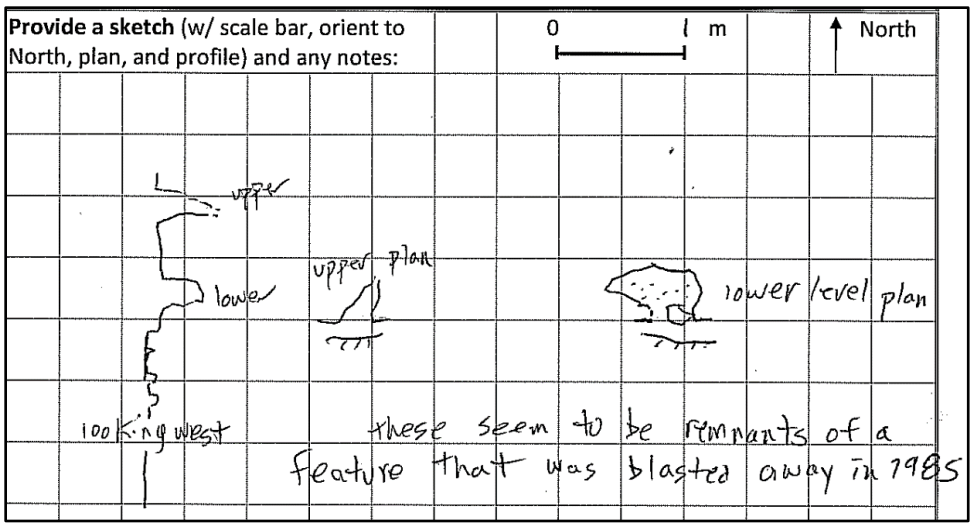

Figure 26. Field sketch of feature 1604-D10.


Figure 27. Overview of feature 1604-D10.

Figure 28. Interior of the upper aperture of feature 1604-D10.

Figure 29. Interior of lower hole of feature 1604-D10.

Feature 1604-D11; Solution Cavity

This feature was located in a roadcut north of the westbound mainlanes of Loop 1604, west of Blanco Road (Figure 30 - Figure 32). It was evaluated on January 12, 2010 and July 3, 2019. This solution cavity measured 0.7 m (2.3 ft) wide by 1.9 m (3.9 ft) long and 0.3 m (0.8 ft) high. It was infilled with gravel and compact red clay. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

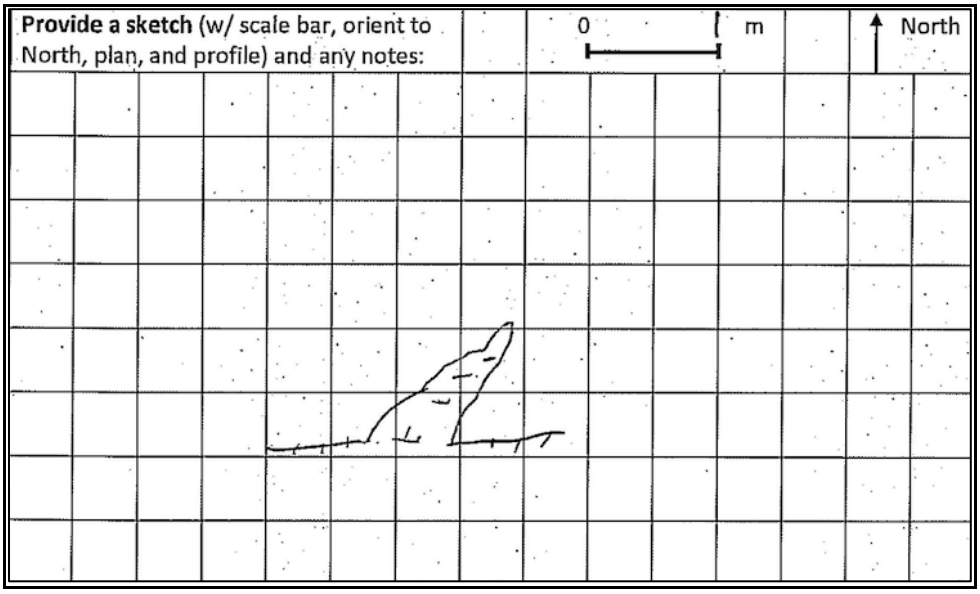

Figure 30. Field sketch of feature 1604-D11.

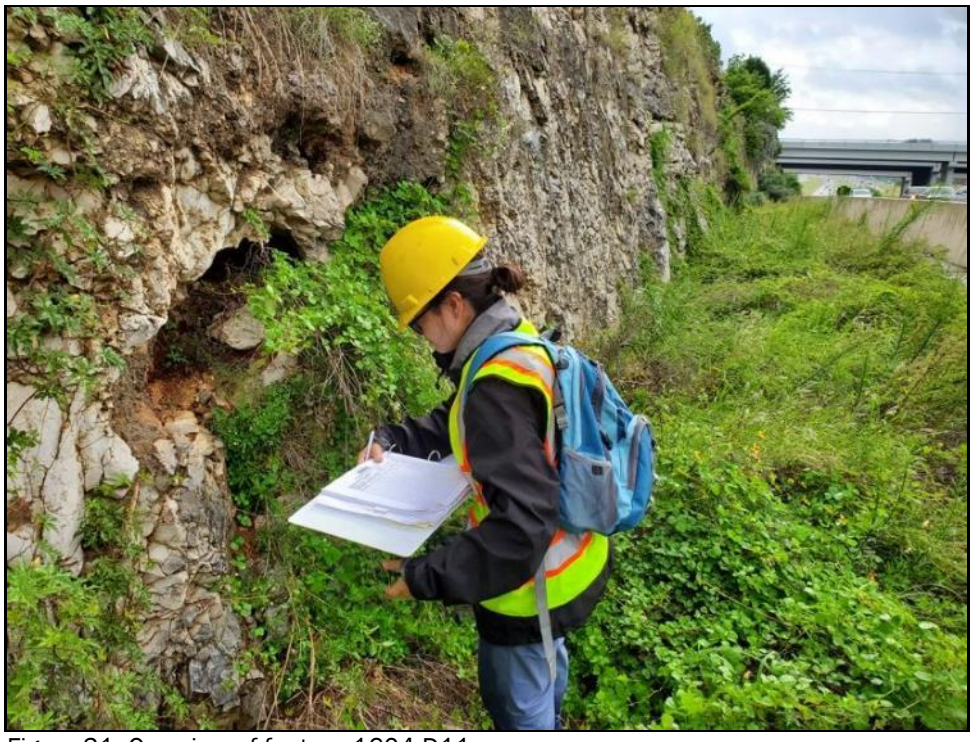

Figure 31. Overview of feature 1604-D11.

Figure 32. Interior of feature 1604-D11.

Feature 1604-D13; Enlarged Bedding Plane

This feature was located in the roadcut of the westbound 1604 mainlane between Blanco Road and Huebner Road. It was evaluated on January 12, 2010 and March 22, 2019 (Figure 33 - Figure 35). This enlarged bedding plane measured 3 m (9.8 ft) wide by 1 m (3.3 ft) long by 0.2 m (0.7 ft) high. It contained rocks, soil and bedrock. This feature had been exposed for several years and was dry with minimal dark space, and no visible mesocavernous voids. This feature had a visual terminus approximately 1 m (3.3 ft) into the roadcut. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

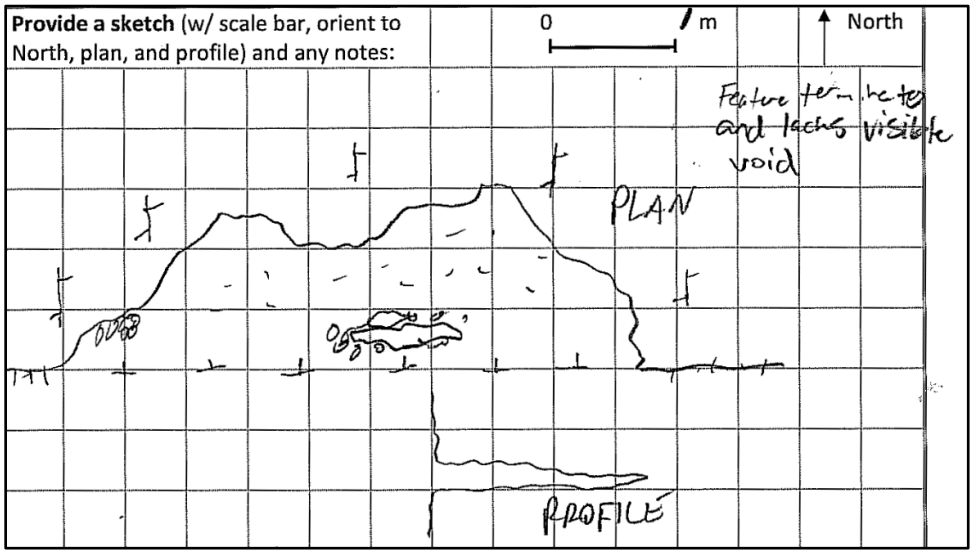

Figure 33. Field sketch of feature 1604-D13.

Figure 34. Overview of feature 1604-D13.

Figure 35. Interior of feature 1604-D13.

Feature 1604-D15; Solution-enlarged Fracture

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604 west of Huebner Road (Figure 36 - Figure 37). It was originally evaluated in 2010 (Zara 2010b), again in 2016, then again on August 15, 2019. This feature consists of two holes, one was a blind solution cavity, to the east, which had no voids extending from it. The other solution cavity measured 0.2 m (0.6 ft) in diameter at its opening, but inside measured 0.1 m (3.3 ft) wide and 0.3 m (1.0 ft) tall and extends 0.9 m (3.0 ft) into the roadcut. The floor of the feature had a thin layer of loose rocks and dark brown soil (Figure 38); however, it is best characterized as a tight, sinuous bedrock tube. Past evaluations noted that some void space can be seen continuing off from the feature, but during the 2019 evaluation we determined the maximum distance that could be sampled with a pole and sticky trap was less than one meter, and during this visit that space was entirely filled with a young possum. Excavation of the site was not warranted because it was nearly entirely bedrock with only a thin layer of loose debris available to move, such that excavation would not yield additional sampleable habitat. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

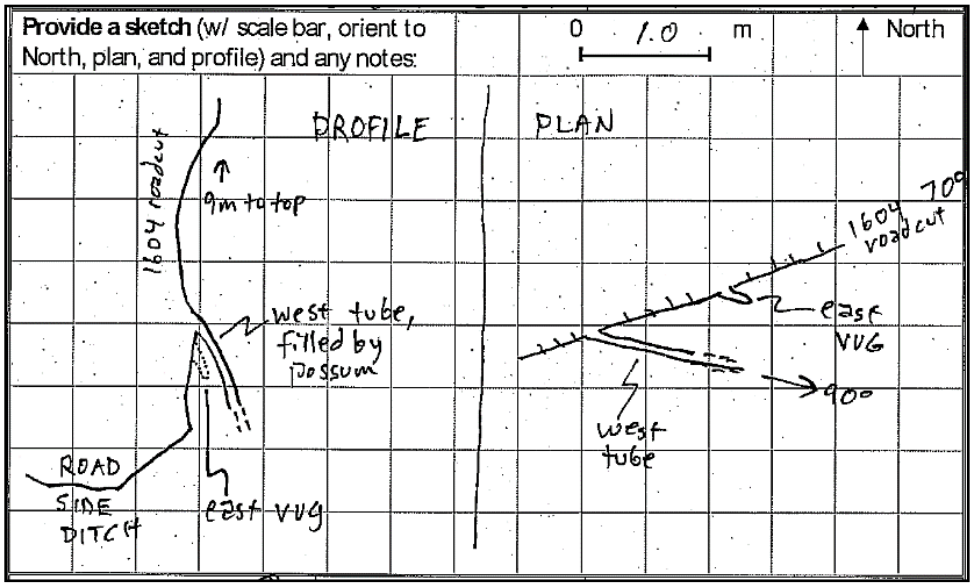

Figure 36. Field sketch of feature 1604-D15.

Figure 37. Overview of feature 1604-D15. To the left of the clipboard was the blind solution cavity, to the right of the clipboard was the 0.9 m (3.0 ft) solution cavity with vegetation growing at the entrance. Scale bar to left of clipboard points north.

Figure 38. Interior of feature 1604-D15

Feature 1604-D16; Solution-enlarged Fracture

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, west of Huebner Road (Figure 39 - Figure 41). It was field evaluated on January 13 and April 22, 2010, and on November 30, 2017. In 2019 the earlier datasets were re-evaluated to verify the potential for karst invertebrate habitat. It was a solution-enlarged fracture that measured 0.2 m (0.8 ft) wide by 0.9 m (3.1 ft) long by 0.3 m (1 ft) high, with no mesocavernous voids extending off. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

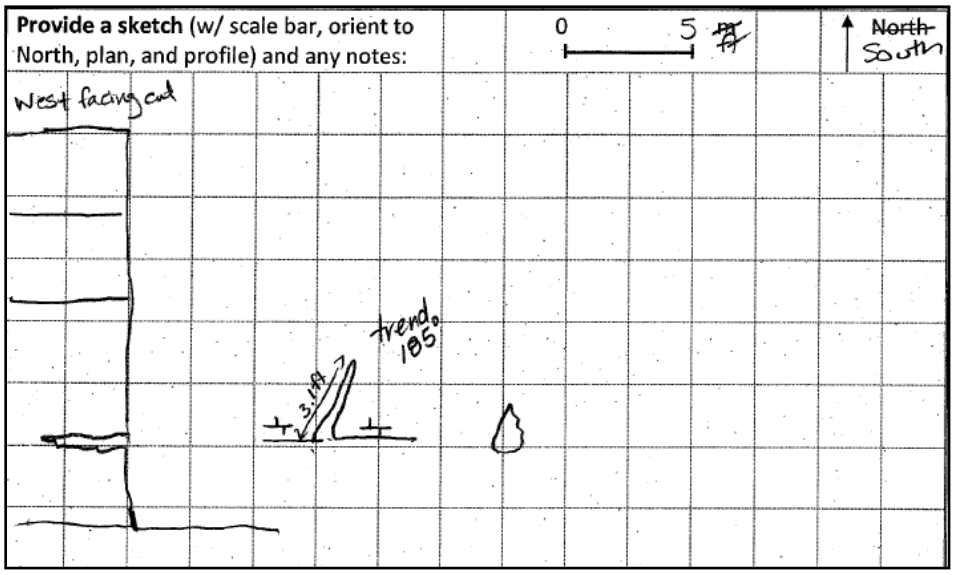

Figure 39. Field sketch of feature 1604-D16.

Figure 40. Overview of feature 1604-D16.

Figure 41. Interior of feature 1604-D16.

Feature 1604-D17; Solution cavity

This feature was located in a roadcut north of the westbound mainlanes of Loop 1604, west of Huebner Road (Figure 42 - Figure 44). It was evaluated on January 13, 2010 and June 19, 2019. This solution cavity measured 0.75 m (2.5 ft) long by 0.75 m (2.5 ft) wide and 0.25 m (0.8 ft) deep. This feature contained loose organic soil and leaf-litter. On August 19, 2010, approximately 0.5 person hours were spend excavating 0.1 m^3 (3.5 ft^3) of material using hand tools. Excavation was terminated after reaching a distinct floor that did not connect to any drains or mesocavernous voids draining downward. The feature was likely a bedding plane that was exposed by road cutting and then buried by ditch fill. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

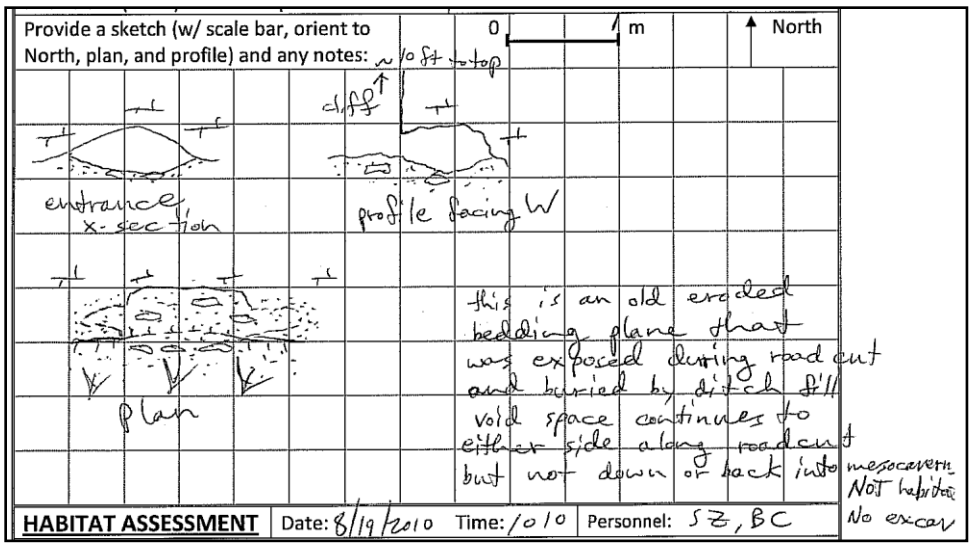

Figure 42. Field sketch of feature 1604-D17 after excavation in 2010.


Figure 43. Overview of feature 1604-D17.

Figure 44. Close-up of feature 1604-D17.

Feature 1604-D19; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 east of Huebner Road (Figure 45 - Figure 46). It was evaluated on January 13, 2010 and August 9, 2019. This feature was a solution-enlarged bedding plane 5 m (16.4 ft) wide by 2.5 m (8.2 ft) long by 0.2 m (0.5 ft) high. The feature contained rocks and exposed bedrock. The feature was located approximately 1.2 m (4 ft) above of the base of the roadcut. It was considered to be potential karst invertebrate habitat due to feature length and the presence of mesocavernous voids (Table 2). Biological surveys were conducted March and April 2010, but no troglobites were found. Presence/absence surveys were conducted in August and September 2019 (Table 4); however, no troglobites were found (Table 1).

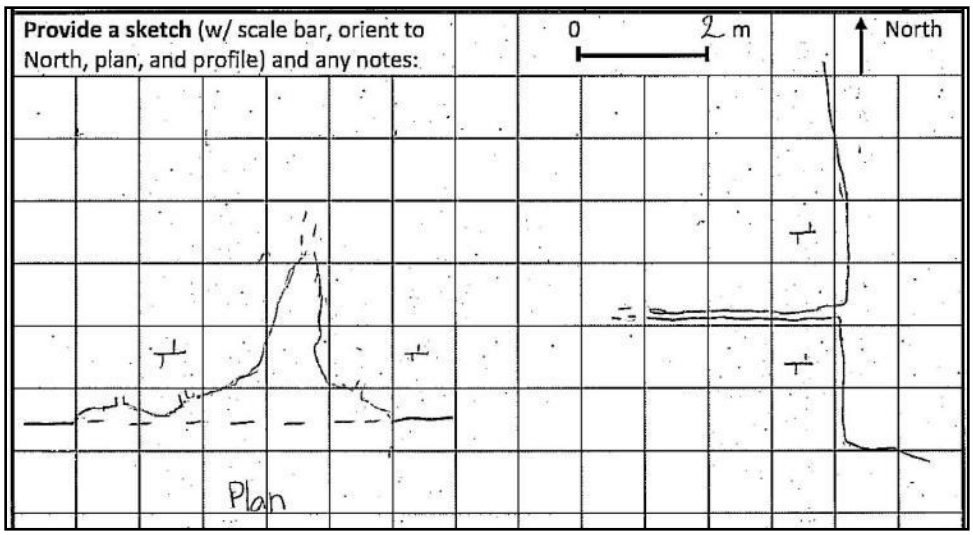

Figure 45. Field sketch of feature 1604-D19.


Figure 46. Overview of feature 1604-D19.

Table 4. Summary of survey activity at feature 1604-D19.

Date	Time	Effort (minutes)	Comments
08/09/2019	-	-	Feature evaluation; set traps and data logger
08/12/2019	9:56	12	Checked and reset traps
08/14/2019	9:03	20	Checked and reset traps
08/16/2019	09:00	10	Checked and reset traps
08/19/2019	08:50	12	Checked and reset traps
08/21/2019	09:03	10	Checked and reset traps
08/23/2019	11:05	10	Checked and reset traps
08/26/2019	10:42	10	Checked and reset traps
08/28/2019	09:54	10	Checked and reset traps
08/30/2019	09:23	6	Checked and reset traps
09/01/2019	08:40	10	Checked and reset traps
09/03/2019	10:10	8	Checked and reset traps
09/05/2019	10:10	9	Checked and reset traps
09/07/2019	08:42	6	Checked and reset traps
09/09/2019	16:33	20	Checked and removed traps and data logger

Table 5. Summary of fauna observations at feature 1604-D19.

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae *Porcellio* sp.
Spider	Araneae
Centipede	Scolopendromorpha
Springtail	Collembola
Insect larvae	Insecta
Cricket	Gryllidae
Earwig	Dermaptera
Cockroach	Blattaria
Beetle	Coleoptera
Ant	Formicidae
Fly/Gnat	Diptera
Mediterranean gecko	*Hemidactylus turcicus*

Feature 1604-D20; Solution Cavity

This feature is located south of the eastbound mainlanes of Loop 1604, east of US 281 (Figure 47 - Figure 49). It was evaluated on January 13, 2010 and June 19, 2019. The feature was a solution cavity that measured 2.5 m (8.2 ft) wide by 0.5 m (1.6 ft long) and 1.2 m (3.9 ft) deep. This feature was floored with bedrock and desiccated due to the large opening. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

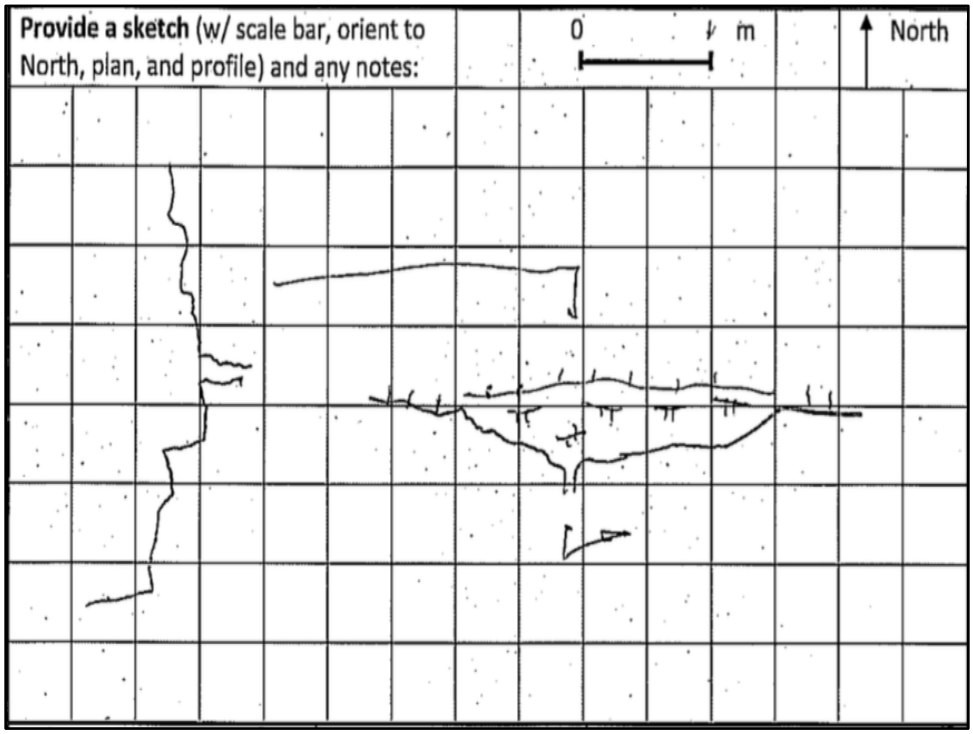

Figure 47. Field sketch of feature 1604-D20.

Figure 48. Overview of feature 1604-D20.

Figure 49. Close-up of feature 1604-D20.

Feature 1604-E04; Solution Cavity

This feature was located in a roadcut north of the westbound mainlanes of Loop 1604, east of Bitters Road (Figure 50 - Figure 53). It was evaluated on January 12, 2010 and July 3, 2019. The feature was a solution cavity 0.78 m (2.6 ft) wide, 1.4 m (4.6 ft) long, and 0.4 m (1.3 ft) high. This feature contained loose rocks and compact sediment. An excavation was performed on March 25, 2010, with the removal of approximately 1 m^3 (35.3 ft^3) of material using hand tools. Another excavation on July 10 and 11, 2019 resulted in 0.05 m^3 (2 ft^3) being excavated. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

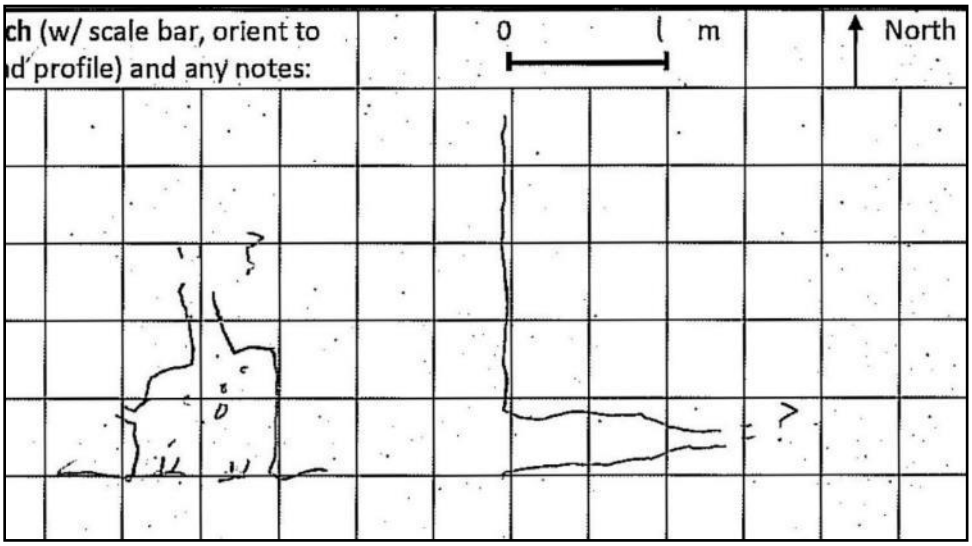

Figure 50. Field sketch of feature 1604-E04.

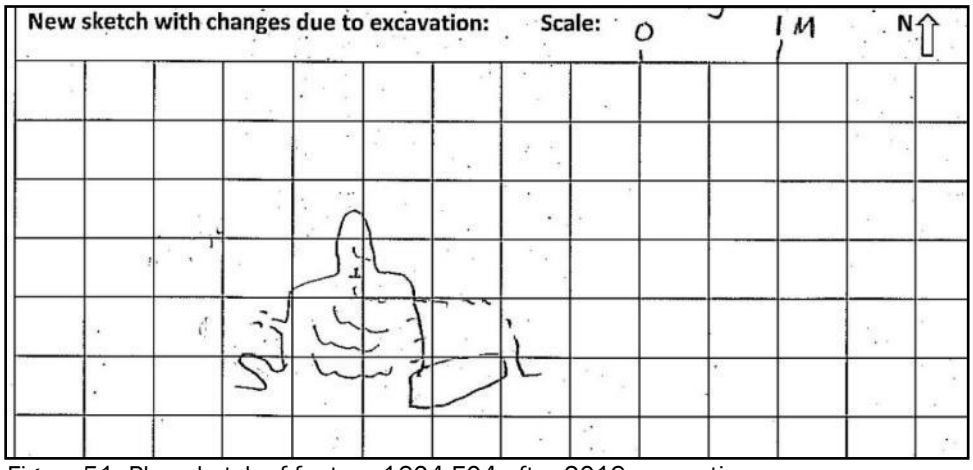

Figure 51. Plan sketch of feature 1604-E04 after 2019 excavation.

Figure 52. Overview of feature 1604-E04.

Figure 53. Interior of feature 1604-E04 after excavation in 2019.

Feature 1604-E05; Solution Cavity

This solution cavity was located in the roadcut north of the westbound mainlanes of Loop 1604 to the east of Huebner Road (Figure 54 - Figure 56). This solution cavity measured 0.2 m (0.7 ft) wide by 0.2 m (0.8 ft) long by 0.9 m (3 ft) high and contained breakdown, flowstone, and exposed bedrock. An assessment performed on January 13, 2010 indicated that excavation was not warranted; however, because of the difficulty of seeing back into the feature, leaving open the potential for mesocavernous voids, subsequent visits were performed on March 25, May 13, and August 17, 2010. Fauna observed on those days included only surface beetles and isopods, and follow up excavation concluded that the void does come to a definitive end less than a meter from the entrance (Figure 54). In 2019 the earlier datasets were re-evaluated to verify the potential for karst invertebrate habitat. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

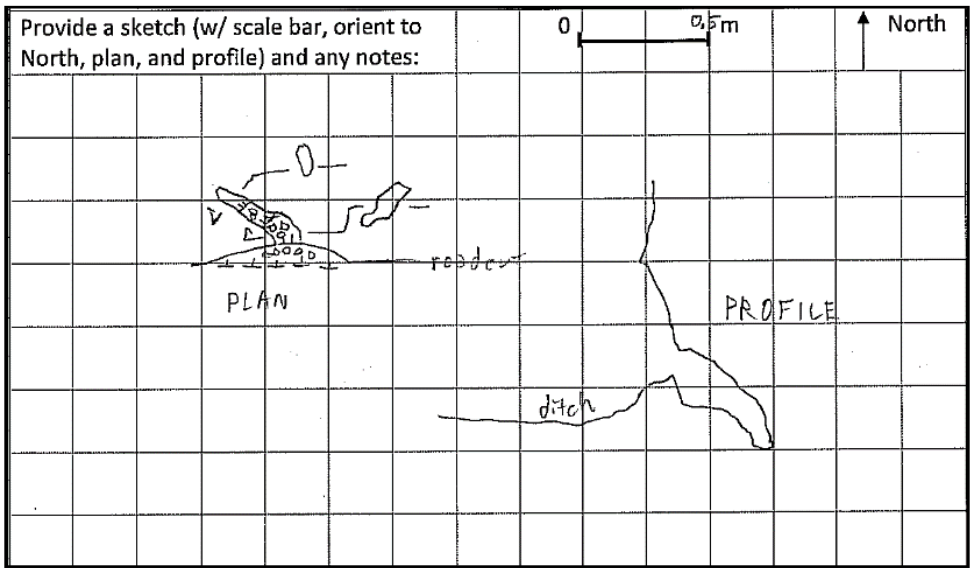

Figure 54. Field sketch of feature 1604-E05.

Figure 55. Overview of feature 1604-E05.

Figure 56. Interior of feature 1604-E05.

Feature 1604-E09 (Green Mountain Road Cave); Cave

This feature, located south of Loop 1604 and just west of Green Mountain Road, was documented on January 14, 2010 as Green Mountain Road Cave (Figure 57 - Figure 59). Green Mountain Road Cave was thought to be a partially explored historic cave with a currently known length of 22 m (72.2 ft) and depth of 15 m (49.2 ft). A collapse feature 40 m (131.2 ft) to the west may be associated with this cave. During the excavation of the cave in 2010, 102.5 person-hours were spent excavating 15.6 m^3 (550.9 ft^3) of material using hand tools, a jackhammer and a backhoe. The bottom of this feature had airflow coming from small spaces in the floor, indicating that continued excavation would likely lead into more passage. Excavation was terminated because collections of troglobites indicated that habitat had been reached. Fauna surveys were conducted in May and September 2010 (TxDOT 2015a).

Due to the possible presence of endangered species, a gate was installed at the cave on June 11, 2012 (Figure 60). Integrated into this gate was a concrete retaining structure designed to prevent loose material from collapsing into the cave. Fauna detected in 2010 included five troglobites, one of which is an eyeless *Cicurina* sp. spider. One author examined the spider tissue from this site, and due to an incongruence between nuclear and mitochondrial DNA concluded that the site needs more study before a species name could be assigned (Hedin et al. 2018). Another author examined only mitochondrial DNA and concluded the best match for that site is *Cicurina baronia* (in prep). Under advice from USFWS (Jenny Wilson, personal communication, 16 August 2019), in this document the species is treated as the endangered *Cicurina baronia* (Figure 61).

Presence/absence surveys conducted in July and August 2019 (Table 6) did not result in the collection of additional *Cicurina* specimens; however, they did result in the collection of a schizomid, an order of arachnids that is rare in Texas (Figure 62). Per Oscar Francke at Universidad Nacional Autónoma de México (UNAM), the collected specimen was missing the flagellum and does not have enough material for a description; however, it is likely an undescribed species in the genus *Agastochizomus*. This would make it the second troglobitic schizomid species in Texas. A summary of notable fauna is in Table 1. Four non-listed troglobites (*Brackenridgia* sp., *Chinquipellobunus* sp., protoschizomida, and *Texoreddellia* sp.), and a potential fifth troglobite, *Eidmannella* sp., were found during the 2019 surveys.

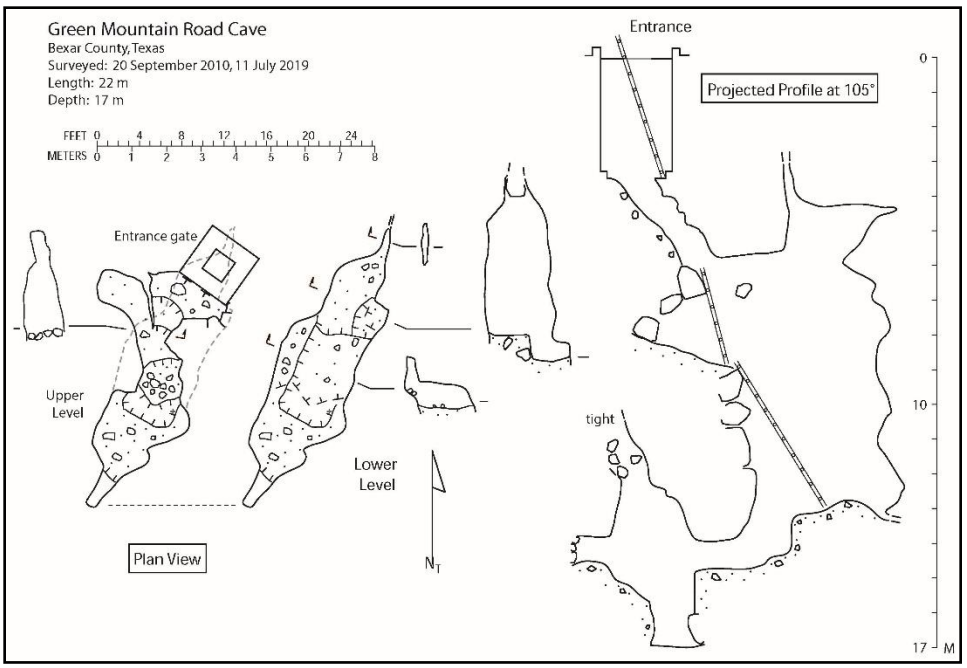

Figure 57. Map of feature 1604-E09 (Green Mountain Road Cave) after excavation. Note that the end of the cave was too narrow to continue.

Figure 58. Overview of feature 1604-E09 (Green Mountain Road Cave) prior to excavation.

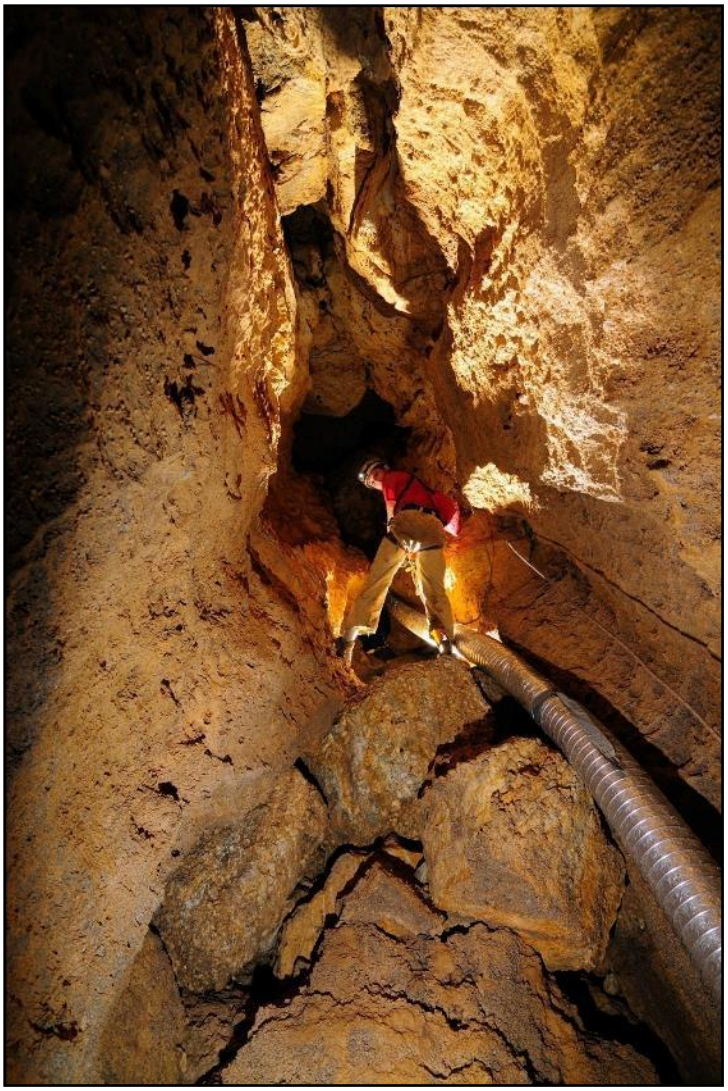

Figure 59. Karst technician descending a pit in feature 1604-E09 (Green Mountain Road Cave). Note ventilation hose on right side.

Figure 60. Gate installed on top of concrete retaining structure at feature 1604-E09 (Green Mountain Road Cave). A concrete slab was then placed on top of the structure to protect the gate.

Figure 61. Immature eyeless *Cicurina baronia* spider found in 2010 in feature 1604-E09 (Green Mountain Road Cave).

Figure 62. Protoschizomid collected on glue trap in feature 1604-E09 (Green Mountain Road Cave).

Table 6. Summary of survey activity for feature 1604-E09 (Green Mountain Road Cave).

Date	Time	Effort (minutes)	Comments
07/15/2019	12:30	210	Set traps and data logger
07/17/2019	12:55	120	Checked and reset traps
07/19/2019	12:30	225	Checked and reset traps
07/22/2019	12:25	140	Checked and reset traps
07/24/2019	22:15	120	Checked and reset traps
07/26/2019	13:05	120	Checked and reset traps
07/29/2019	21:50	124	Checked and reset traps
07/31/2019	21:45	124	Checked and reset traps
08/02/2019	10:30	195	Checked and reset traps
08/07/2019	13:10	160	Checked and reset traps
08/12/2019	14:10	130	Checked and reset traps
08/14/2019	13:38	134	Checked and reset traps
08/16/2019	12:00	140	Checked and reset traps
08/19/2019	13:33	120	Checked and reset traps
08/21/2019	12:45	126	Checked traps; removed traps and data logger

Table 7. Summary of fauna observed at feature 1604-E09 (Green Mountain Road Cave) in 2019.

Common Name	Lowest Taxonomic Identification
Slug	Gastropoda
Woodlice	*Brackenridgia* sp.
Mite	Acarina
Harvestman	*Chinquipellobunus* sp.
Spider	Araneae Araneae (reduced eyes, probably *Eidmannella* sp.)
Schizomid	Protoschizomidae
Millipede	*Cambala* sp.
Springtail	Collembola
Silverfish	*Texoreddellia* sp.
Cricket	Gryllidae *Ceuthophilus* sp. *Ceuthophilus cunicularis* *Ceuthophilus secretus*
Grasshopper	Orthoptera
Cockroach	Blattaria
Ant	Formicidae
Fly/Gnat	Diptera

Feature 1604-F061 (Scottish Beard Cave); Cave

Scottish Beard Cave was located south of the eastbound mainlanes of Loop 1604, east of Bitters Road (Figure 63 - Figure 66). A feature evaluation was performed on August 6, 2009 and June 20, 2019. This cave was 1.8 m (5.9 ft) wide at the entrance, was 5.5 m (18 ft) long, and 3.8 m (12.5 ft) deep. Previous records from TSS indicate this feature may also have the name "I Think It's a Cave". Excavation was conducted on October 6-8 and 14, 2009, utilizing 51.5 person hours of effort and removing approximately 5.1 m^3 (180.1 ft^3) of material. The sloping entrance crawlway was enlarged, giving access to a 2.6 m (8.5 ft) climb-down. This climb-down lands on a gravel and rubble floor that goes up and over a rise to the north for 2 m (6.6 ft), where small voids continue. Biological surveys were conducted in October and November 2009, when four non-listed troglobite species were found.

In July 2019, rocks which had been placed over the entrance were removed. Presence/absence surveys were conducted in June and July 2019 (Table 8); notable fauna is summarized in Table 1. Three non-listed troglobites (*Brackenridgia* sp., *Chinquipellobunus* sp., and *Texoreddellia* sp.) were found during the 2019 surveys.

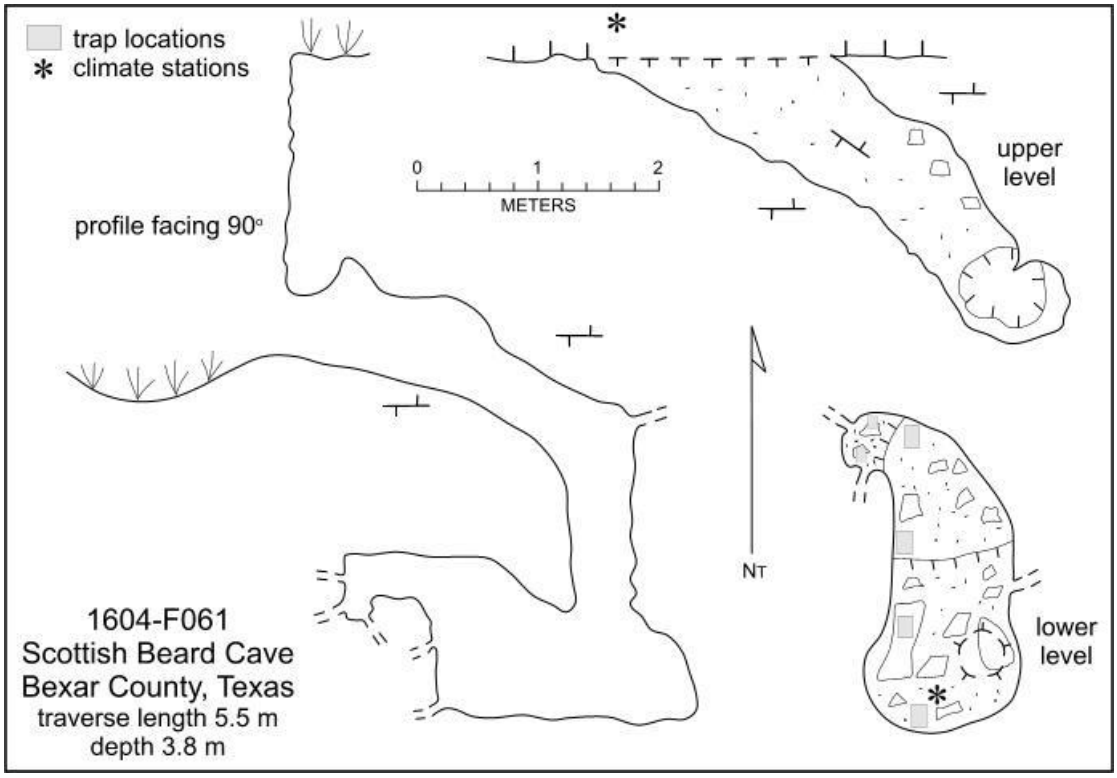

Figure 63. Map of feature 1604-F061 (Scottish Beard Cave).


Figure 64. Overview of feature 1604-F061 (Scottish Beard Cave) prior to re-opening.

Figure 65. Rocks removed to reveal entrance to feature 1604-F061 (Scottish Beard Cave).

Figure 66. Interior view of feature 1604-F061. Notice the climate data loggers located within the cave.

Table 8. Summary of 2019 survey activity at feature 1604-F061 (Scottish Beard Cave).

Date	Time	Effort (minutes)	Comments
06/27/2019	14:06	90	Feature evaluation; set traps and data logger
07/01/2019	11:45	44	Checked and reset traps
07/03/2019	13:40	44	Checked and reset traps
07/05/2019	10:50	50	Checked and reset traps
07/08/2019	12:55	60	Checked and reset traps
07/10/2019	12:00	60	Checked and reset traps
07/12/2019	10:05	30	Checked and reset traps
07/15/2019	11:15	50	Checked and reset traps
07/17/2019	12:05	90	Checked and reset traps
07/19/2019	11:30	105	Checked and reset traps
07/22/2019	11:45	40	Checked and reset traps
07/24/2019	21:25	60	Checked and reset traps
07/26/2019	12:13	34	Checked and reset traps
07/29/2019	21:05	60	Checked and reset traps
07/31/2019	21:01	64	Checked and removed traps and data logger

Table 9. Summary of fauna observed at feature 1604-F061 (Scottish Beard Cave) in 2019.

Common Name	Lowest Taxonomic Identification
Woodlice	*Brackenridgia* sp.
Harvestman	*Chinquipellobunus* sp.
Millipede	*Cambala* sp.
Silverfish	*Texoreddellia* sp.
Cricket	Gryllidae
Earwig	Dermaptera
Ant	Formicidae
Moth	Lepidoptera
Fly/Gnat	Diptera
Mosquito	Culicidae
Cliff chirping frog	*Eleutherodactylus marnockii*
Gulf Coast toad	*Incilius nebulifer*
Mouse	*Mus* sp.

Feature 1604-F063; Solution Cavity

This feature was in the roadcut north of the westbound mainlanes of Loop 1604 west of Huebner Road. This was a solution cavity located at the bottom of the roadcut that was 1 m (3.3 ft) wide by 2.5 m (8.2 ft) long by 1 m (3.3 ft) high (Figure 67 - Figure 69). The feature contained gray soil. The void extends into the roadcut at a 315-degree trend, ending with no mesocavernous voids extending off (Figure 69). This feature was evaluated on August 6, 2009, February 2, 2010, and August 9, 2019. While the feature meets the length criteria for habitat, the presence of calcite coating nearly all the surfaces, the lack of connectivity to other voids, and the large entrance diameter combine to make this feature unsuitable. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

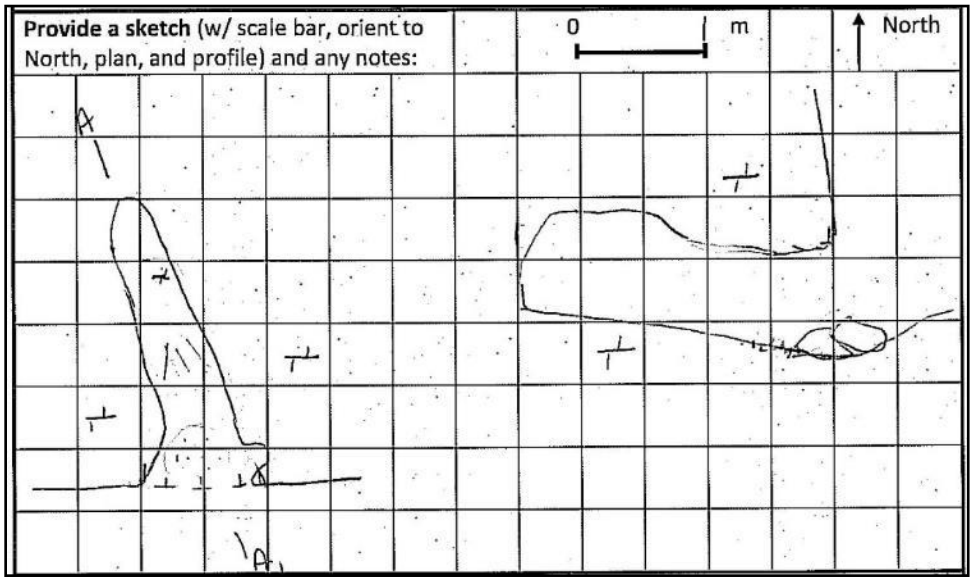

Figure 67. Field sketch of feature 1604-F063.

Figure 68. Overview of feature 1604-F063.

Figure 69. Interior of feature 1604-F063, showing no mesocavernous voids extending from the end.

Feature 1604-F064; Enlarged Fracture

This feature was in the roadcut north of the westbound mainlanes of Loop 1604 west of Huebner Road. It was evaluated on August 6, 2009, November 29, 2017, and September 25, 2019. This solution cavity was 3 m (9.8 ft) wide by 1.5 m (5 ft) long by 1.25 m (4.1 ft) tall (Figure 70 - Figure 71). It was filled loose rocks and red clay soil. Although it was slightly over 1 m (3.3 ft) in length, the large diameter of its opening and lack of mesocavernous voids make it unsuitable. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

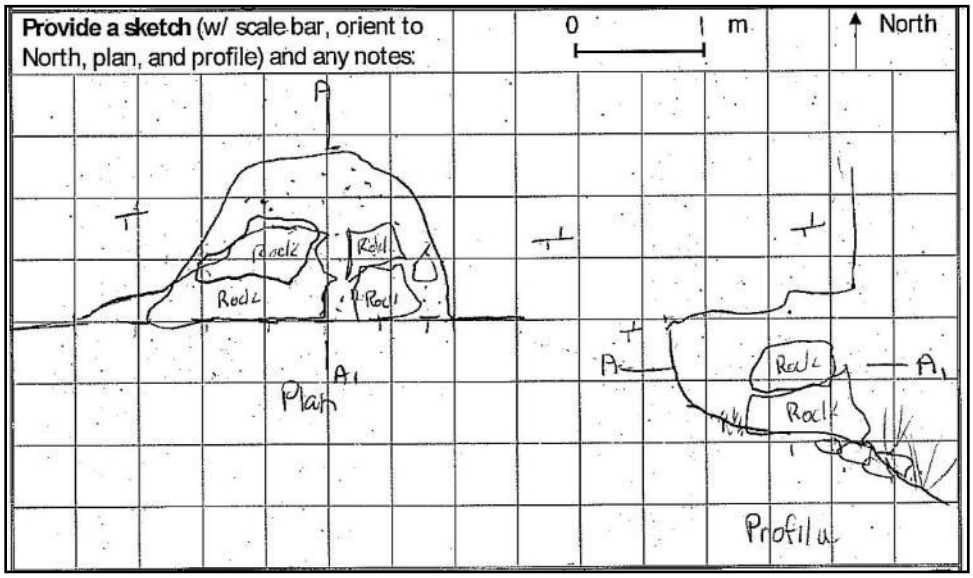

Figure 70. Field sketch of feature 1604-F064.

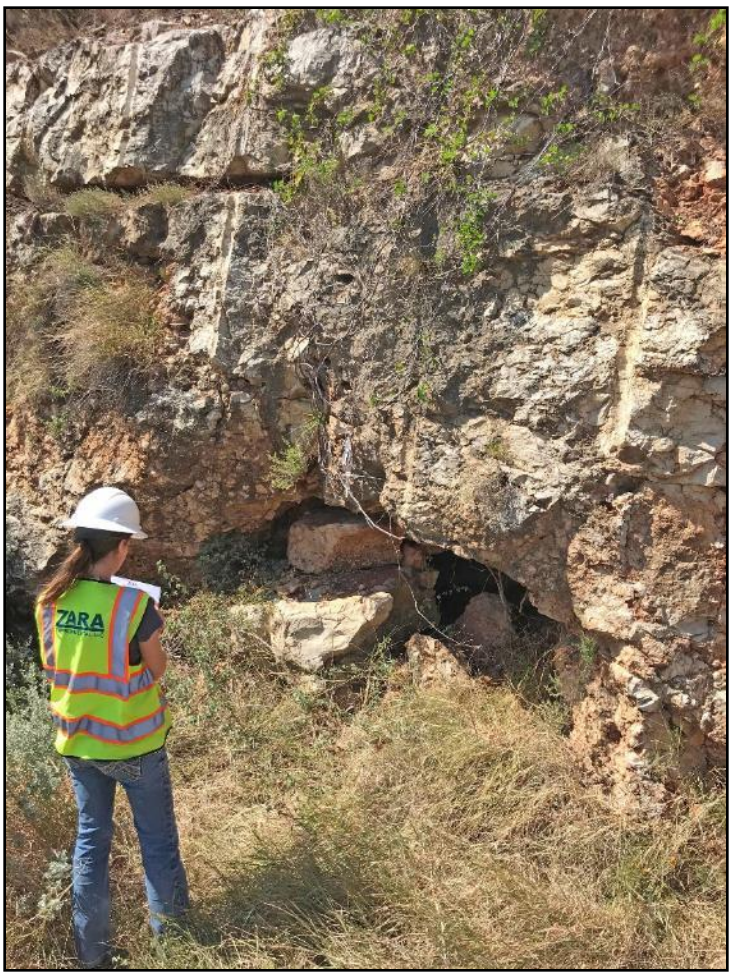

Figure 71. Overview of feature 1604-F064.

Figure 72. Interior of feature 1604-F064.

Feature 1604-F066; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Huebner Road (Figure 73 - Figure 74). It was evaluated on August 6, 2009, November 29, 2017, and August 14, 2019. This solution-enlarged bedding plane measured 1.5 m (5 ft) wide by 0.5 m (1.6 ft) long by 0.2 m (0.6 ft) high. It narrows as it extends into the roadcut and had no mesocavernous voids extending from the footprint. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

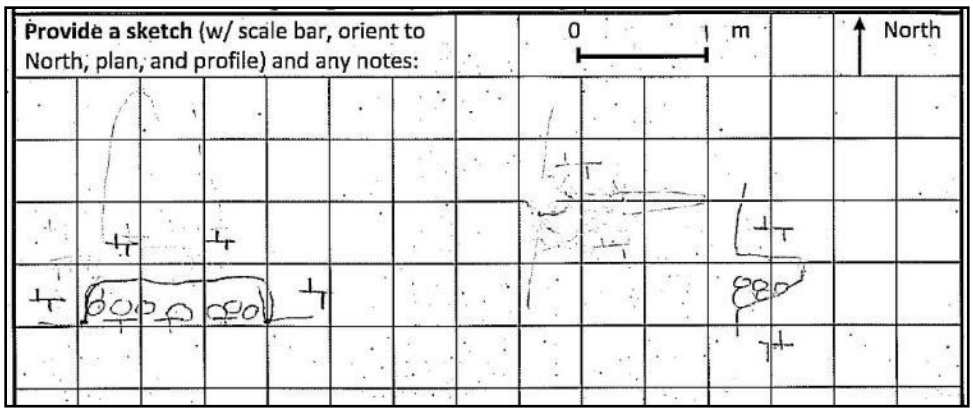

Figure 73. Field sketch of feature 1604-F066.


Figure 74. Overview of feature 1604-F066.

Feature 1604-F069; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 west of Huebner Road (Figure 75 - Figure 77). It was evaluated on August 6, 2009, February 2, 2010, and August 9, 2019. This solution-enlarged bedding plane measured 3.5 m (11.4 ft) wide by 2.5 m (8.2 ft) long by 0.75 m (2.5 ft) high. This feature was infilled with loose rocks. It narrows as it extends into the roadcut and continues as a very low bedding plane. While the feature meets the length criteria for habitat, the large entrance diameter makes this feature overly exposed to the surface to provide habitat for cave species. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

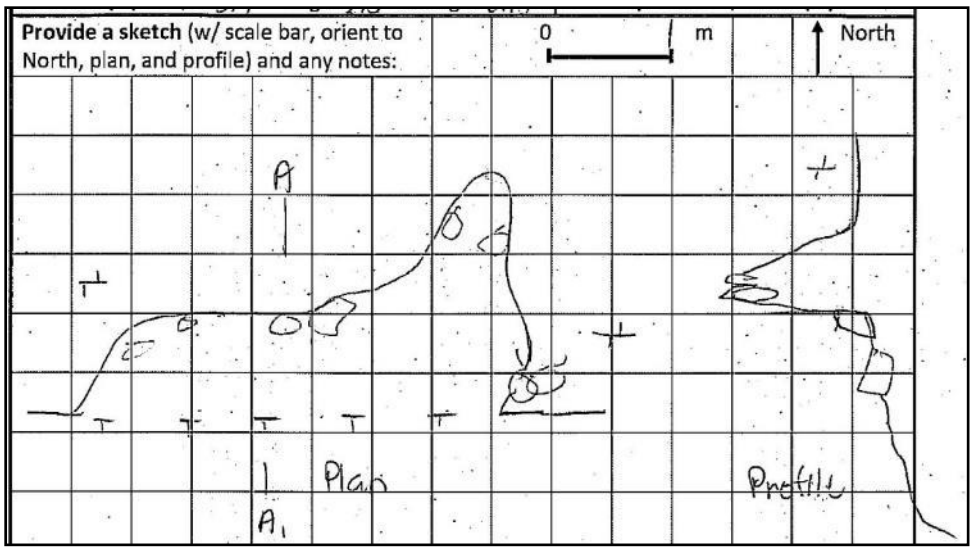

Figure 75. Field sketch of feature 1604-F069.


Figure 76. Overview of feature 1604-F069.

Figure 77. Interior of feature 1604-F069.

Feature 1604-F070; Zone with Solution Cavity and Solution-enlarged Fractures

This zone of features was located in the roadcut south of the eastbound mainlanes of Loop 1604 and east of Huebner Road (Figure 78 - Figure 81). Field evaluations were performed on August 2, 2009 and November 30, 2017, and field datasheets were re-evaluated in 2019 to verify the potential for karst invertebrate habitat. The feature had a solution-enlarged fracture located at the base of the roadcut that was 0.5 m (1.6 ft) wide by 1.0 m (3.3 ft) high and 0.7 m (2.3 ft) long. In addition to the solution-enlarged fracture, a solution-enlarged bedding plane and bisected solution cavity are also present immediately above the solution-enlarged fracture. The zone containing all three features measured 15.2 m (50 ft) wide by 0.8 m (2.5 ft) long by 4.3 m (14 ft) high. These features are infilled with loose soils, rocks, bedrock, and vegetation. Flowstone was present in the solution-enlarged fracture. There was no airflow, no mesocavernous voids, and the feature was not humanly enterable. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

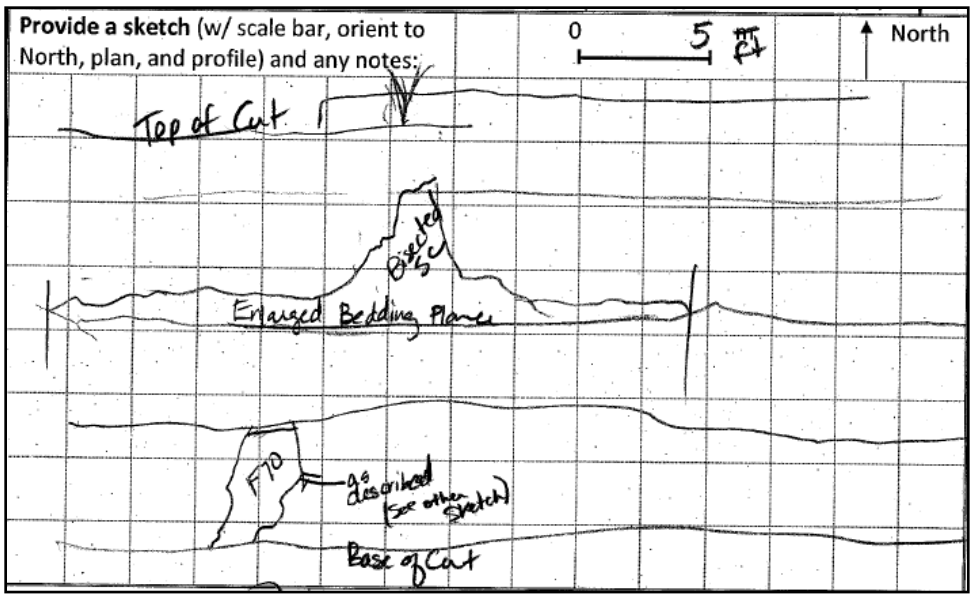

Figure 78. 2017 field sketch of feature 1604-F070.


Figure 79. Overview of solution-enlarged bedding plane and bisected solution cavity at feature 1604-F070.

Figure 80. Solution cavity at feature 1604-F070.

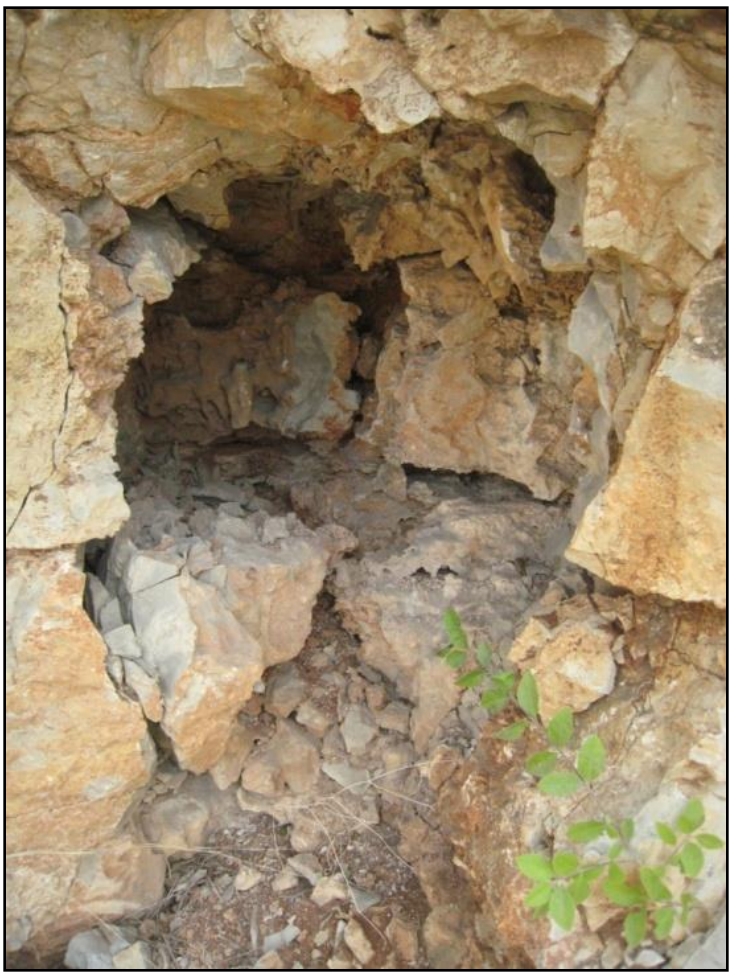

Figure 81. Interior of solution cavity at feature 1604-F70.

Feature 1604-F071; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 east of Huebner Road situated at the base of a roadcut (Figure 82 - Figure 84). It was evaluated on August 2, 2009 and August 14, 2019. This solution-enlarged bedding plane was 2.5 m (8.2 ft) wide by 1.0 m (3.3 ft) long by 0.3 m (1.0 ft) high. This feature contained loose, modern soils likely introduced by landscaping activities, coarse cobbles, flowstone, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

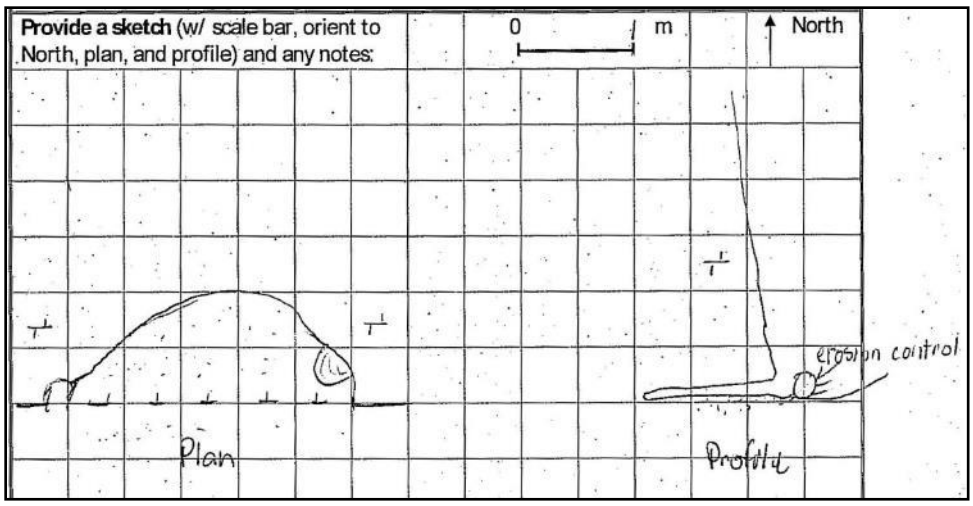

Figure 82. Field sketch of feature 1604-F071.


Figure 83. Overview of feature 1604-F071.

Figure 84. Interior of feature 1604-F071.

Feature 1604-F072 (Air Filter Cave); Cave

Air Filter Cave was located in the roadcut south of the eastbound mainlanes of Loop 1604 east of Huebner Road (Figure 85 - Figure 87). This cave had previously been referred to as 1604 Cave, F15H, and 1604-F26. It was evaluated on August 2, 2009 and on March 22, 2019. Air Filter Cave had an entrance that was 12 m (39 ft) wide, extends 10 m (33 ft) into the roadcut, and had maximum height of 2 m (6.6 ft) at its entrance. The cave was developed on a low bedding plane passage that was barely enterable prior to excavation (Figure 87). The floor was partially covered with flowstone and there are numerous stalactites. Excavation was conducted in September and October 2009, utilizing 29 person hours of effort and removing 1.4 m^3 (15 ft^3) of material. Excavation primarily involved chiseling flowstone from the floor to allow access to the back of the cave. The back of the cave drops down slightly but there are no voids extending from it. Presence/absence surveys were conducted in October 2009, during which no karst invertebrate species were found. The cave was re-evaluated on March 22, 2019 as part of a study for planned improvements at Blanco Road (TxDOT 2019a). Although this site meets two of the size criteria for potential habitat (extends greater than 1 m [3.3 ft] and was humanly enterable) (Table 2), it had been subject to desiccation and daylight since the original construction of Loop 1604 in the 1980's due to the great width of the entrance. Consequently, it was not considered habitat for karst invertebrates and was not surveyed in 2019 (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

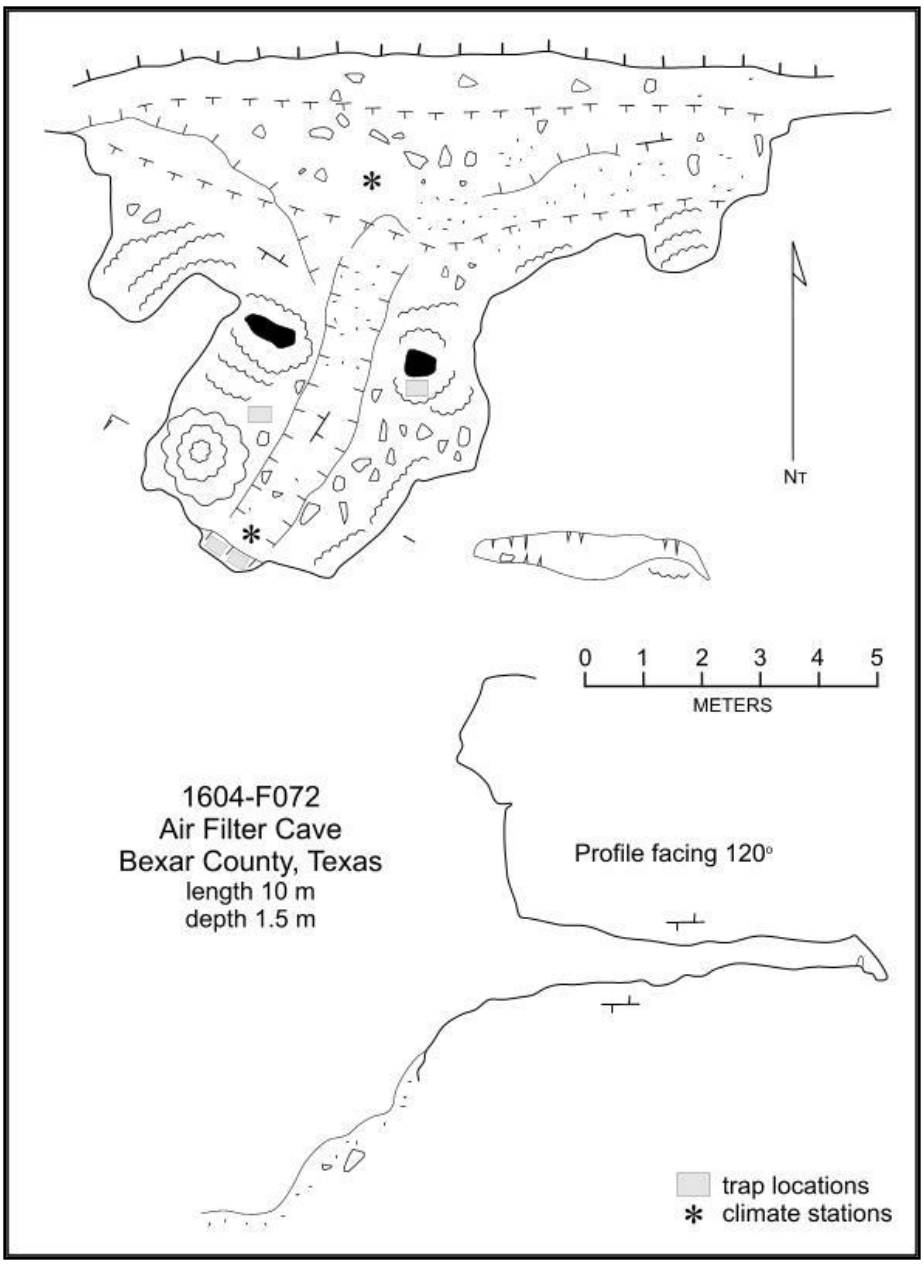

Figure 85. Map of feature 1604-F072 (Air Filter Cave).

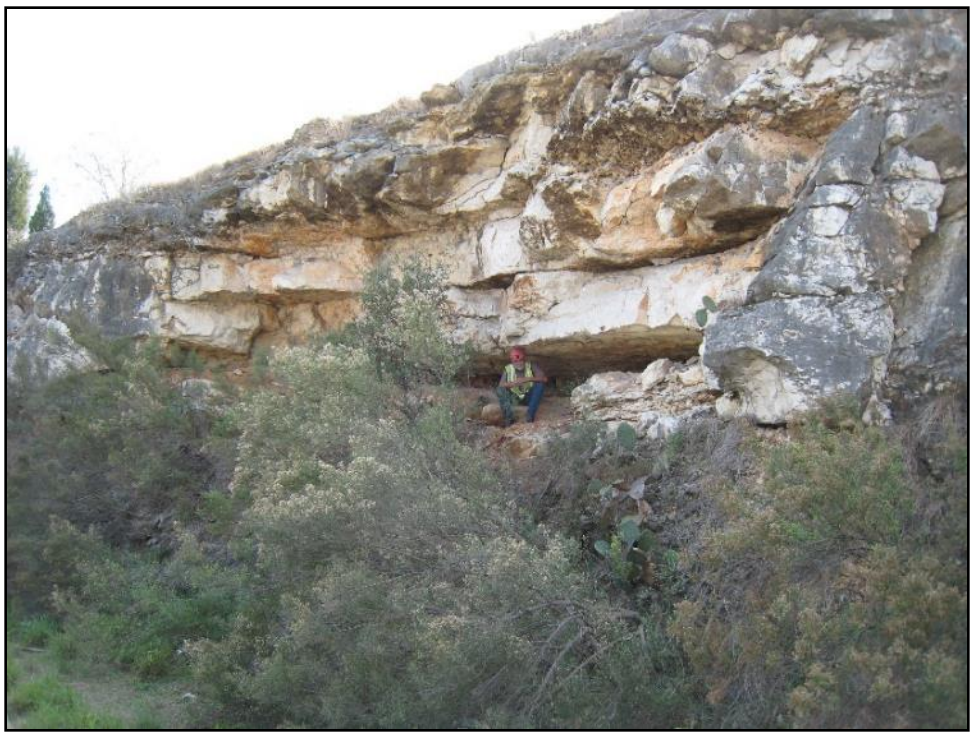

Figure 86. Overview of feature 1604-F072 (Air Filter Cave).

Figure 87. Interior of feature 1604-F072 (Air Filter Cave).

Feature 1604-F073 (Leopard Cave); Cave

This cave was located at the base of the roadcut south of the eastbound mainlanes of Loop 1604, east of Huebner Road (Figure 88 - Figure 90). It was evaluated on August 2, 2009 and on March 22, 2019 (TxDOT 2015a, 2019a). It was formed on a solution-enlarged bedding plane at the base of the roadcut, and appears to be developed along a fracture trending 90 degrees with a dip of 35 degrees south. Infill consists of course rocks, calcite, and bedrock. The feature was 2.4 m wide (7.9 ft) wide at the entrance by 3.5 m (11.5 ft) long by 1.5 m (5 ft) high at the entrance. Excavation to remove a large block at the entrance occurred in October 2009, utilizing 39.5 person hours of labor, resulting in the removal of 3 m^2 (33 ft^3) of material from the feature. This feature was infilled with speleothems, bedrock, and loose rocks, and it had mesocavernous voids extending off the back of it (Figure 90). This feature meets many of the criteria for potential habitat, including void size greater than or equal to 1 m, similarity to nearby caves and being humanly enterable (Table 2), and qualifies as potential karst invertebrate habitat. Presence/absence surveys conducted in October and November 2009 detected cave crickets, including the more rarely seen *Ceuthophilus cunicularis*, but no troglobites. Presence/absence surveys were conducted in March and April 2019 (Table 10) (TxDOT 2019a); notable fauna is summarized in Table 1. A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

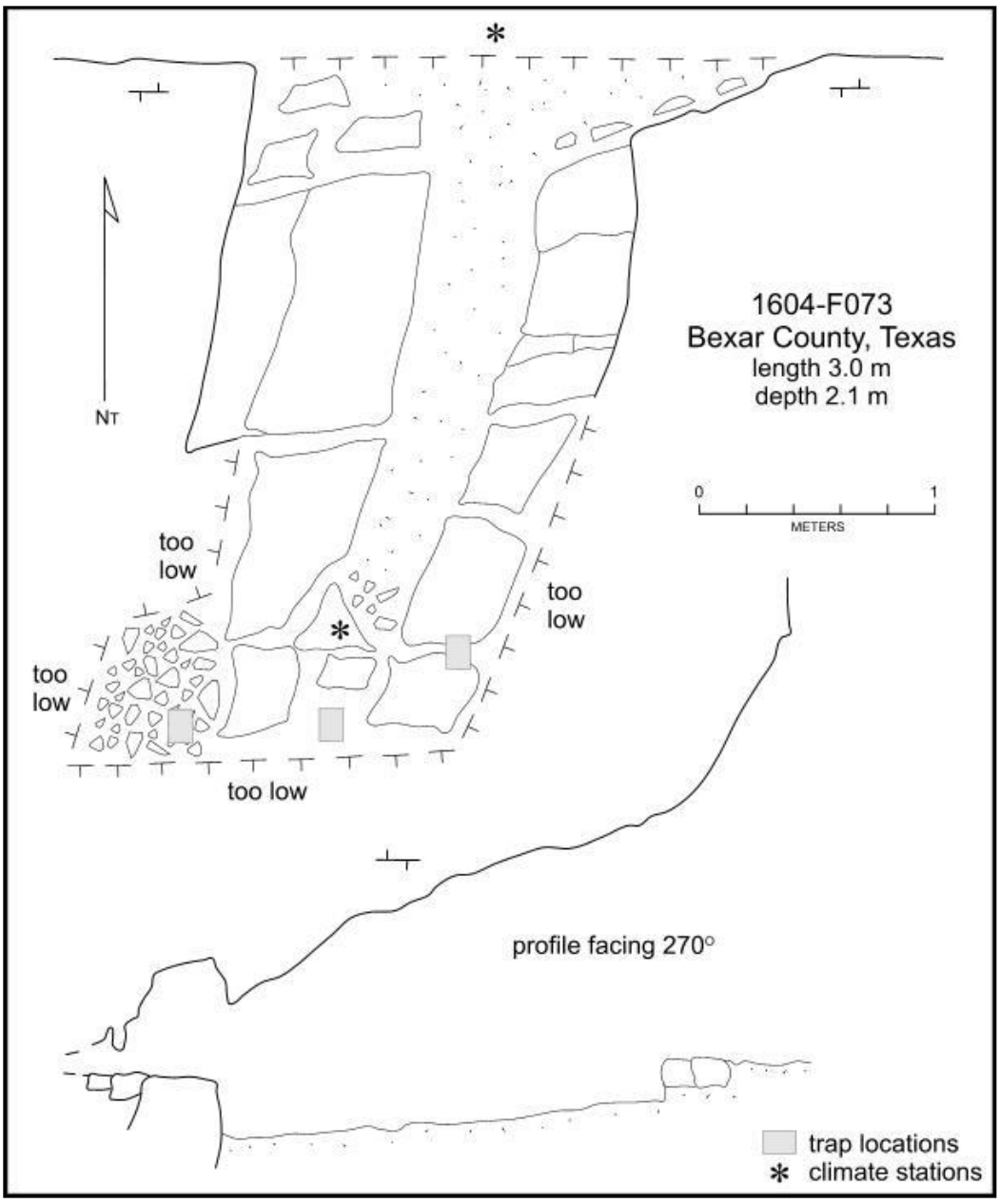

Figure 88. Map of feature 1604-F073 (Leopard Cave).

Figure 89. Overview of feature 1604-F073 (Leopard Cave).

Figure 90. Interior of feature 1604-F073 (Leopard Cave).

Table 10. Summary of fauna observations at feature 1604-F073.

Common Name	Lowest Taxonomic Identification
Snail (epigean)	Gastropoda
Woodlice	*Porcellio* sp.
Flea	Siphonaptera
Cricket	Gryllidae *Ceuthophilus* sp. *Ceuthophilus cunicularis*
Fly/Gnat	Diptera
Moth	Lepidoptera

Feature 1604-F074; Solution Cavity

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, east of Huebner Road (Figure 91 - Figure 93). It was evaluated on August 2, 2009, November 30, 2017 (TxDOT 2015a, TxDOT 2018a), and August 12, 2019. This solution cavity measured 0.8 m (2.6 ft) wide by 2.5 m (8.2 ft) long and was 0.8 m (2.6 ft) high. It contained dry flowstone and exposed bedrock and was infilled with loose rocks (Figure 93). About 1.5 m (5 ft) into the feature, it splits into two mesocavernous voids. Due to its length, presence of mesocavernous voids, and similarity to nearby caves, it was considered potential karst invertebrate habitat (Table 2). Presence/absence surveys were conducted in August and September 2019 (Table 11); however, no troglobites were found (Table 1). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

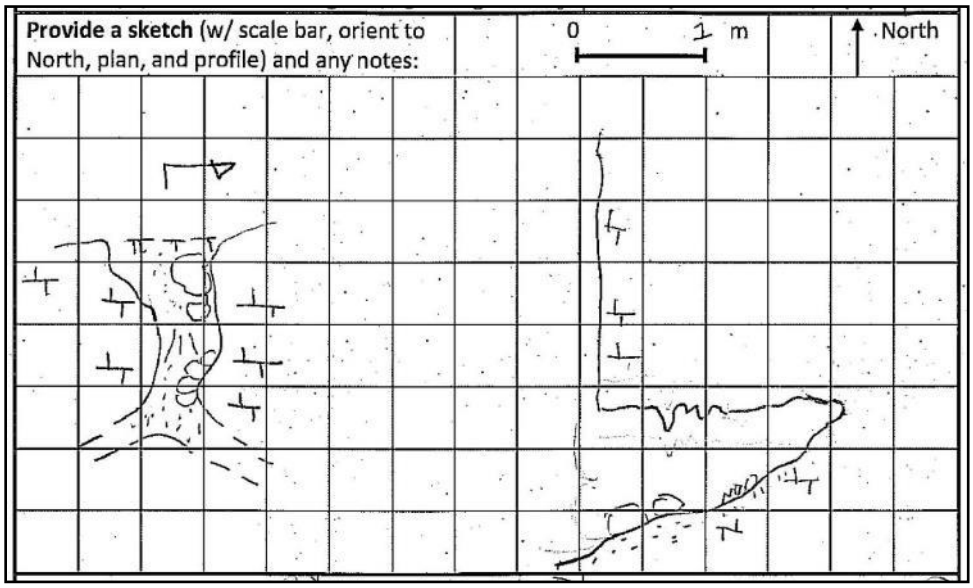

Figure 91. Field sketch of feature 1604-F074.

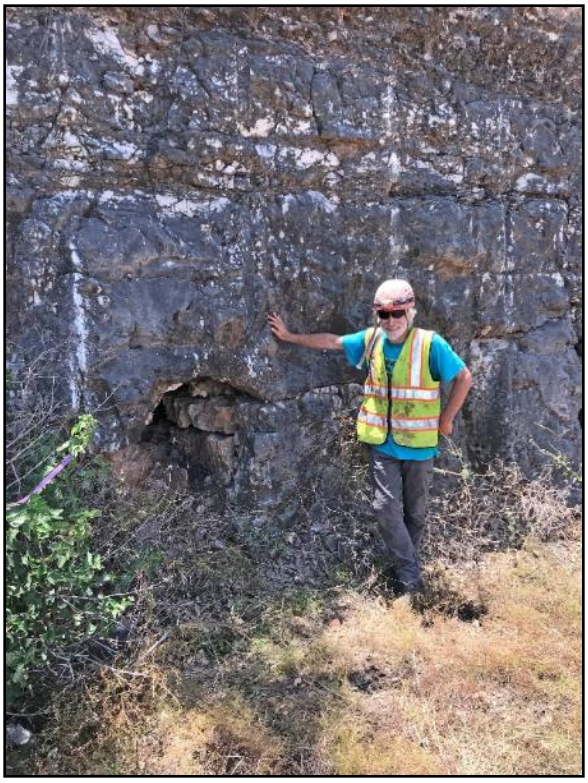

Figure 92. Overview of feature 1604-F074.

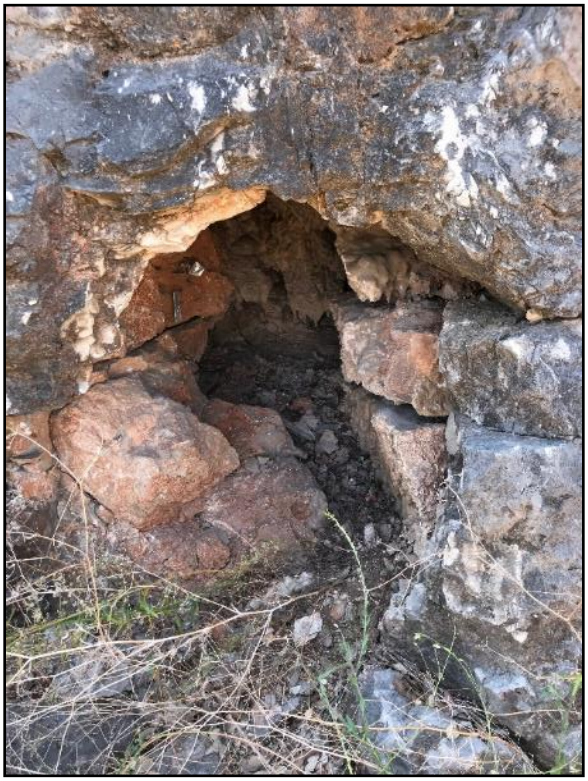

Figure 93. Interior of feature 1604-F074.

Table 11. Summary of survey activity at feature 1604-F074.

Date	Time	Effort (minutes)	Comments
08/26/2019	12:34	14	Set traps and data logger
08/28/2019	13:52	14	Checked and reset traps
08/30/2019	12:02	10	Checked and reset traps
09/01/2019	10:49	6	Checked and reset traps
09/03/2019	12:17	12	Checked and reset traps
09/05/2019	12:15	21	Checked and reset traps
09/07/2019	10:18	6	Checked and reset traps
09/09/2019	18:14	4	Checked and reset traps
09/11/2019	18:43	4	Checked and reset traps
09/13/2019	10:57	4	Checked and reset traps
09/15/2019	09:43	12	Checked and reset traps
09/17/2019	15:10	4	Checked and reset traps
09/19/2019	16:17	4	Checked and reset traps
09/21/2019	10:21	4	Checked and reset traps
09/23/2019	10:26	12	Checked traps; removed traps and data logger

Table 12. Summary of fauna observations at feature 1604-F074.

Common Name	Lowest Taxonomic Identification
Woodlice	*Porcellio* sp.
Springtail	Collembola
Cricket	Gryllidae
Earwig	Dermaptera
Cockroach	Blattaria
Wasp	Hymenoptera
Ant	Formicidae
Moth	Lepidoptera
Fly / Gnat	Diptera
Mediterranean Gecko	*Hemidactylus turcicus*

Feature 1604-F076; Solution-enlarged Fracture

This feature was located at the base of a roadcut north of the westbound mainlanes of Loop 1604, west of Blanco Road (Figure 94 - Figure 96). It was evaluated on August 2, 2009 and July 3, 2019. The feature was a solution-enlarged fracture that measured 0.2 m (0.7 ft) wide, 0.5 m (1.6 ft) long, by 0.15 m (0.5 ft) high. This feature contained bedrock and was infilled with loose rocks, organic soil, and leaf litter. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

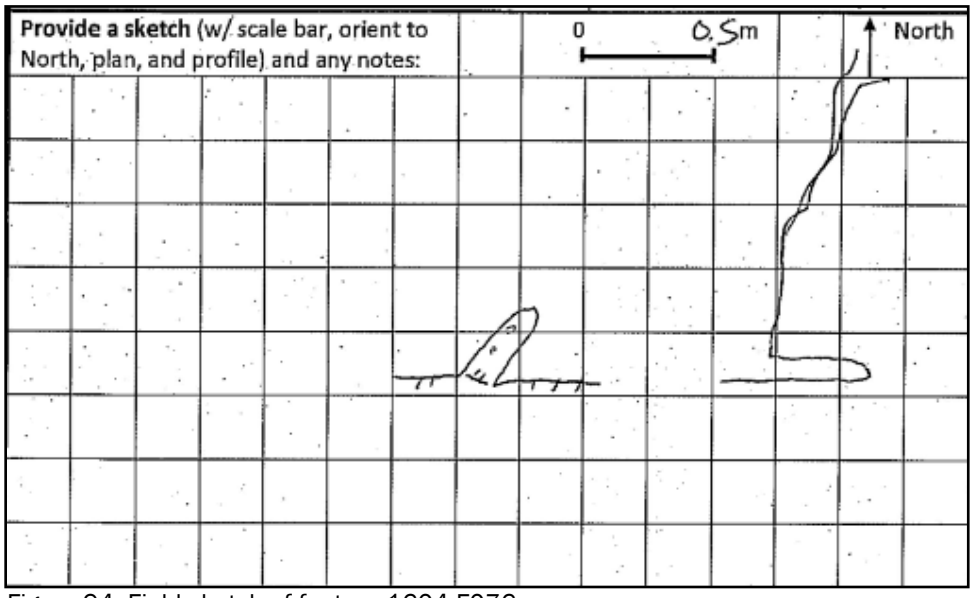

Figure 94. Field sketch of feature 1604-F076.

Figure 95. Entrance of feature 1604-F076.

Figure 96. Interior of feature 1604-F076.

Feature 1604-F077 (Hubcap Cave); Cave

Hubcap Cave was located at grade in the roadcut of the westbound mainlanes of Loop 1604 between Blanco Road and Huebner Road (Figure 97). When evaluated on August 2, 2009, it was apparent that excavation had taken place previously at the site. These excavation efforts ceased with narrow extensions continuing beyond line of sight. Further excavation took place on October 7 and 12, 2009, utilizing 30 person hours of effort. Three m^3 (105.9 ft^3) of material were removed from the cave. The entrance opened into a sloping room 3 m (9.8 ft) wide and 3.5 m (11.5 ft) long. Beyond this was a constricted drain that dropped another 2 m (6.6 ft) to two small drain holes. Biological surveys were conducted on October 15 and 22, 2009, and November 3, 2009. A single troglobite was found (*Brackenridgia cavernarum)*; therefore, this feature was karst invertebrate habitat. No listed species were found during the 2009 surveys (TxDOT 2015a).

Feature 1604-F077 was re-evaluated on March 22, 2019 (Figure 98 - Figure 100) (TxDOT 2019a). It was 1.9 m (6.2 ft) wide at the entrance, was 5 m (16.4 ft) long, and 4 m (13 ft) deep. It contained leaf-litter, soil and rocks. Hand excavation was performed to remove rocks previously placed in the entrance; approximately 1.5 m^3 (16 ft^3) of rocks and boulders were removed. This cave met many of the criteria for potential habitat, including the presence of leaf-litter and modern soils, void size greater than or equal to 1 m, similarity to nearby caves, and being humanly enterable (Table 2). Speleothems and moisture were present within this feature. Debris found in the rear of the cave indicates that water was entering the feature from the bar ditch (Figure 100). Presence/absence surveys were conducted in March and April 2019 (Table 13)(TxDOT 2019a); notable fauna is summarized in Table 1. Troglobitic organisms encountered during the 2019 survey included woodlice (*Brackenridgia* sp.). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

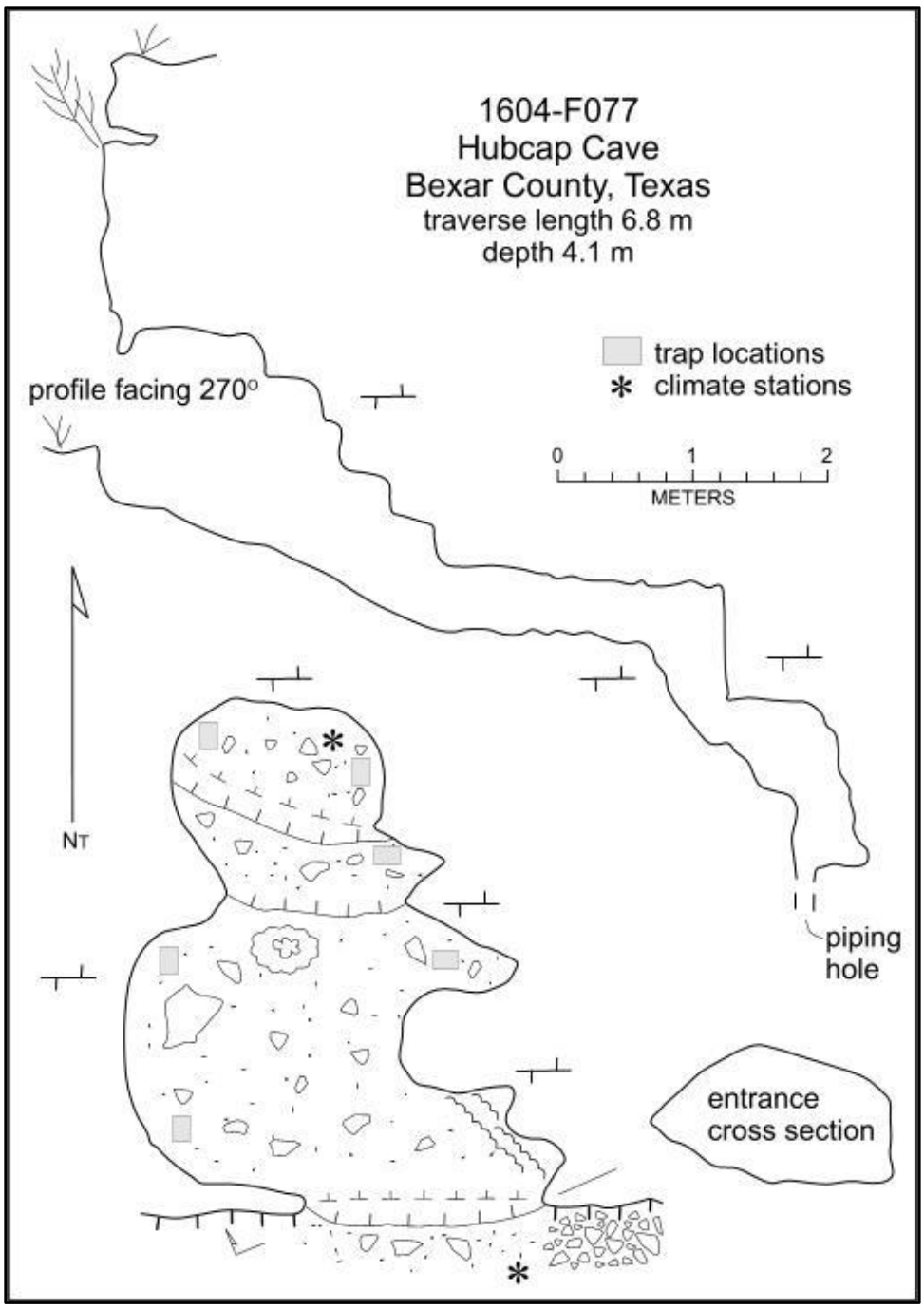

Figure 97. Map of feature 1604-F077 (Hubcap Cave).

Figure 98. Overview of feature 1604-F077 (Hubcap Cave) prior to hand excavation.

Figure 99. Interior of feature 1604-F077 (Hubcap Cave) looking toward the entrance.

Figure 100. The rear floor of feature 1604-F077 (Hubcap Cave) showing debris.

Table 13. Summary of fauna observations at feature 1604-F077 (Hubcap Cave) in 2019.

Common Name	Lowest Taxonomic Identification
Woodlice	*Porcellio* sp. *Brackenridgia* sp.
Spider (epigean)	Araneae
Cellar spider	Pholcidae
Flea	Siphonaptera
Springtail	Collembola
Booklice	Psocoptera
Cricket	Gryllidae
Cockroach	Blattaria
Moth	Lepidoptera
Fly Gnat	Diptera
Mouse	*Mus* sp.

Feature 1604-F078; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Blanco Road (Figure 101 - Figure 104). It was evaluated on August 2, 2009 and July 3, 2019. This feature was formed at the base of the road cut, and slopes downward to a rubble fill. It was a solution cavity that measured 1.2 m (3.9 ft) wide by 0.7 m (2.4 ft) long and 1.5 m (4.9 ft) deep. Excavation was conducted on October 2 and 5, 2009, expending 14 person hours of effort and removing 3 m^3 (105.9 ft^3) of material. This excavation effort enlarged the feature length to 1.5 m (4.9 ft) and vertical extent to 2.2 m (7.2 ft). At the point where excavation stopped, there were no open voids continuing into bedrock, only some small tubes and vugs plugged with red clay. This site was not considered karst invertebrate habitat at that time. When re-assessed in 2019, it had been filled in with rocks. No airflow was noted coming from the rock fill. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

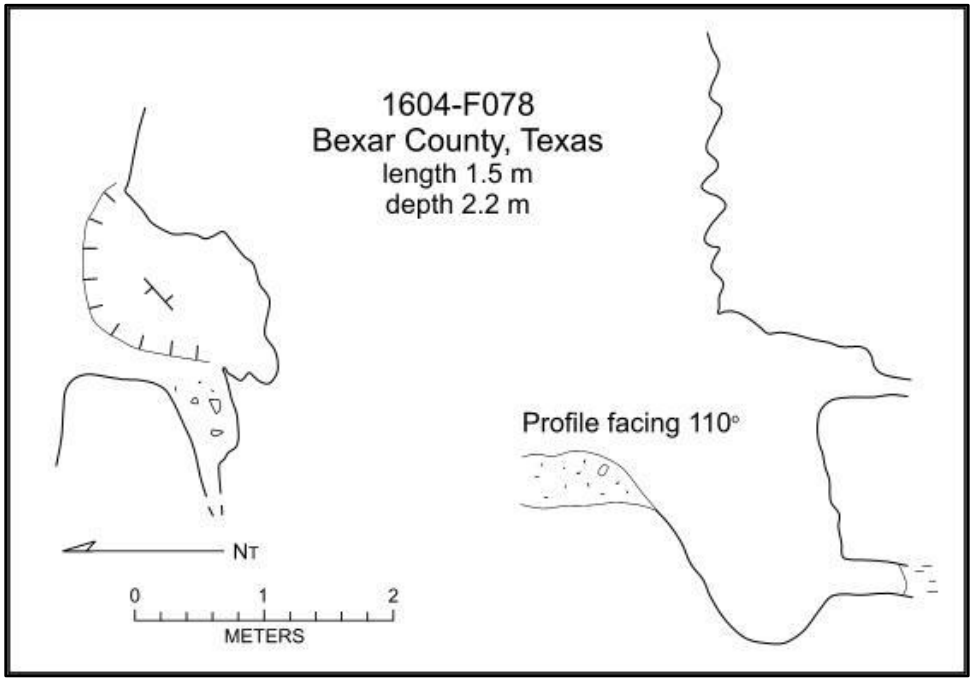

Figure 101. Map of feature 1604-F078, after excavation in 2009.

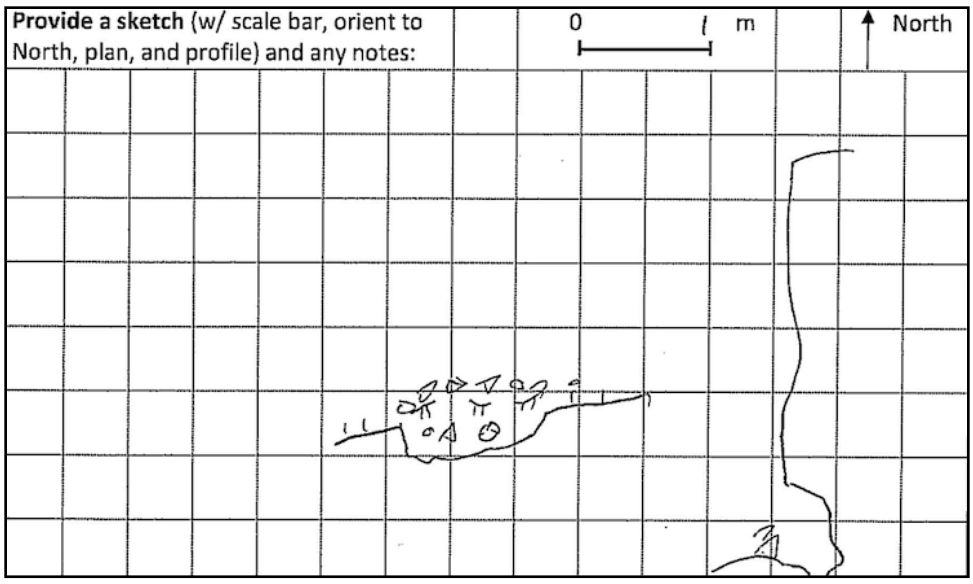

Figure 102. Field sketch of feature 1604-F078 in 2019, after back-filling with rocks.


Figure 103. Entrance of feature 1604-F078, showing rocks placed in it.

Figure 104. Interior of feature 1604-F078.

Feature 1604-F079; Solution-enlarged bedding plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Blanco Road (Figure 105 - Figure 107). It was evaluated on August 2, 2009 and July 3, 2019. The feature was a solution-enlarged bedding plane that measured 1.2 m (3.9 ft) wide by 0.7 m (2.4 ft) long and 1.5 m (4.9 ft) deep, situated about 0.8 m (2.6 ft) above the bottom of the road cut. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

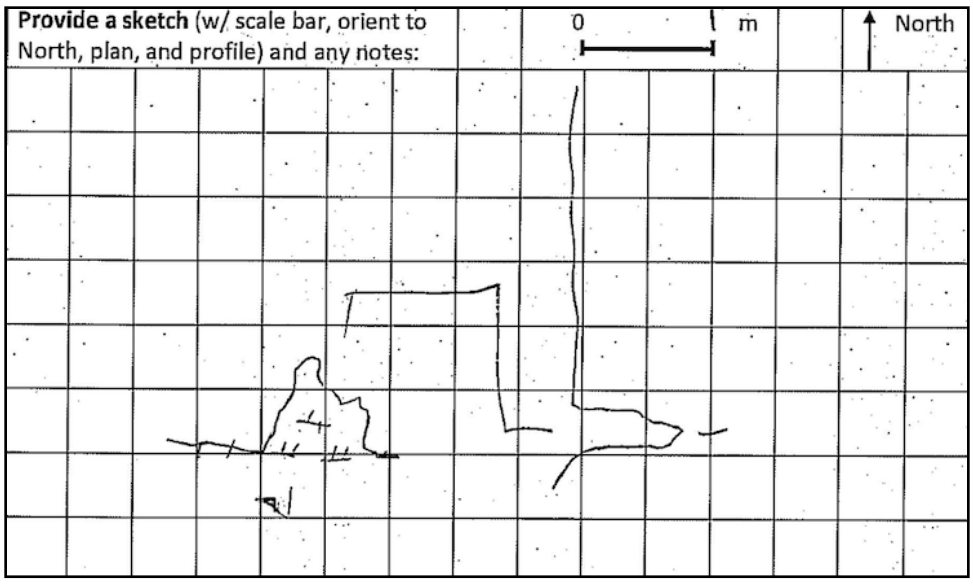

Figure 105. Field sketch of feature 1604-F079.


Figure 106. Entrance of feature 1604-F079.

Figure 107. Interior of feature 1604-F079.

Feature 1604-F083; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Blanco Road (Figure 108 - Figure 110). It was evaluated on August 2, 2009 and July 3, 2019. The feature was a solution cavity that measured 0.5 m (1.6 ft) wide by 0.5 m (1.6 ft) long and 0.7 m (2.3 ft) high. This feature was filled with loose rocks. This feature was not humanly enterable, had no noticeable airflow and no mesocavernous voids. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

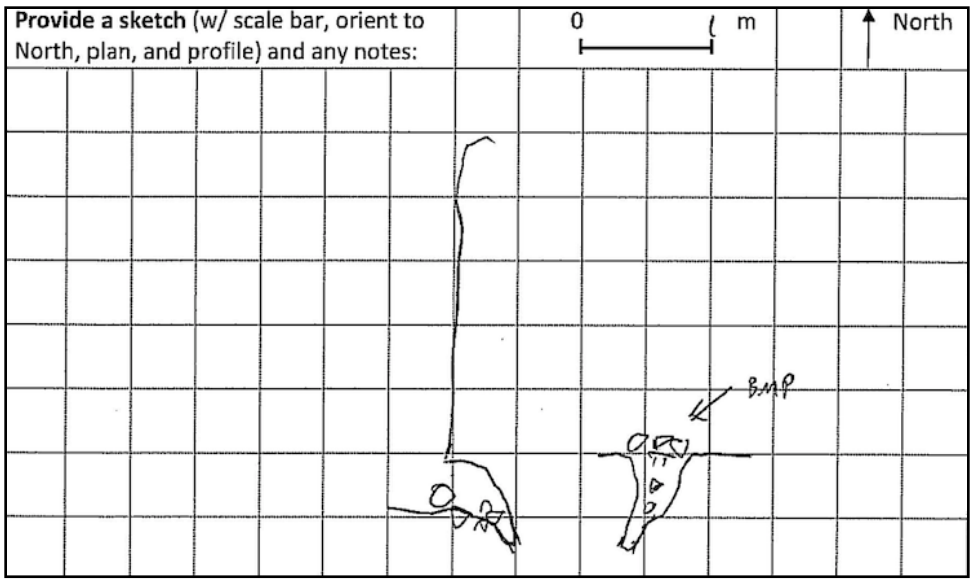

Figure 108. Field sketch of feature 1604-F083.


Figure 109. Entrance of feature 1604-F083.

Figure 110. Interior of feature 1604-F083.

Feature 1604-F084; Enlarged Bedding Plane

This feature was located approximately 1 m (3.3 ft) above grade in the mainlane roadcut of eastbound Loop 1604, just west of Blanco Road (Figure 111 - Figure 113). It was evaluated on August 2, 2009 and March 22, 2019 (TxDOT 2015a, TxDOT 2019a). It was an enlarged bedding plane that was 1.5 m (4.9 ft) wide, 3.0 m (9.8 ft) long, and 0.3 m (1 ft) high. It contained bedrock, rocks and soil. It was determined that this feature met criteria for potential habitat, including void size greater than 1 m (3.3 ft), mesocavernous voids, and similarity to nearby caves (Table 2). Presence/absence surveys were conducted in March and April 2019 (Table 14); however, no troglobites were found (Table 1)(TxDOT 2019a. A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

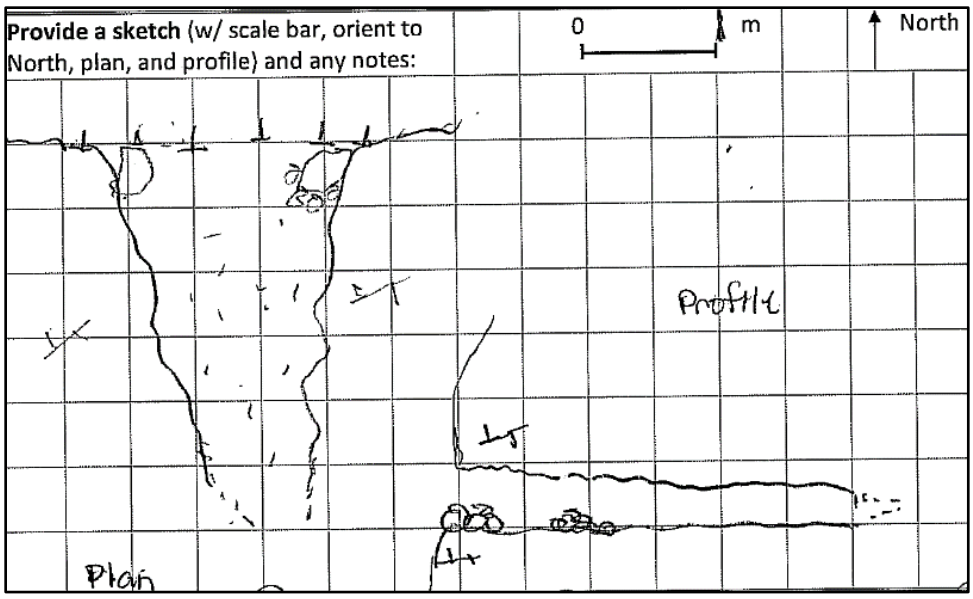

Figure 111. Field sketch of feature 1604-F084.


Figure 112. Overview of feature 1604-F084.

Figure 113. Interior of feature 1604-F084.

Table 14. Summary of fauna observations at feature 1604-F084.

Common Name	Lowest Taxonomic Identification
Cockroach	Blattaria
Beetle	Coleoptera (epigean)
Fly Gnat	Diptera
Rat snake	*Pantherophis* sp.
Frog	Anura
Mouse	*Mus* sp.

Feature 1604-F085; Solution-enlarged Bedding Plane

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Blanco Road (Figure 114 - Figure 116). It was evaluated on August 2, 2009 and July 3, 2019. The feature was a solution-enlarged bedding plane that measured 0.7 m (2.3 ft) wide by 1.1 m (3.6 ft) long and 1.2 m (3.9 ft) high. It was not humanly enterable and there was no airflow. This feature contained bedrock, organic soil, and loose rocks. While the feature meets the length criteria for potential habitat, the large height of the entrance cavity makes the interior unsuitable due to surface climate effects. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

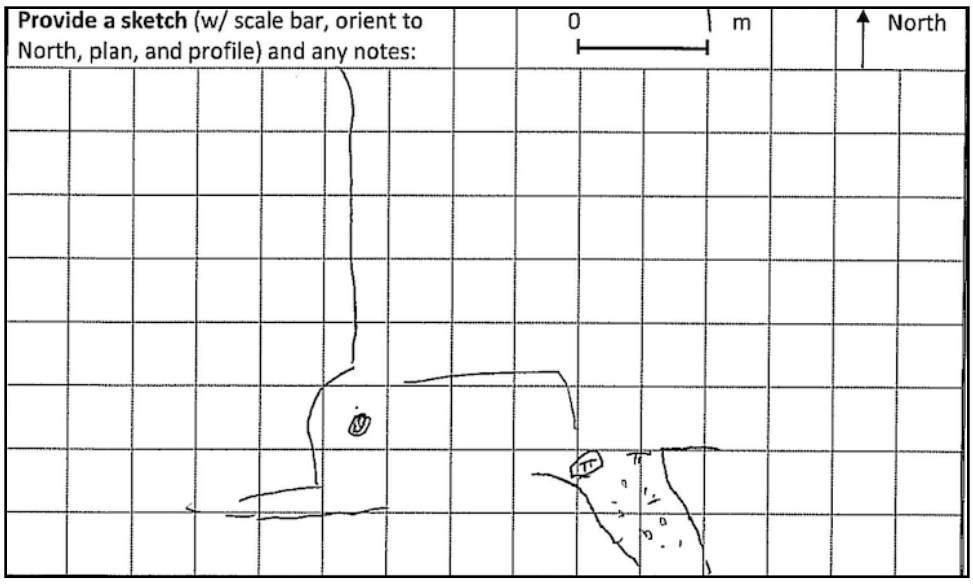

Figure 114. Field sketch of feature 1604-F085.

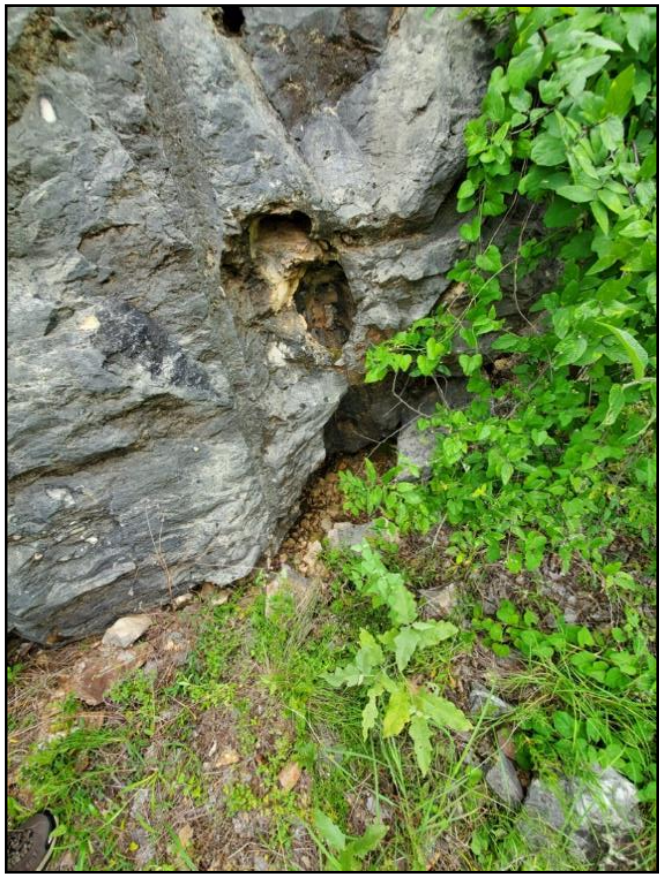
Figure 115. Overview of feature 1604-F085.

Figure 116. Interior of feature 1604-F085.

Feature 1604-F101 (Tally Ho Cave); Cave

This cave was found on 15 July 2009 on the south side of Loop 1604, just east of US 281 (Figure 117 - Figure 118). It was partially mined away for the 2012 construction of the 281/1604 interchange, with the remainder grouted shut as part of the Water Pollution Abatement Plan (WPAP) for that project (Figure 119). This feature was comprised of four holes stacked one above the other in the road cut, developed on an enlarged fracture. Initially, the lowest entrance, near ground level, was 2.2 m (7.2 ft) wide and extended 1.6 m (5.2 ft) into the face of the road cut. Total vertical extent of this feature was 5 m (16.4 ft). The lower part of the feature was excavated using 15.8 person hours of effort, with 7.5 m^3 (80.7 ft^3) of material removed from the feature, making it 5 m (16.4 ft) long and 2 m (6.6 ft) deep. After an initial drop-off at the entrance, there was a step-up at a narrow spot that then gives access to a room measuring 1.5 (4.9 ft) by 2 m (6.6 ft), with some small holes extending up into the ceiling. Biological surveys were conducted on October 6, 16, and 23, 2009 (TxDOT 2015a). An eyeless spider was collected in a glue trap that was identified as *Cicurina platypus*. This is a non-listed species known very few other localities. Since this feature was plugged with grout (Figure 120), it was not assessed for karst species in 2019 (Table 1).

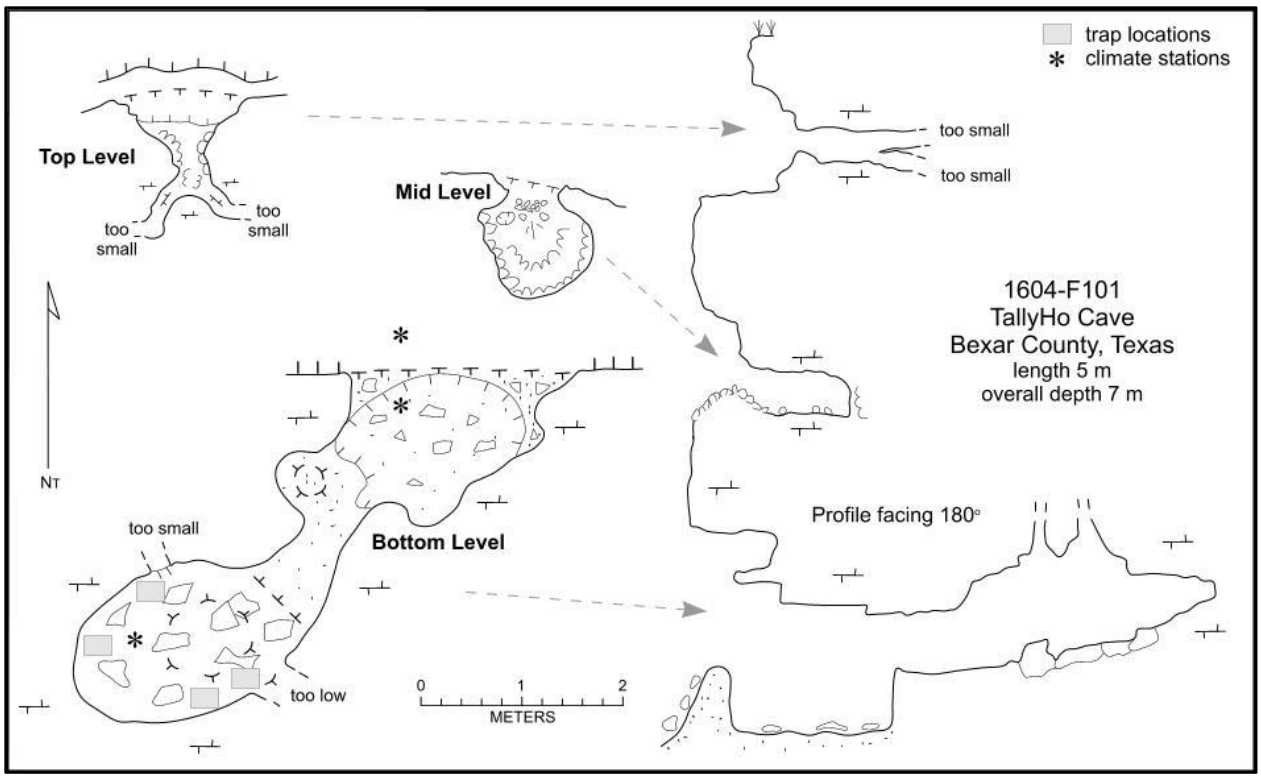

Figure 117. Map of feature 1604-F101 (Tally Ho Cave) prior to it being mined away.

Figure 118. Overview of feature 1604-F101 (Tally Ho Cave) in 2009, after excavation.

Figure 119. Google Street View image from 2015 of feature 1604-F101 (Tally Ho Cave). Roadcut had been mined back, and feature sealed with grout.

Figure 120. Feature 1604-F101 (Tally Ho Cave) in 2019.

Feature 1604-FZ3; Enlarged Bedding Plane

This feature was located approximately 0.5 m above grade in the roadcut of eastbound 1604 between Blanco Road and Huebner Road (Figure 121 - Figure 123). It was evaluated on January 12, 2010 and March 22, 2019 (TxDOT 2015a, TxDOT 2019a). Feature 1604-FZ3 was an enlarged bedding plane that measured 0.3 m (1 ft) wide by 3 m (9.8 ft) long by 0.3 m (1 ft) high. It contained bedrock and rocks. It was determined that this feature met criteria for potential habitat, including void length greater than 1 m (3.3 ft), presence of mesocavernous voids, and similarity to nearby caves (Table 2). Fauna surveys were conducted on March 11 and 24, and April 5, 2010, during which no karst invertebrates were found. Evaluations in 2019 also indicated potential habitat, and those presence/absence surveys were conducted in March and April 2019 (Table 15); however, no troglobites were found (Table 1). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

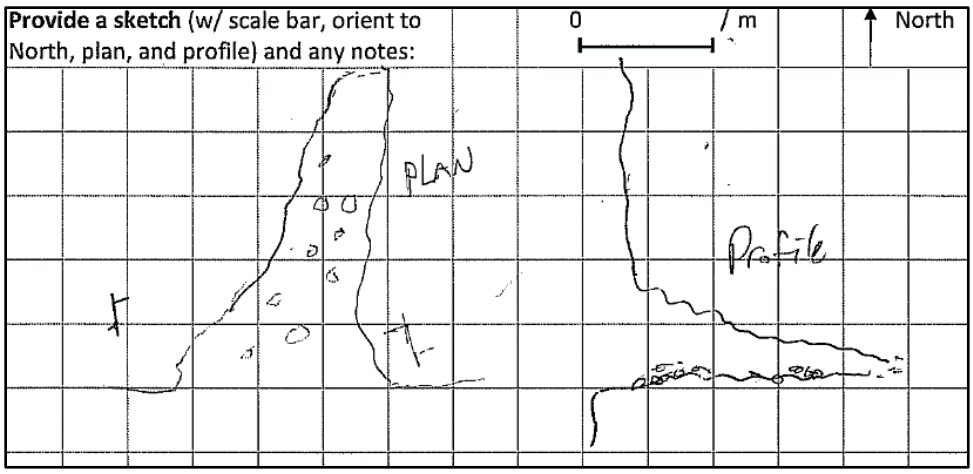

Figure 121. Field sketch of feature 1604-FZ3.

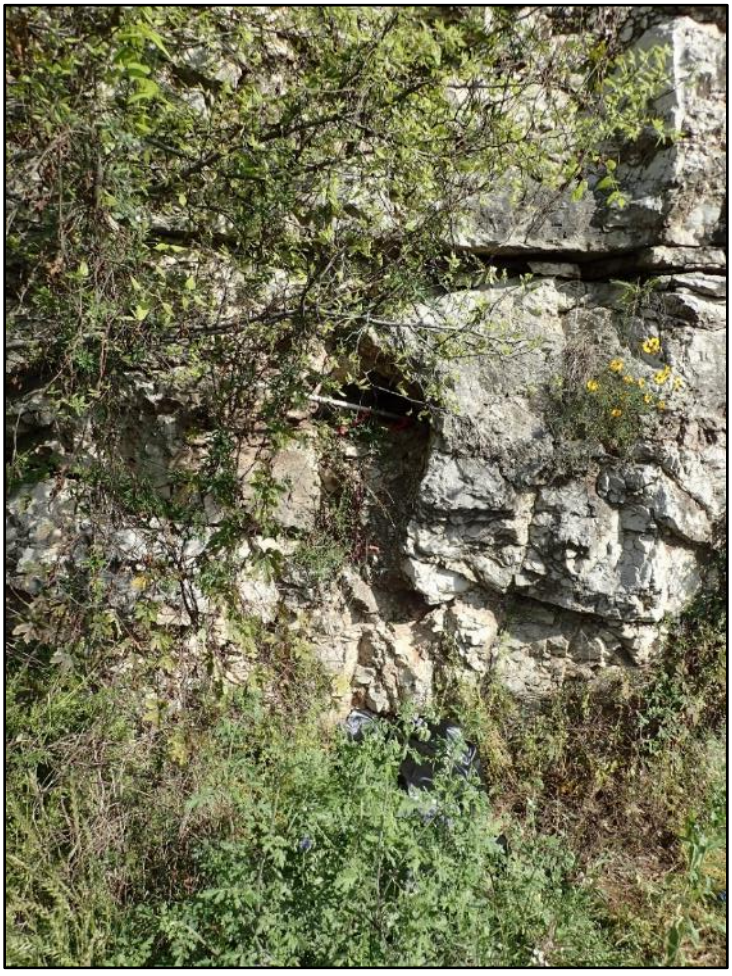
Figure 122. Overview of feature 1604-FZ3 showing a PVC survey pole.

Figure 123. Interior of feature 1604-FZ3, showing trap pole.

Table 15. Summary of fauna observations at feature 1604-FZ3.

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae *Porcellio* sp.
Spider (epigean)	Araneae
Ant	Formicidae
Fly Gnat	Diptera

Feature 1604-FZ4; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Blanco Road (Figure 124 - Figure 126). It was evaluated on August 2, 2009 and July 3, 2019. The feature was a solution cavity 0.45 m (1.5 ft) wide by 1.1 m (3.6 ft) long, and 0.25 m (0.8 ft) high. There was no noticeable airflow and the feature was not humanly enterable. Mesocavernous voids were observed. This feature contained fine organic soil and leaf litter. In 2009, it did not meet the criteria for karst invertebrate habitat; however, the current criteria are more slightly more stringent (USFWS 2015a) and the 2019 set of measurements put this feature over that threshold. Due to it having mesocavernous voids and a length greater than 1 m (3.3 ft), it was considered potential karst invertebrate habitat (Table 2). Presence/absence surveys were conducted in August and September 2019 (Table 16); however, no troglobites were found (Table 1). A review of TxDOT 2019b and USFWS 2019 indicates that this feature may be removed during future construction at the Blanco Road intersection.

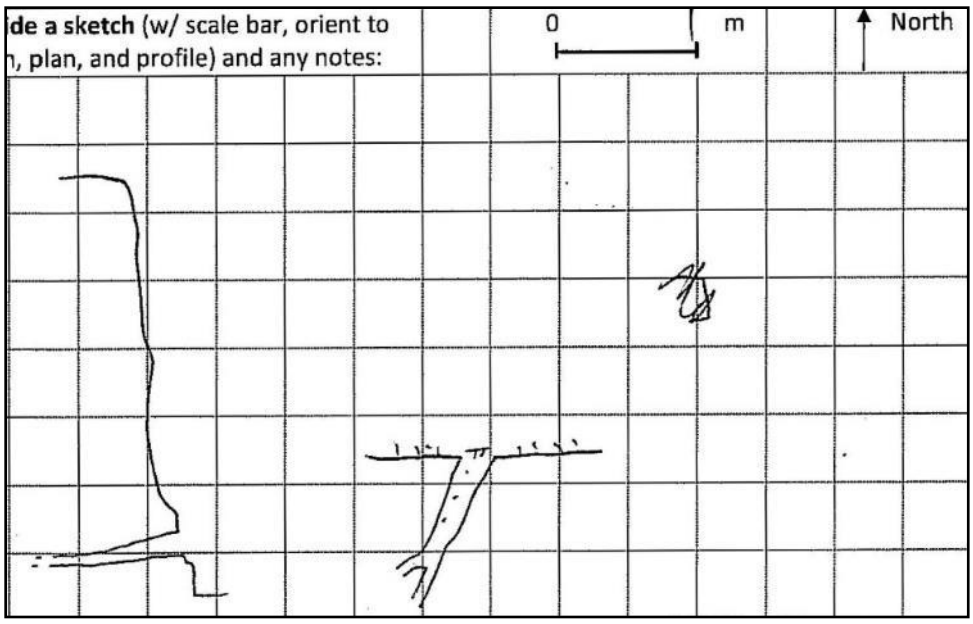

Figure 124. Field sketch of feature 1604-FZ4.


Figure 125. Exterior of feature 1604-FZ4.

Figure 126. Interior of feature 1604-FZ4.

Table 16. Summary of survey activity at feature 1604-FZ4.

Date	Time	Effort (minutes)	Comments
08/23/2019	13:28	10	Set traps and data logger
08/26/2019	12:45	10	Checked and reset traps
08/28/2019	14:01	18	Checked and reset traps
08/30/2019	12:09	10	Checked and reset traps
09/01/2019	10:53	12	Checked and reset traps
09/03/2019	12:25	10	Checked and reset traps
09/05/2019	11:45	9	Checked and reset traps
09/07/2019	10:28	8	Checked and reset traps
09/09/2019	18:20	6	Checked and reset traps
09/11/2019	18:47	4	Checked and reset traps
09/13/2019	11:02	6	Checked and reset traps
09/15/2019	10:00	10	Checked and reset traps
09/17/2019	15:13	8	Checked and reset traps
09/19/2019	16:21	6	Checked and reset traps
09/21/2019	10:25	4	Checked traps; removed traps and data logger

Table 17. Summary of fauna observations at feature 1604-FZ4.

Common Name	Lowest Taxonomic Identification
Springtail	Collembola
Insect larva	Insecta
Cockroach	Blattaria
Ant	Formicidae
Wasp	Apocrita
Moth	Lepidoptera
Fly/Gnat	Diptera
Mouse	*Mus* sp.

Feature 1604-FZ6; Zone with Solution-enlarged Fracture and Solution Cavity

This feature was a zone containing two features in the roadcut north of the westbound mainlanes of Loop 1604 east of Huebner Road (Figure 127 - Figure 128). It was evaluated on August 2, 2009 and November 29, 2017 (TxDOT 2015a and TxDOT 2018a). The largest feature in the zone was a solution-enlarged fracture located 0.5 m (1.6 ft) above the base of the roadcut. It was 0.6 m (2 ft) wide by 0.97 m (3.2 ft) long by 0.5 m (1.8 ft) high (Figure 129). This feature contained loose rocks, fine sediment, and bedrock. A smaller solution cavity was also present at the base of the cut that was 0.2 m (0.6 ft) in diameter and extends 0.2 m (0.8 ft) into the roadcut (Figure 130). The features both trend at approximately 320 degrees into the roadcut and contain mesocavernous voids that extend into the roadcut along that trend. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

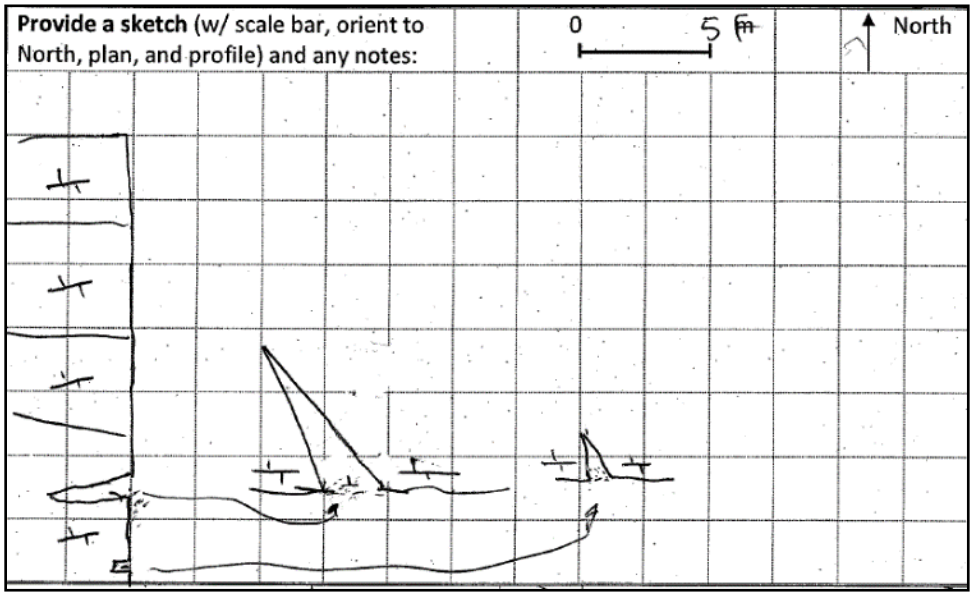

Figure 127. Field sketch of feature 1604-FZ6.

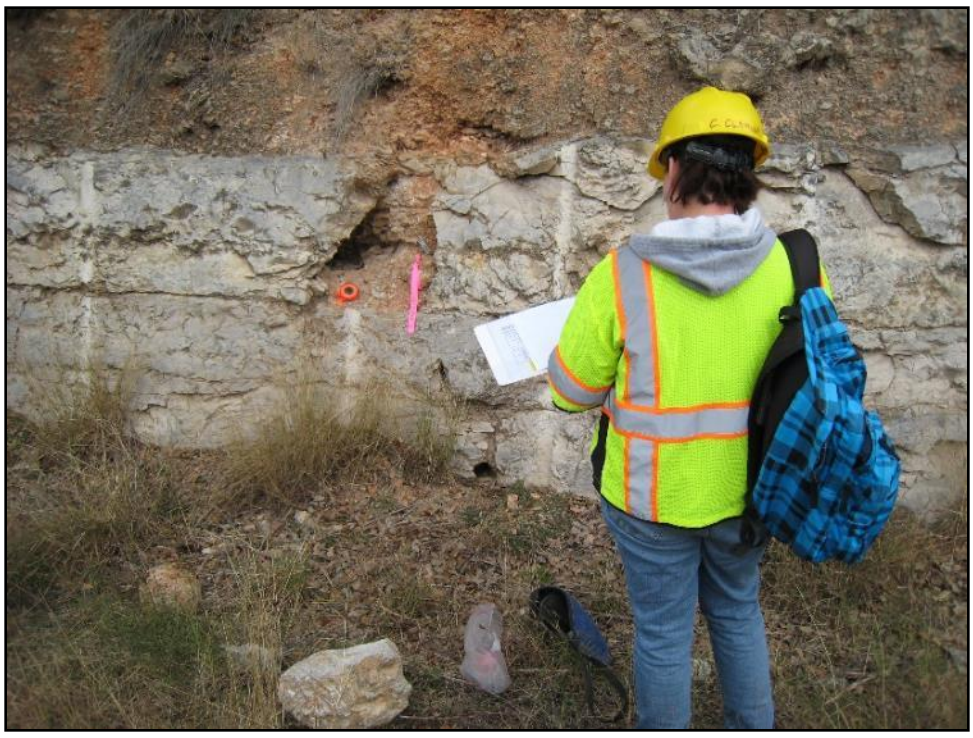

Figure 128. Overview of feature 1604-FZ6.

Figure 129. The larger solution-enlarged fracture of feature 1604-FZ6.

Figure 130. The smaller solution cavity of feature 1604-FZ6.

Feature 1604-FZ7; Solution Cavity

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Huebner Road (Figure 131 - Figure 134). It was evaluated on August 6, 2009 (TxDOT 2015a), November 29, 2017 (TxDOT 2018a), and August 19, 2019. It was a solution cavity that was 0.8 m (2.6 ft) wide by 1 m (3.3 ft) by 1 m (3.3 ft) high when originally examined in 2009. No voids could be seen extending from it; however, excavation on October 7, 2009 to remove loose rocks resulted in the removal of 1.2 m^3 (43 ft^3) of material, which appeared to be road base. The feature was excavated to a total width of 2.5 m (8 ft) by 3.5 m (11.5 ft) long by 2.6 m (8.5 ft) deep, where it ended in a mesocavernous drain. It was considered to be karst invertebrate habitat, and presence/absence surveys were conducted in October and November 2009, when a non-listed troglobitic species was found (*Brackenridgia* sp.). Presence/absence surveys were conducted in July 2019 (Table 18); notable fauna are summarized in Table 1. Troglobitic fauna encountered in 2019 included *Cicurina platypus/bullis* (Figure 135) whose identity was determined using mtDNA (Appendix C) and *Brackenridgia* sp.

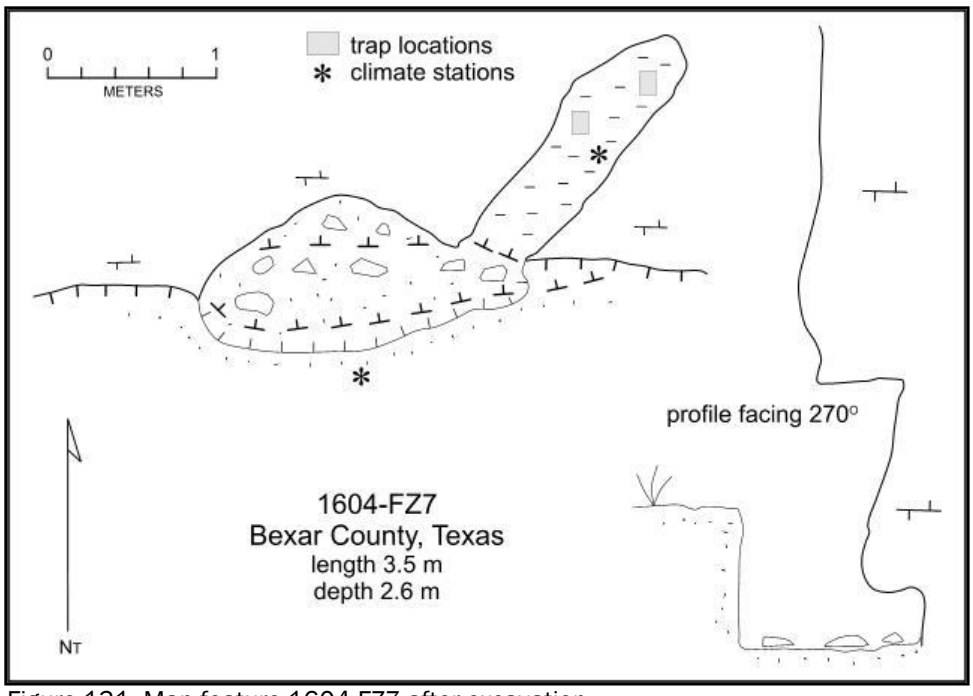

Figure 131. Map feature 1604-FZ7 after excavation.

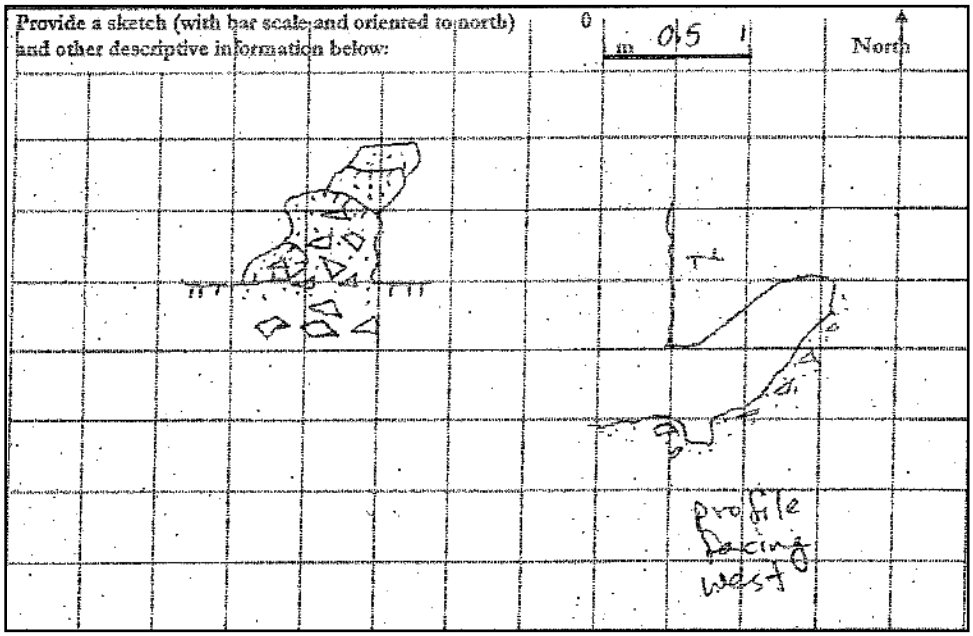

Figure 132. Field sketch of feature 1604-FZ7 prior to excavation.

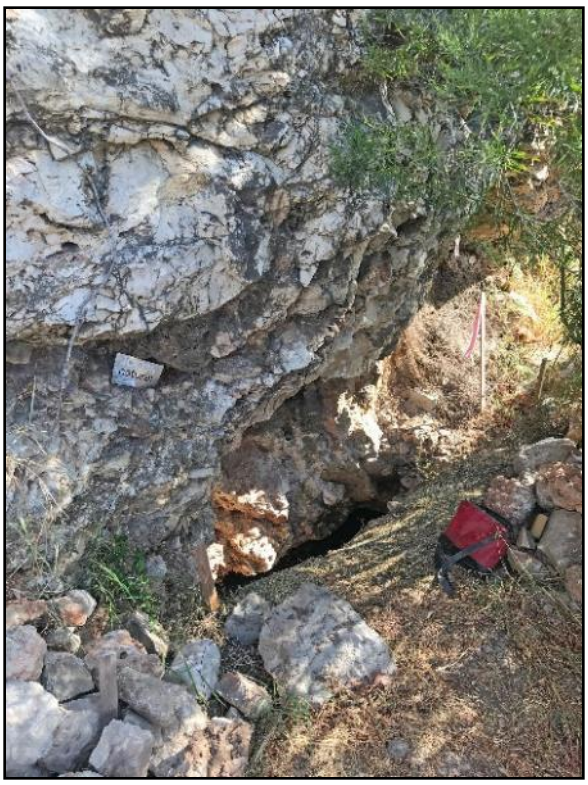

Figure 133. Overview of feature 1604-FZ7.

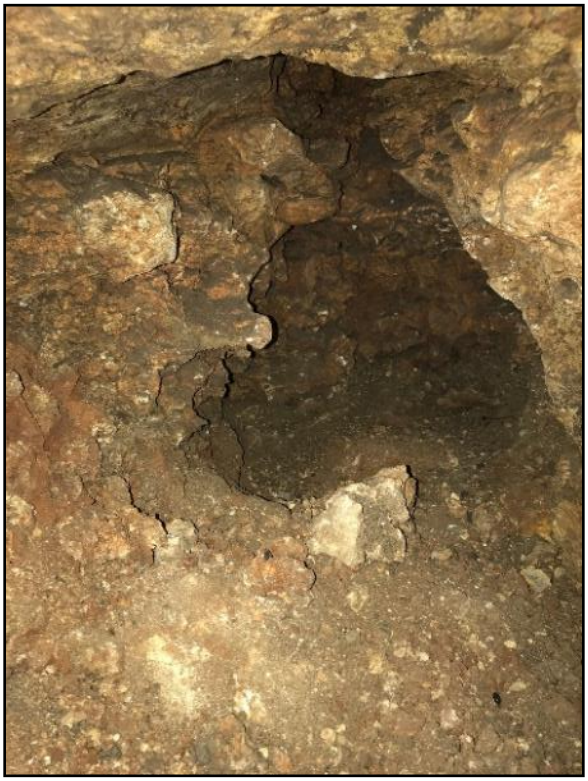

Figure 134. Interior of feature 1604-FZ7.

Figure 135. *Cicurina platypus/bullis* from feature 1604-FZ7.

Table 18. Summary of 2019 survey activity for feature 1604-FZ7.

Date	Time	Effort (minutes)	Comments
06/27/2019	12:10	30	Set traps and data logger
07/01/2019	10:20	40	Checked and reset traps
07/03/2019	10:20	20	Checked and reset traps
07/05/2019	09:50	10	Checked and reset traps
07/08/2019	11:14	40	Checked and reset traps
07/10/2019	10:45	40	Checked and reset traps
07/12/2019	08:55	30	Checked and reset traps
07/15/2019	11:51	30	Checked and reset traps
07/17/2019	10:50	30	Checked and reset traps
07/19/2019	10:05	45	Checked and reset traps
07/22/2019	10:40	40	Checked and reset traps
07/24/2019	20:45	50	Checked and reset traps
07/26/2019	10:28	40	Checked and reset traps
07/29/2019	08:40	30	Checked and reset traps
07/31/2019	08:32	26	Checked traps; removed traps and data logger

Table 19. Summary of 2019 fauna observations at feature 1604-FZ7.

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae *Brackenridgia* sp.
Spider (epigean)	Araneae
Dictynidae	*Cicurina platypus/bullis*
Harvestman	*Leiobunum townsendi*
Millipede	Diplopoda *Cambala* sp.
Springtail	Collembola
Cricket (epigean)	Gryllidae
Earwig	Dermaptera
Roach	Blattaria
Beetle	Coleoptera
Ant	Formicidae
Gnat	Diptera
Mosquito	Culicidae
Cliff chirping frog	*Eleutherodactylus marnockii*

Feature 1604-FZ8; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Bitters Road (Figure 136 - Figure 137). It was evaluated on August 6, 2009 (TxDOT 2015a) and November 28, 2017 (TxDOT 2018a). It was an enlarged bedding plane situated 0.5 m (1.6 ft) above the base of the roadcut. It was 3 m (10 ft) wide by 1.6 m (5.3 ft) long by 0.3 m (1 ft) high. No mesocavernous voids were observed. The feature was filled with loose cobbles, fine sediment and bedrock (Figure 138). Although this feature met the habitat criteria of being greater than 1 m in length, it had no mesocavernous voids and a very wide entrance which made the feature desiccated. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

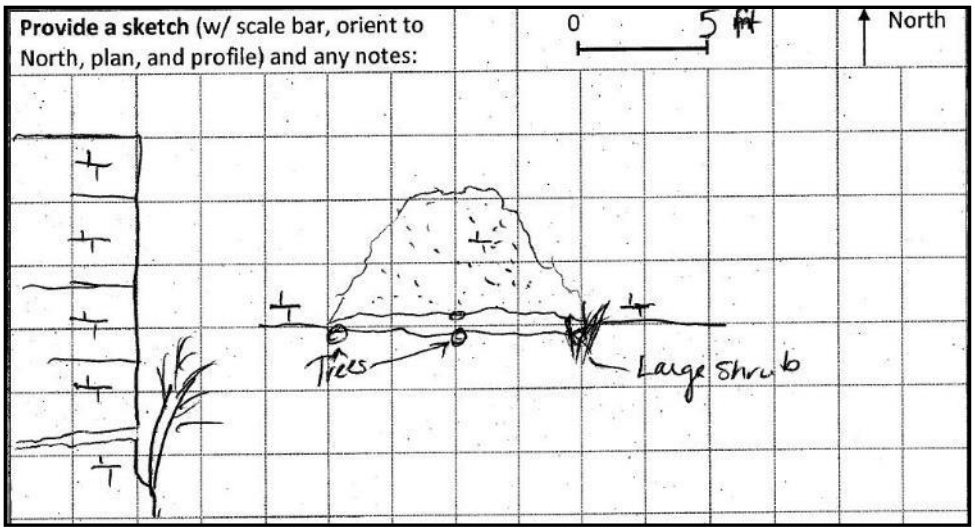

Figure 136. Field sketch of feature 1604-FZ8.


Figure 137. Overview of feature 1604-FZ8.

Figure 138. Interior of feature 1604-FZ8.

Feature 1604-K41; Solution Cavity

This feature was located in a roadcut north of the westbound mainlanes of Loop 1604, east of Gold Canyon Road (Figure 139 - Figure 141). A feature evaluation was performed on December 8, 2009 and June 17, 2019. This solution cavity measured 0.6 m (2 ft) wide by 0.3 m (1.1 ft) high and 0.4 m (1.3 ft) deep. Excavation performed on August 19, 2010 detected no mesocavernous voids. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

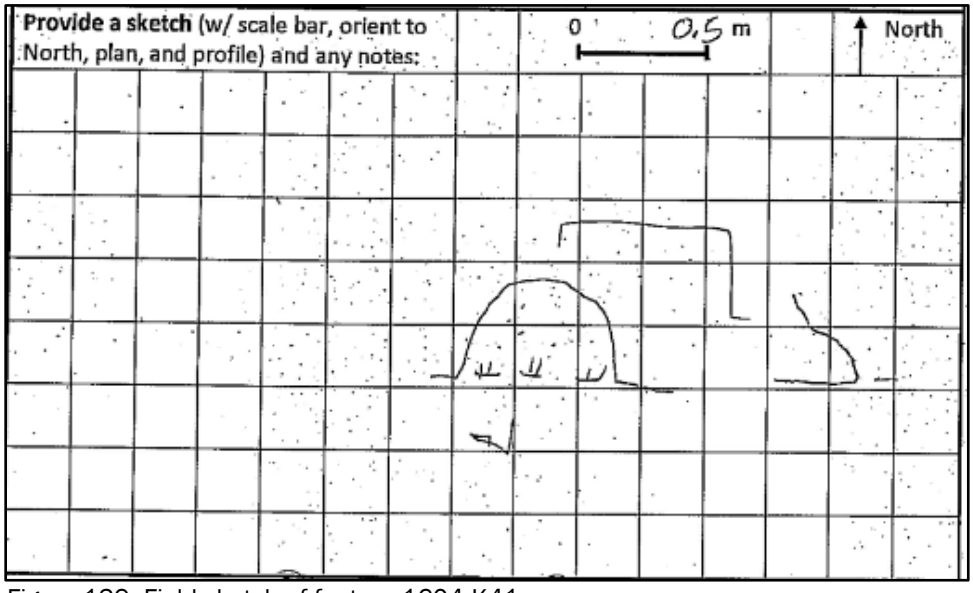

Figure 139. Field sketch of feature 1604-K41.

Figure 140. Overview of feature 1604-K41.

Figure 141. Close-up of feature 1604-K41.

Feature 1604-L02; Solution-enlarged Bedding Plane

This feature was located in a roadcut north of the westbound mainlanes of Loop 1604 and west of Bitters Road (Figure 142 - Figure 144). An evaluation was performed on December 9, 2009 and June 18, 2019. The feature was a solution-enlarged bedding plane that measured 2.0 m (6.6 ft) wide by 0.2 m (0.7 ft) long and was 0.06 m (0.2 ft) high. There was no noticeable airflow and the feature was not humanly enterable. This feature contained organic soil and leaf litter. On August 19, 2010, approximately 0.6 person hours were spent excavating 20 L (0.02 m^3, 0.71 ft^3) of material until encountering a zone of small interconnecting voids extending downward along a small fracture. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

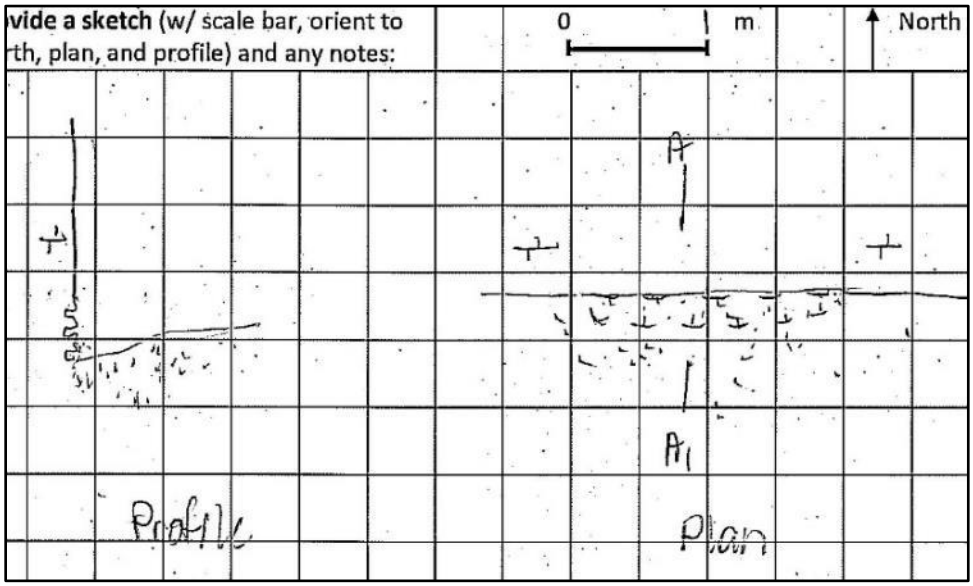

Figure 142. Field sketch of feature 1604-L02.

Figure 143. Overview of feature 1604-L02.

Figure 144. Close-up of feature 1604-L02.

Feature 1604-L11; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Bitters Road (Figure 145 - Figure 147). It was assessed on December 9, 2009 (TxDOT 2015a) and November 28, 2017 (TxDOT 2018a), then these datasets were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution-enlarged bedding plane measured 2.7 m (9 ft) wide by 0.8 m (2.5 ft) long and was 0.9 m (3 ft) high. The feature contained exposed bedrock, flowstone, and coarse breakdown. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

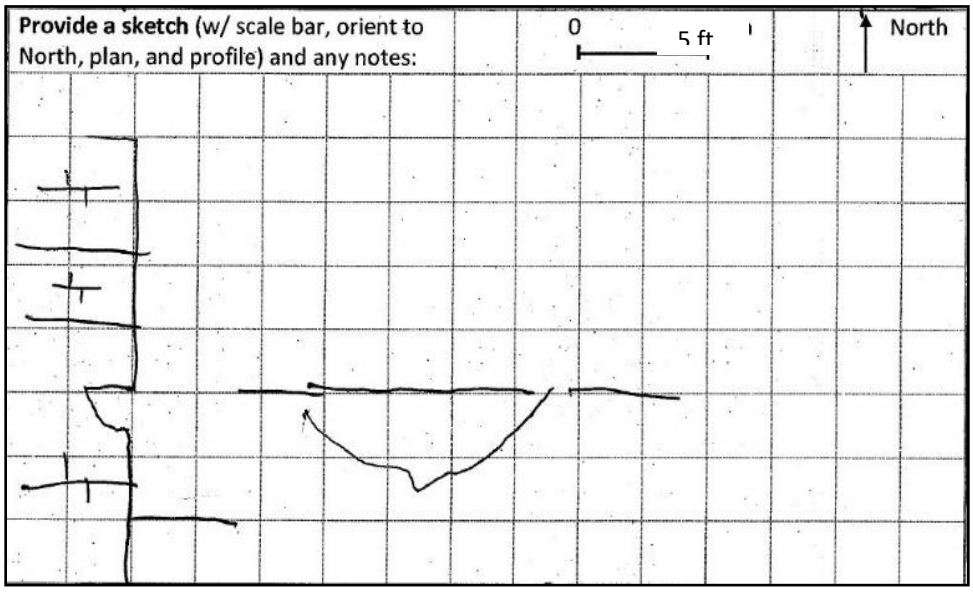

Figure 145. Field sketch of feature 1604-L11.

Figure 146. Overview of feature 1604-L11.

Figure 147. Interior of feature 1604-L11.

Feature 1604-L12; Solution-enlarged Bedding Plane

This solution-enlarged bedding plane was located in the roadcut north of the westbound mainlanes of Loop 1604 west of Bitters Road (Figure 148 - Figure 151). It was evaluated on August 17, 2009 and August 5, 2019. It was initially 0.9 m (3.0 ft) wide by 1.2 m (4 ft) long and 0.5 m (1.5 ft) high. In August 2010, 0.6 person hours were spent removing 0.7 ft^3 of material using hand tools (Figure 149). The feature contained exposed bedrock, modern soils and breakdown, and roadside debris such as tire fragments that appear to have washed into the void. A distinct terminus was reached 1.7 m (5.6 ft) from the entrance, with a mesocavernous void leading off from the ceiling (Figure 150). The feature was too small to be enterable. It was re-evaluated on August 5, 2019 and measured 2.0 m (6.6 ft) wide, 1.4 m (4.6 ft) long, and 0.2 m (0.7 ft) tall at that time. An erosion control log had been placed in front of it (Figure 151). It met requirements for potential habitat due to a length over 1 m (3.3 ft) with continuing mesocavernous voids (Table 2). Presence/absence surveys were conducted in August and September 2019 (Table 20); however, no troglobites were found (Table 1).

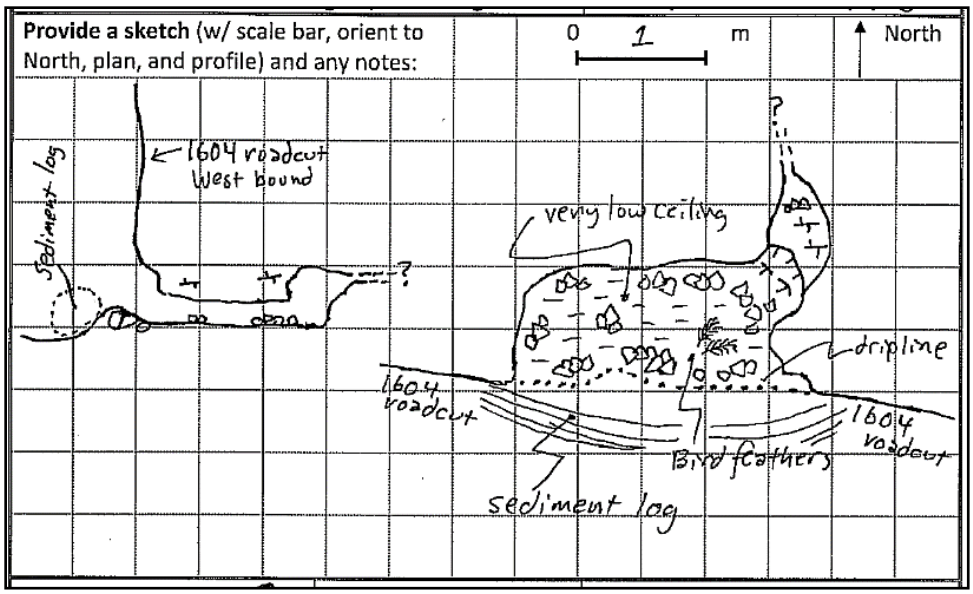

Figure 148. Field sketch of feature 1604-L12.


Figure 149. Material excavated from feature 1604-L12 in 2010.

Figure 150. Interior of feature 1604-L12 after 2010 excavation, showing a mesocavernous void extending into the cut at the top center of the image.

Figure 151. Overview of feature 1604-L12 in 2019. Scale bar points north.

Table 20. Summary of survey activity for feature 1604-L12.

Date	Time	Effort (minutes)	Comments
08/07/2019	11:05	20	Feature evaluation; set traps and data logger
08/09/2019	11:52	10	Checked and reset traps
08/12/2019	10:21	10	Checked and reset traps; set new data logger
08/14/2019	10:20	12	Checked and reset traps
08/16/2019	09:20	12	Checked and reset traps
08/19/2019	10:23	8	Checked and reset traps
08/21/2019	09:21	12	Checked and reset traps
08/23/2019	11:22	12	Checked and reset traps
08/26/2019	11:02	6	Checked and reset traps
08/28/2019	10:42	10	Checked and reset traps
08/30/2019	09:40	6	Checked and reset traps
09/01/2019	08:54	10	Checked and reset traps
09/03/2019	10:27	6	Checked and reset traps
09/05/2019	10:26	9	Checked and reset traps
09/07/2019	09:00	6	Checked traps; removed traps and data logger

Table 21. Summary of fauna observations at feature 1604-L12.

Common Name	Lowest Taxonomic Identification
Weevil	Curculionoidea
Spider	Araneae
Springtail	Collembola
Cricket	Gryllidae
Earwig	Dermaptera
Assassin bug	Reduviidae
Ant	Formicidae
Moth	Lepidoptera
Fly/Gnat	Diptera
Mosquito	Culicidae
Mediterranean gecko	*Hemidactylus turcicus*

Feature 1604-L13 and 13a; Solution Cavities

These features were located in the roadcut north of the westbound mainlanes of Loop 1604, immediately west of Bitters Road (Figure 152 - Figure 156). They were evaluated on December 9, 2009 and August 5, 2019. These are two solution cavities situated one on top of the other (Figure 153). Feature 1604-L13 measured 0.08 m (ft) wide by 1.12 m (ft) long by 0.1 m (ft) high while feature 1604-L13a measured 0.2 m (0.7 ft) wide by 0.8 m (2.6 ft) long by 0.2 m (0.5 ft) high. The lower feature 1604-L13 contained silt, pebbles, and exposed bedrock and had a very small void leading out of sight at the back (Figure 155). The upper feature 1604-L13a contained rocks and red clay, and had no voids extending off (Figure 156). Features 1604-L13 and 13a were considered potential karst invertebrate habitat due to the void size greater than or equal to 1 m (3.3 ft), and presence of mesocavernous voids (Table 2). Presence/absence surveys were conducted in August and September 2019 (Table 22); however, no troglobites were found (Table 1).

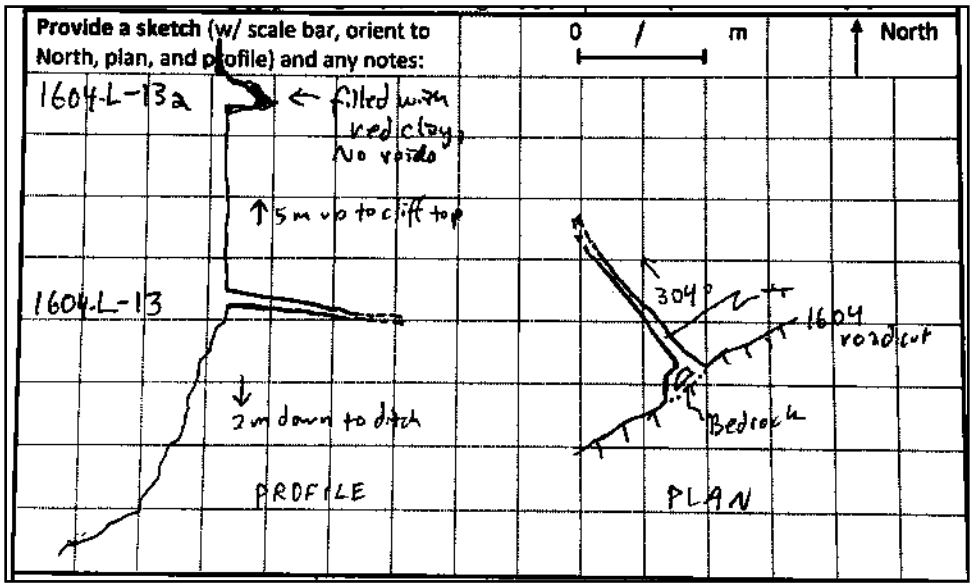

Figure 152. Field sketch of feature 1604-L13 and 13b.

Figure 153. Overview of feature 1604-L13 (lower) and 1604-L13a (upper).

Figure 154. Close up of feature 1604-L13. Scale bar points north.

Figure 155. Interior of feature 1604-L13, showing very small continuing void.

Figure 156. Close up of feature 1604-L13a, showing red clay fill and no mesocavernous voids extending from the feature.

Table 22. Summary of survey activity for feature 1604-L13.

Date	Time	Effort (minutes)	Comments
08/07/2019	11:16	20	Feature evaluation; set traps and data logger
08/09/2019	12:01	10	Checked and reset traps
08/12/2019	10:28	10	Checked and reset traps
08/14/2019	10:27	10	Checked and reset traps
08/16/2019	09:29	8	Checked and reset traps
08/19/2019	10:29	10	Checked and reset traps
08/21/2019	09:28	10	Checked and reset traps
08/23/2019	11:31	6	Checked and reset traps
08/26/2019	11:07	6	Checked and reset traps
08/28/2019	10:48	10	Checked and reset traps
08/30/2019	09:44	6	Checked and reset traps
09/01/2019	09:00	12	Checked and reset traps
09/03/2019	10:32	6	Checked and reset traps
09/05/2019	10:30	16	Checked and reset traps
09/07/2019	09:03	6	Checked traps; removed traps and data logger

Table 23. Summary of fauna observations at feature 1604-L13 and 13a.

Common Name	Lowest Taxonomic Identification
Weevil	Curculionoidea
Spider	Araneae
Assassin bug	Reduviidae
Ant	Formicidae
Fly/Gnat	Diptera
Gulf Coast toad	*Incilius nebulifer*

Feature 1604-L16 (12A Cave); Solution-enlarged Bedding Plane

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604 west of Bitters Road (Figure 157 - Figure 159). This feature was assessed on December 9, 2009 and August 5, 2019. It was an enlarged bedding plane measuring 0.9 m (3.0 ft) wide by 3.5 m (11.5 ft) long and 0.8 m (2.6 ft) high. This feature was in the TSS database as "12A Cave" even though it does not meet the length requirements of a cave (5 m [16.4 ft]) established by the TSS. The feature contained breakdown pebbles and rocks, flowstone and red-tan silty clay. Three karst invertebrate presence/absence surveys were performed in 2010 (Zara 2010b), and no karst invertebrate species were found during those surveys. Presence/absence surveys were conducted in August and September 2019 (Table 24, Table 25); notable fauna are summarized in Table 1. One troglobitic species, a *Cambala* sp. millipede, was detected.

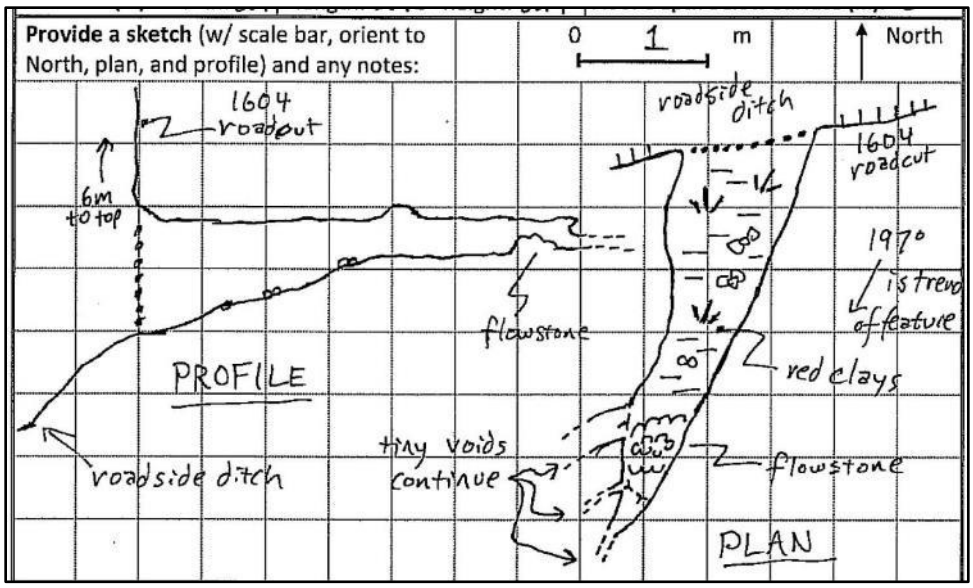

Figure 157. Field sketch of feature 1604-L16 (12A Cave).


Figure 158. Overview of feature 1604-L16 (12A Cave).

Figure 159. Interior of feature 1604-L16 (12A Cave). Scale bar points north.

Table 24. Summary of 2019 survey activity for feature 1604-L16 (12A Cave).

Date	Time	Effort (minutes)	Comments
08/05/2019	10:10	50	Feature evaluation; set traps and data logger
08/09/2019	12:23	14	Checked and reset traps
08/12/2019	12:22	16	Checked and reset traps
08/14/2019	12:05	20	Checked and reset traps
08/16/2019	11:11	16	Checked and reset traps
08/19/2019	12:08	18	Checked and reset traps
08/21/2019	10:51	12	Checked and reset traps
08/23/2019	13:15	10	Checked and reset traps
08/26/2019	12:17	18	Checked and reset traps
08/28/2019	13:36	20	Checked and reset traps
08/30/2019	11:45	26	Checked and reset traps
09/01/2019	10:29	28	Checked and reset traps
09/03/2019	12:08	12	Checked and reset traps
09/09/2019	19:52	24	Checked and reset traps
09/11/2019	07:46	22	Checked traps; removed traps and data logger

Table 25. Summary of fauna observations in 2019 at feature 1604-L16 (12A Cave).

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae *Porcellio* sp.
Spider	Araneae
Cellar spider	Pholcidae
Millipede	*Cambala* sp.
Springtail	Collembola
Cricket	Gryllidae *Ceuthophilus secretus*
Earwig	Dermaptera
Beetle	Tenebrionidae
Ant	Formicidae
Wasp	Apocrita
Fly/Gnat	Diptera
Mediterranean gecko	*Hemidactylus turcicus*
Gulf Coast toad	*Incilius nebulifer*
Cliff chirping frog	*Eleutherodactylus marnockii*
Snake	Colubridae

Feature 1604-M14; Sinkhole

This feature was located north of the westbound mainlanes of Loop 1604, east of NW Military Highway (Figure 160 - Figure 162). It was assessed on December 2, 2009 and on 19 June 2019. The center of the feature was outside the ROW and the sinkhole footprint was bisected by the ROW fence. It was adjacent to a fire hydrant, and although it has the appearance of a natural sinkhole, it may also have been related to water line trenching for the hydrant. This feature was not excavated due to the center of the feature not being located on the ROW; however, it meets the criteria to justify excavation to fully determine whether habitat exists below grade (Table 2). It measured 0.8 m (2.5 ft) long by 0.2 m (0.66 ft) wide and 0.04 m (0.13 ft) deep. This feature contained loose soil and vegetation. Surveyors did not have right of entry; therefore, no habitat determination could be made for this feature, and no fauna surveys were performed.

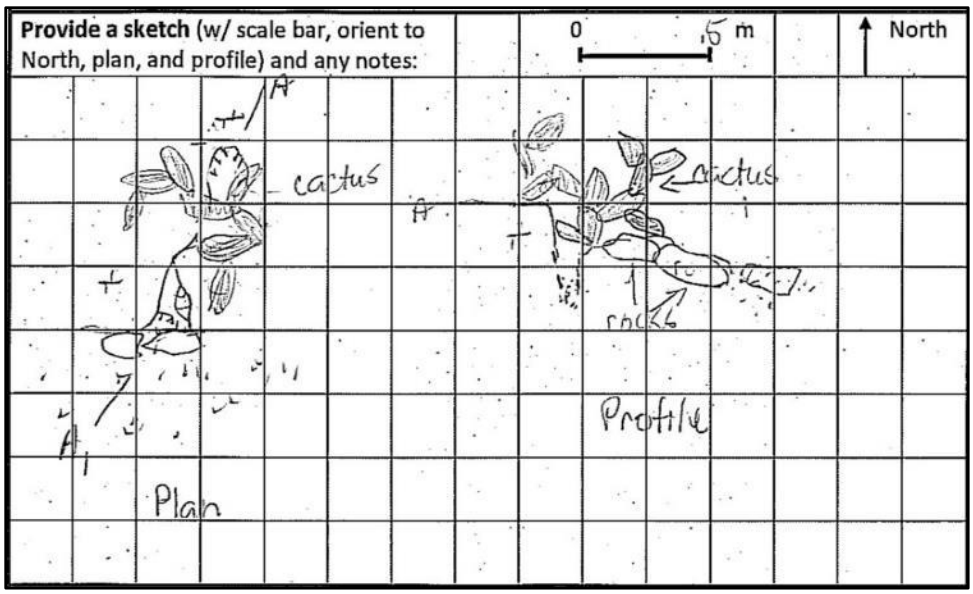

Figure 160. Field sketch of feature 1604-M14.

Figure 161. Overview of feature 1604-M14.

Figure 162. Close up of feature 1604-M14, showing ROW fence.

Feature 1604-M21 (Han's Grotto); Cave

This feature was located in Salado Creek under the west bound access road of Loop 1604 east of NW Military Highway (Figure 163 - Figure 167). It was evaluated on 6, 8 and 11 September 2000 (SWCA 2000), December 9, 2009 (Zara 2010b), and 19 June 2019 (current study). This feature measured 2.0 m (6.5 ft) wide by 3.0 m (9.8 ft) long and 0.3 m (0.98 ft) deep. It had partially been filled with concrete and was originally 16.5 m (54 ft) long, according to TSS. Prior to it being filled, biological collections made in the cave in 1984 included two troglobites, *Brackenridgia* sp. isopods and *Cambala* sp. millipedes (Table 1). SWCA (2000) reports observations made prior to the concrete plug which likely bisected the cave during construction of the bridge in April 2001. Their observations included two species of cave crickets and several troglophiles, but no troglobites. Although it clearly contained karst invertebrate habitat, that habit was no longer accessible due to the concrete plug. This plug nearly reaches the ceiling, and excavation to re-open the cave was not feasible; therefore, no biological surveys were conducted.

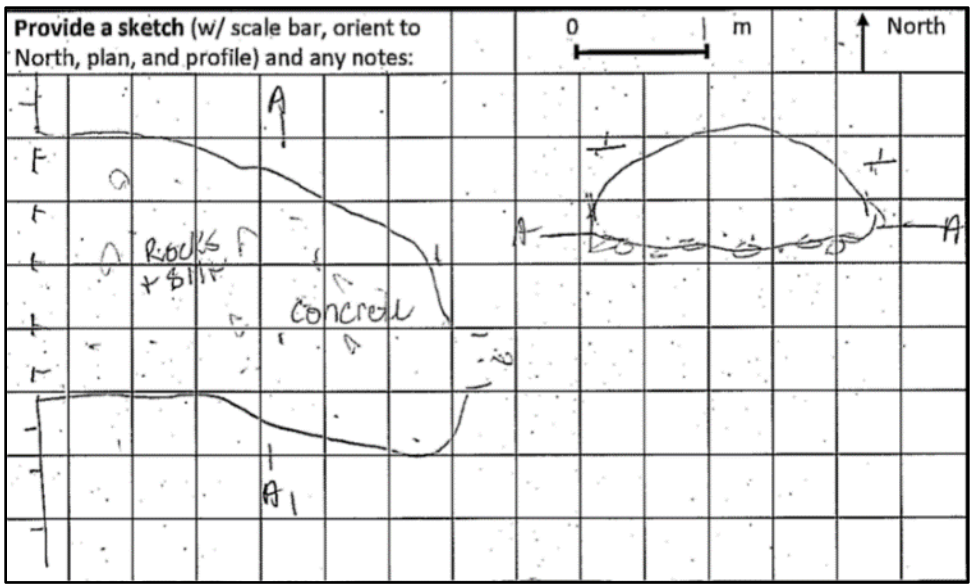

Figure 163. Field sketch of feature 1604-M21 (Han's Grotto) from 2019.

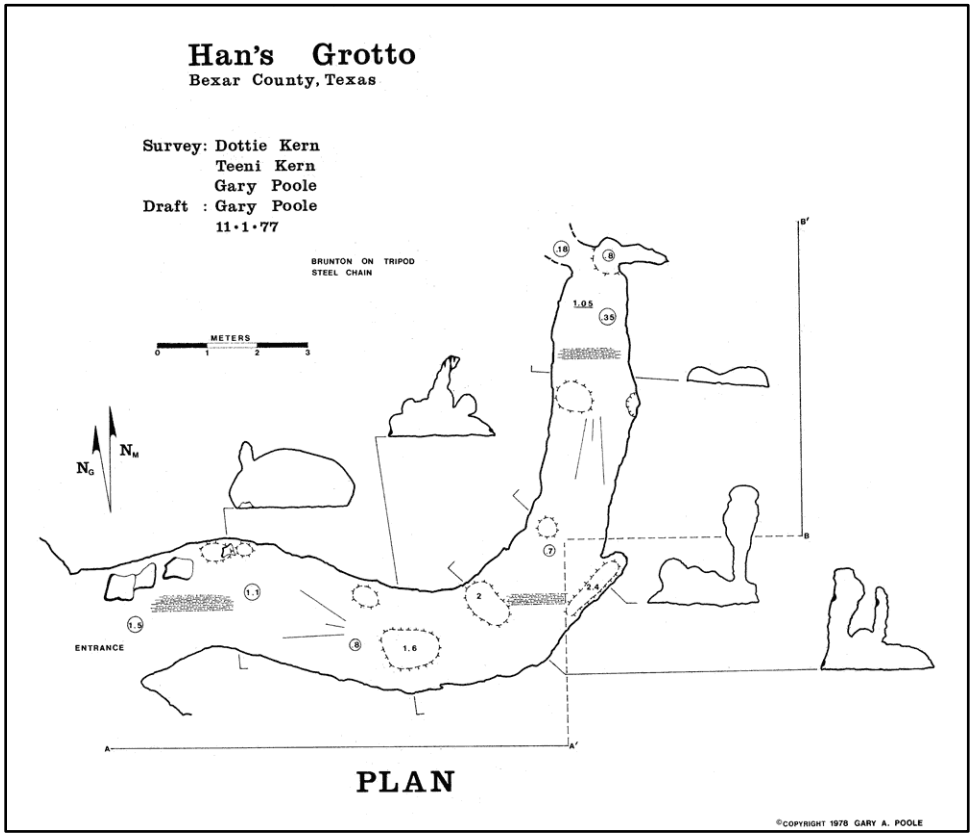

Figure 164. Plan view map of feature 1604-M21 (Han's Grotto) prior to filling with concrete.

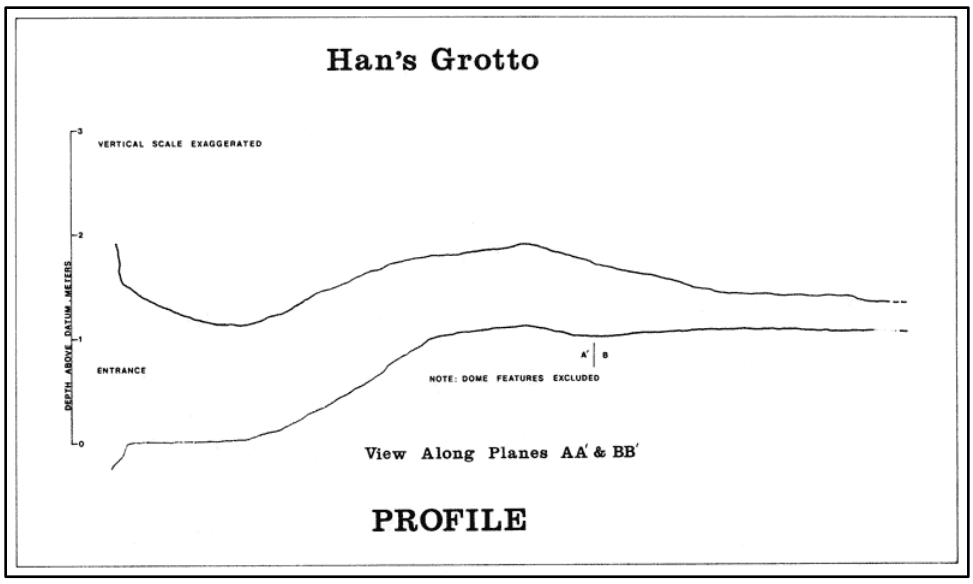

Figure 165. Profile view map of feature 1604-M21 (Han's Grotto) prior to filling with concrete.


Figure 166. Overview of feature 1604-M21 (Han's Grotto).

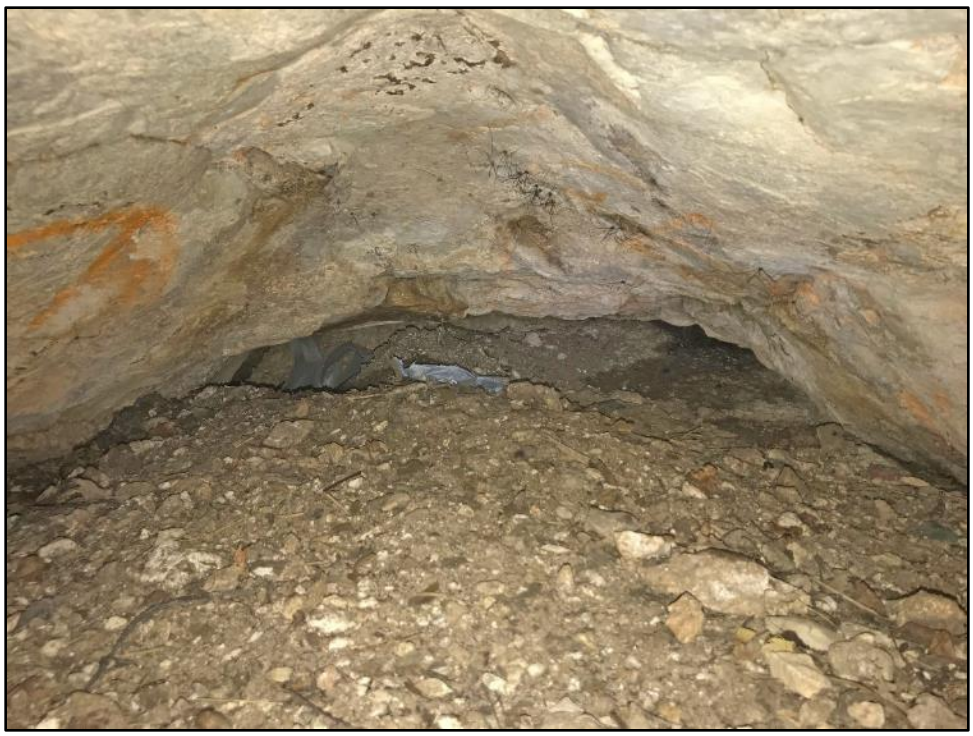

Figure 167. Interior of feature 1604-M21, showing concrete plug.

Feature 1604-M22; Solution cavities

This feature was located in a drainage under the westbound mainlanes of Loop 1604, west of Bitters Road (Figure 168 - Figure 170). It was evaluated on December 9, 2009 and 19 June 2019. This solution cavity was and 0.8 m (2.5 ft) wide, 1 m (3.2 ft) long by 0.2 m (0.66 ft) wide high, and had a second, smaller similar feature about 4 m (13.1 ft) away (1604-M22b). It was excavated on August 17, 2010 for a total of 0.6 person hours, removing 0.02 m^3 (0.6 ft^3) of material using hand tools. Excavation was terminated after reaching a distinct terminus with no voids or drains extending from the footprint of the feature. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

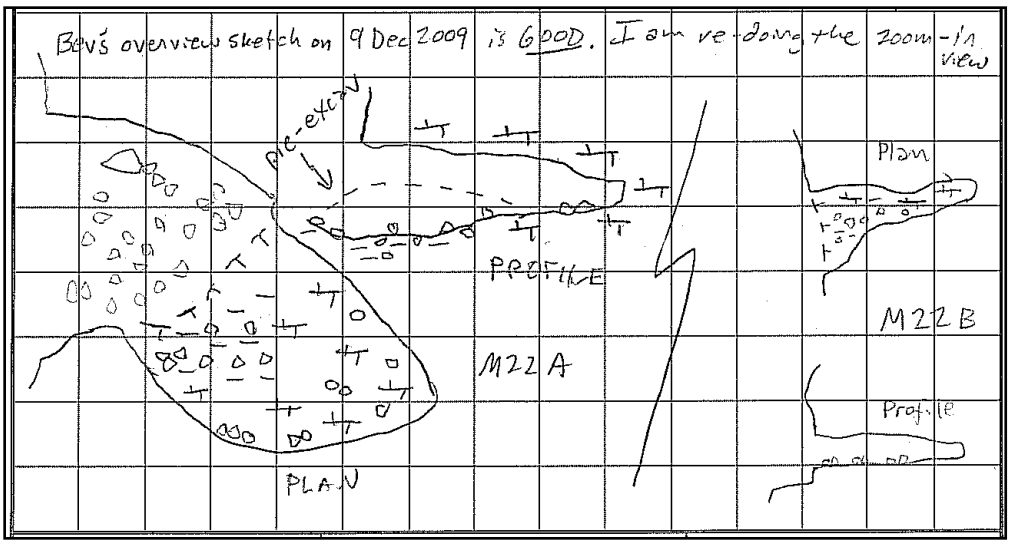

Figure 168. Detailed sketch of feature 1604-M22, showing extent of excavation and end of passage.


Figure 169. Overview of feature 1604-M22 (left) and 1604-M22b (right).

Figure 170. Interior of feature 1604-M22.

Feature 1604-Q48; Solution cavity

This feature was located in a cliff under the westbound mainlanes of Loop 1604 and west of Interstate-10 (I-10). It was evaluated on December 15, 2009 and August 30, 2019 (Figure 171 - Figure 173). The feature was a solution cavity developed along a bedding plane, and measured 1.5 m (4.9 ft) wide, 2 m (6.5 ft) long, and 0.75 m (2.5 ft) high. The floor of the feature contained loose rocks, and fine, compact soil. The 2009 evaluation indicated that excavation was warranted, and that was conducted on March 10, 2010, at which time the feature was seeping water. The back of the feature was reached 2 m (6.6 ft) in. While the feature met the length criterion for habitat, the wide opening has made the feature desiccated and therefore determined not to provide potential habitat for listed karst invertebrate species, and no fauna surveys were performed (Table 2).

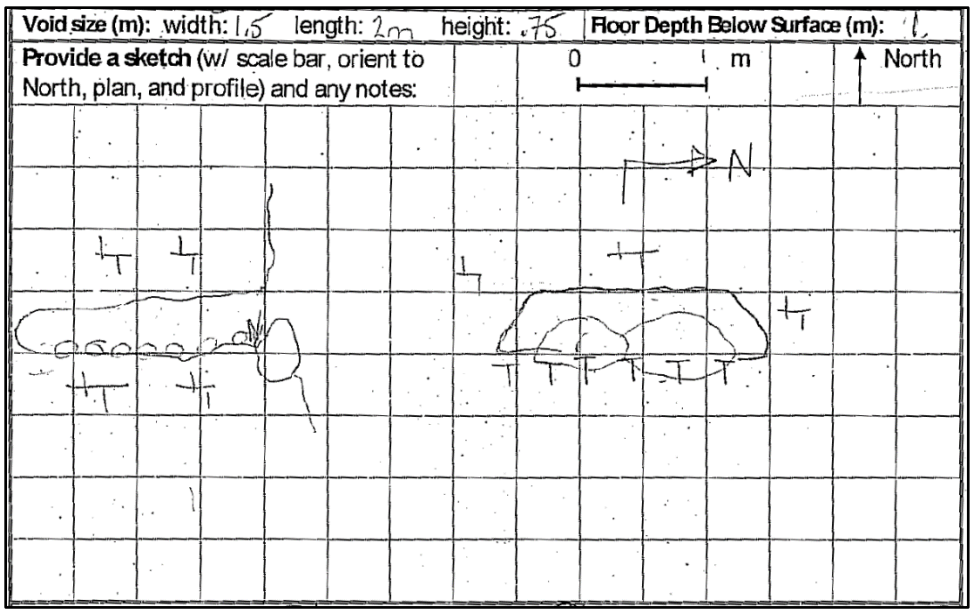

Figure 171. Field sketch of feature 1604-Q48.


Figure 172. Entrance of feature 1604-Q48.

Figure 173. Interior of feature 1604-Q48. Note the bedrock terminus.

Feature 1604-R03; Cave

This feature was located north of the westbound lanes of Loop 1604 west of I-10, on Leon Creek (Figure 174 - Figure 177). It was evaluated on December 15, 2009 and June 11, 2019. It consists of two. small, humanly enterable passages stacked on top of each other. The higher passage had a rocky floor and slopes upwards to where it becomes too narrow to traverse. The lower passage was a narrow horizontal crawlway that becomes too narrow to traverse after 4.9 m (16.1 ft). Due to its length and the presence of mesocavernous voids, it was considered to be potential karst invertebrate habitat (Table 2).

Presence/absence surveys conducted in March and April 2010 detected no karst invertebrate species; however, hundreds of soft bodied ticks, which are known carriers of relapsing fever, were found in the cave. Presence/absence surveys were conducted in August 2019 by inserting traps on long poles into the cave so that surveyors would not have to risk entry (Table 26); however, no troglobites were found (Table 1, Table 27).

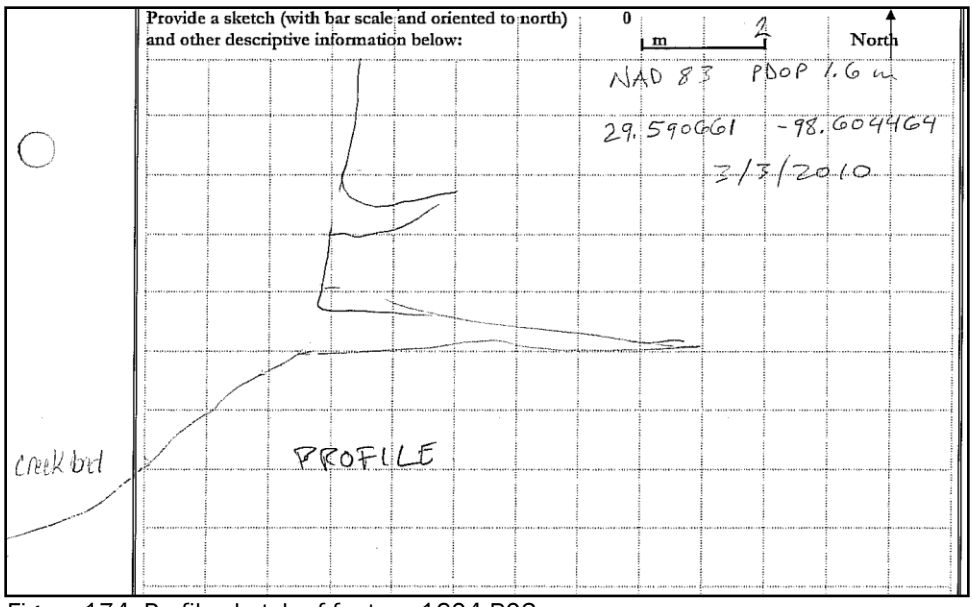

Figure 174. Profile sketch of feature 1604-R03.

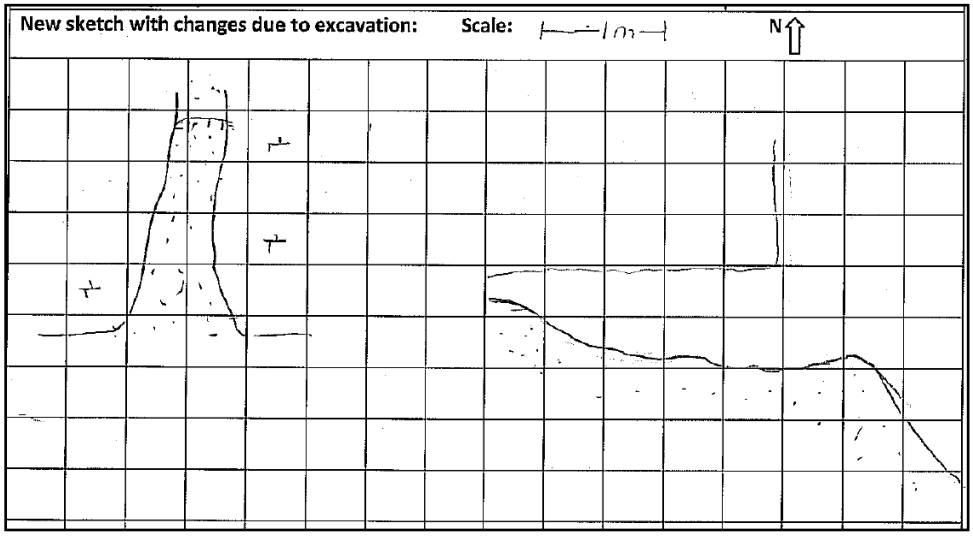

Figure 175. Field sketch of lower part of feature 1604-R03 showing plan and profile.

Figure 176. Overview of feature 1604-R03.

Figure 177. Interior of feature 1604-R03.

Table 26. Summary of 2019 survey activity at feature 1604-R03.

Date	Time	Effort (minutes)	Comments
08/09/2019	-	-	Set traps and data logger
08/12/2019	11:30	10	Checked and reset traps
08/14/2019	11:43	14	Checked and reset traps
08/16/2019	10:37	22	Checked and reset traps
08/19/2019	11:39	12	Checked and reset traps
08/21/2019	10:33	10	Checked and reset traps
08/23/2019	12:39	10	Checked and reset traps
08/26/2019	11:54	12	Checked and reset traps
08/29/2019	12:26	12	Checked and reset traps
08/30/2019	11:09	12	Checked and reset traps
09/01/2019	10:11	8	Checked and reset traps
09/03/2019	11:51	8	Checked and reset traps
09/05/2019	11:45	9	Checked and reset traps
09/07/2019	10:01	10	Checked and reset traps
09/09/2019	17:34	8	Checked traps; removed traps and data logger

Table 27. Summary of fauna observed at feature 1604-R03 in 2019.

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae *Porcellio* sp.
Soft tick	Argasidae
Millipede	Diplopoda
Cricket	Gryllidae *Ceuthophilus* sp. *Ceuthophilus secretus*
Earwig	Dermaptera
Cockroach	Blattaria
Beetle	Coleoptera
Weevil	Curculionidae
Ant	Formicidae
Wasp	Apocrita
Moth	Lepidoptera
Fly/Gnat	Diptera
Mosquito	Culicidae
Gulf Coast toad	*Incilius nebulifer*

Feature 1604-R04; Solution-enlarged bedding plane

This feature was located in a natural cliff near the westbound lanes of Loop 1604, west of I-10 on the west bank of Leon Creek (Figure 178 - Figure 180). A feature evaluation was performed on December 15, 2009, February 25, 2010, and June 11, 2019. It was a solution-enlarged bedding plane that measured 3.0 m (9.8 ft) wide by 1.8 m (5.9 ft) long by 1.8 m (5.9 ft) high at the entrance. This feature contained rocks and leaf-litter. The feature was not humanly enterable and had no airflow. The feature was similar to other features in this cliff, and it had mesocavernous voids.

Feature 1604-R04 was considered potential karst invertebrate habitat due to void size greater than or equal to 1 m (3.3 ft) and similarity to nearby caves (Table 2). Presence/absence surveys were conducted in August and September 2019 (Table 28); however, no troglobites were found (Table 1, Table 29).

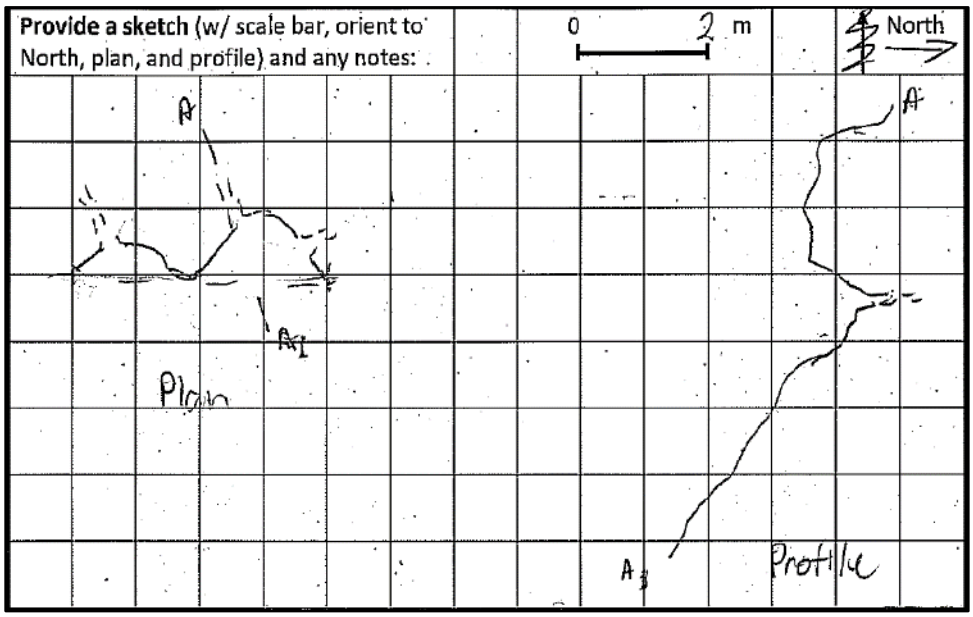

Figure 178. Field sketch of feature 1604-R04.

Figure 179. Overview of feature 1604-R04.

Figure 180. Interior of feature 1604-R04.

Table 28. Summary of survey activity at feature 1604-R04.

Date	Time	Effort (minutes)	Comments
06/11/2019	13:03	-	Feature evaluation;
08/28/2019	11:25	10	Set traps and data logger
08/30/2019	11:08	20	Checked and reset traps
09/01/2019	10:03	7	Checked and reset traps
09/03/2019	11:41	4	Checked and reset traps
09/05/2019	12:15	21	Checked and reset traps
09/07/2019	09:55	10	Checked and reset traps
09/09/2019	17:29	4	Checked and reset traps
09/11/2019	17:00	14	Checked and reset traps
09/13/2019	10:43	6	Checked and reset traps
09/15/2019	09:27	6	Checked and reset traps
09/17/2019	14:49	4	Checked and reset traps
09/19/2019	14:29	4	Checked and reset traps
09/21/2019	10:03	4	Checked and reset traps
09/23/2019	10:05	6	Checked and reset traps
09/25/2019	12:24	8	Checked traps; removed traps and data logger

Table 29. Summary of fauna observed at feature 1604-R04.

Common Name	Lowest Taxonomic Identification
Springtail	Collembola
Roach	Blattaria
Wasp	Hymenoptera
Ant	Formicidae
Gnat	Diptera
Mosquito	Culicidae

Feature 1604-R05; Solution-enlarged bedding plane

This feature was located in a natural cliff in the west bank of Leon Creek near the westbound lanes of Loop 1604, west of I-10 (Figure 181 - Figure 182). An evaluation was performed on December 15, 2009, February 25, 2010, and June 11, 2019. The feature was a solution-enlarged bedding plane that measured 1.8 m (5.9 ft) wide by 2 m (6.6 ft) long and was 0.9 m (3 ft) high at the entrance. It was floored with bedrock. This feature was considered potential karst invertebrate habitat due to void length greater than 1 m (3.3 ft) and the presence of mesocavernous voids (Table 2). Presence/absence surveys were conducted in August and September 2019 (Table 30); however, no troglobites were found (Table 1, Table 31).

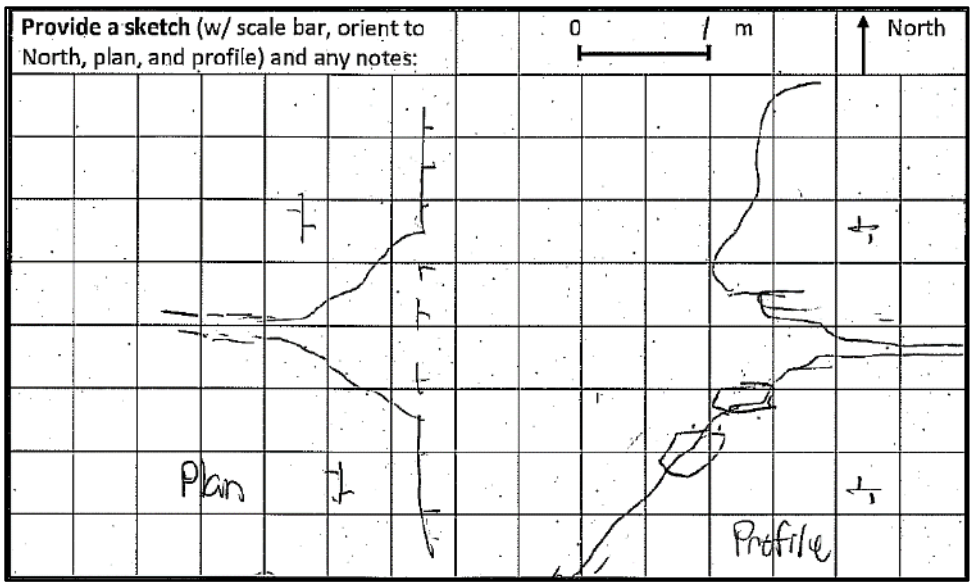

Figure 181. Field sketch of feature 1604-R05.


Figure 182. Close up of feature 1604-R05.

Table 30. Summary of survey activity at feature 1604-R05.

Date	Time	Effort (minutes)	Comments
06/11/2019	10:14	-	Feature evaluation;
08/28/2019	12:18	14	Set traps and data logger
08/30/2019	10:49	6	Checked and reset traps
09/01/2019	10:00	6	Checked and reset traps
09/03/2019	11:35	6	Checked and reset traps
09/05/2019	11:34	15	Checked and reset traps
09/07/2019	09:03	6	Checked and reset traps
09/09/2019	17:26	4	Checked and reset traps
09/11/2019	16:57	4	Checked and reset traps
09/13/2019	10:39	6	Checked and reset traps
09/15/2019	09:21	8	Checked and reset traps
09/17/2019	14:47	4	Checked and reset traps
09/19/2019	14:26	4	Checked and reset traps
09/21/2019	09:58	6	Checked and reset traps
09/23/2019	10:01	9	Checked and reset traps
09/25/2019	12:16	14	Checked traps; removed traps and data logger

Table 31. Summary of fauna observed at feature 1604-R05.

Common Name	Lowest Taxonomic Identification
Spider (epigean)	Araneae
Soft Tick	Argasidae
Ant	Formicidae
Moth	Lepidoptera
Gnat	Diptera
Mosquito	Culicidae

Feature 1604-R06; Solution-enlarged Bedding Plane

This feature was located north of Loop 1604, just west of I-10 (Figure 183 - Figure 185). It was assessed on December 15, 2009 and June 11, 2019. This was a 12.2 m (40.0 ft) zone of enlarged bedding planes and vuggy cliff face that extends up to 0.9 m (3.0 ft) into the rock and had an overall depth of approximately 1.8 m (5.9 ft). The feature contained breakdown, silty clay, and exposed bedrock. Due to the presence of mesocavernous voids (Table 2), it was sampled for karst fauna in March and April 2010 using traps pushed back into the voids with retrieval strings. No karst invertebrate species were detected. Presence/absence surveys were conducted in August and September 2019 (Table 32); however, no troglobites were found (Table 1).

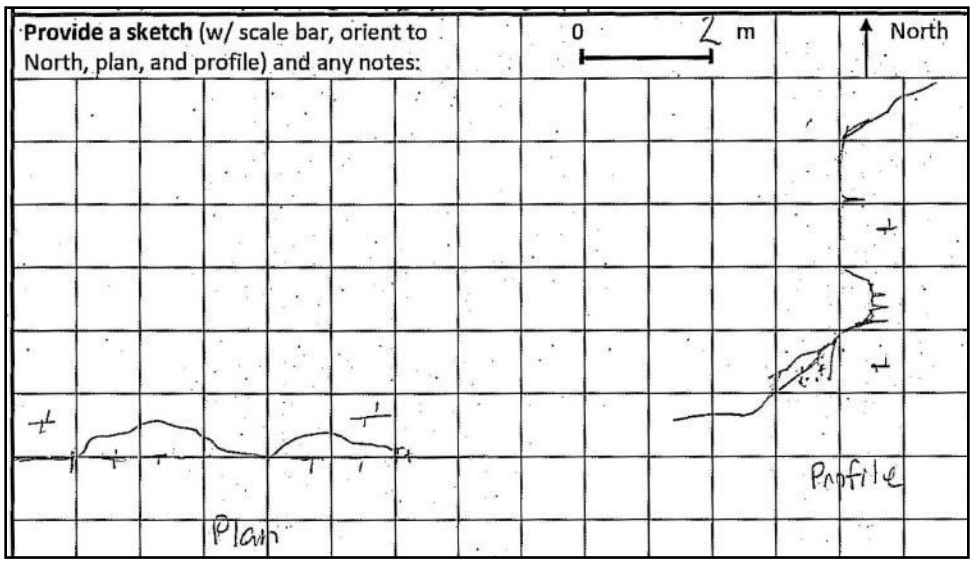

Figure 183. Field sketch of feature 1604-R06.


Figure 184. Overview of feature 1604-R06.

Figure 185. Enlarged bedding planes characteristic of feature 1604-R06.

Table 32. Summary of survey activity at feature 1604-R06.

Date	Time	Effort (minutes)	Comments
08/12/2019	11:20	10	Feature evaluation; set traps and data logger
08/14/2019	11:35	12	Checked and reset traps
08/16/2019	10:28	10	Checked and reset traps
08/19/2019	11:32	8	Checked and reset traps
08/21/2019	10:27	8	Checked and reset traps
08/23/2019	12:32	8	Checked and reset traps
08/26/2019	11:50	4	Checked and reset traps
08/28/2019	11:49	8	Checked and reset traps
08/30/2019	10:44	6	Checked and reset traps
09/01/2019	09:57	6	Checked and reset traps
09/03/2019	11:33	4	Checked and reset traps
09/05/2019	11:30	12	Checked and reset traps
09/07/2019	09:48	6	Checked and reset traps
09/09/2019	17:24	4	Checked and reset traps
09/11/2019	16:54	4	Checked and removed traps and data logger

Table 33. Summary of fauna observations at feature 1604-R06.

Common Name	Lowest Taxonomic Identification
Spider	Araneae
Cockroach	Blattaria
Ant	Formicidae
Moth	Lepidoptera
Fly/Gnat	Diptera
Garter snake	*Thamnophis marcianus*

Feature 281-117; Cave (sealed)

Feature 281-117 was encountered during construction on August 31, 2017, during the excavation of a footing for Bent 4 of the westbound Loop 1604 to northbound US 218 Direct Connect at station 207+84, on the northeast corner of Loop 1604 and US 281 (Figure 186 - Figure 188) (TxDOT 2019c). The feature was 1.5 m (4.9 ft) wide, 1.5 m (4.9 ft) long, and 2.5 m (8.2 ft) deep. The feature was evaluated the same day and found to be an enterable cave. The cave had indications of moisture, including flowstone and active drips. Organic rich sediment was also present within the cave, as were mesocavernous extensions. No airflow or troglobitic fauna were observed during the initial evaluation; however, spider webs were observed in the cave (Figure 188).

This feature was considered potential karst invertebrate habitat due to the size of the void and the presence of spider webs (Table 2). The feature was excavated by hand on September 1, 2017 to remove debris and allow space for surveyors to set traps and conduct biota surveys. Presence/absence surveys were conducted in September and October 2017;

notable fauna are summarized in Table 1 and Table 34. Karst invertebrate habitat was confirmed with the observation of troglobitic silverfish (*Texoreddellia* sp.); however, no listed species were detected. The feature was sealed after surveys were complete to continue with construction. The construction activities were covered under the 281 Biological Opinion (USFWS 2015b).

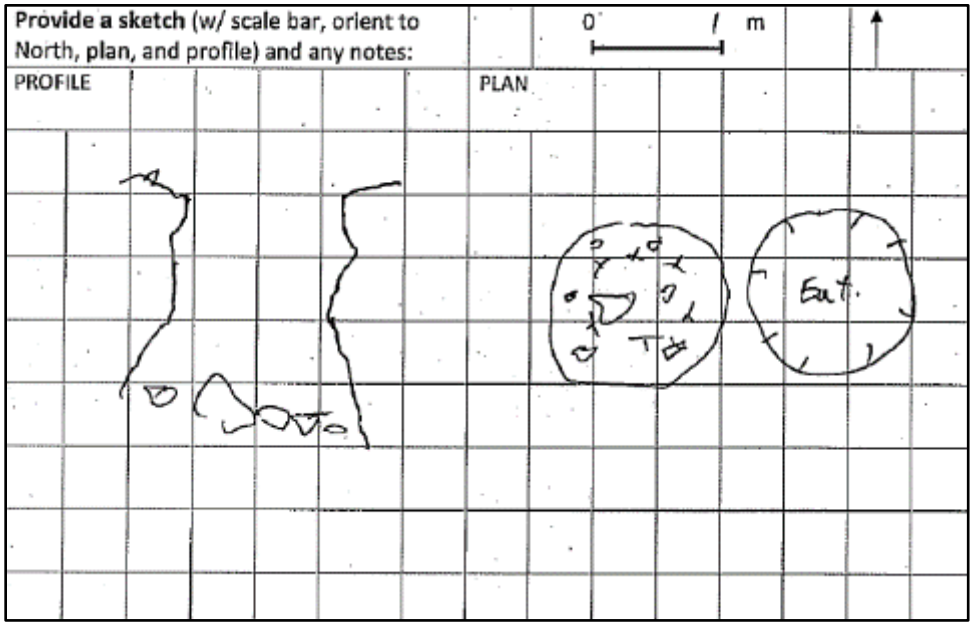

Figure 186. Field sketch of feature 281-117.


Figure 187. Entrance of feature 281-117.

Figure 188. Interior of feature 281-117. Note spider webs in the center right of the view.

Table 34. Summary of fauna observations at feature 281-117.

Common Name	Lowest Taxonomic Identification
Spider	Araneae (epigean)
Mites	Acarina
Silverfish	*Texoreddellia* sp.
Cricket	Gryllidae
Earwig	Dermaptera
Beetle	Coleoptera (epigean)
Ant	Formicidae *Solenopsis invicta*
Fly	Diptera (larva)

Feature 281-121 (Turnaround Cave); Cave; destroyed

Feature 281-121 was located on the northeast corner of northbound US 281 and the westbound turnaround of Loop 1604 (Figure 189 - Figure 191) (TxDOT 2019c). It was encountered on November 3, 2017 during the drilling of a shaft for the support structure of a flyover for the Loop 1604/US 281 interchange project (Figure 190). It was a humanly enterable, highly decorated cave. The cave chamber was 9 m (29.5 ft) long, 5 m (16.4 ft) wide, and 2.1 (6.9 ft) high. The drilling rig penetrated the ceiling of the chamber at a depth of 2.8 m (9.2 ft). The cave exhibited a range of sediment and surface types, and had active drips from ceiling formations as well as pores and jointed and fractured cracks in the limestone bedrock (Figure 191). The cave walls were a combination of calcite flowstone and

bedrock, while the cave floor was composed of bedrock, fine-grained rock sediment, red/brown and/or tan clay, dark brown mud cracks, and calcite surfaces. Prior to construction, the cave did not have an entrance or any kind of surface expression, nor was any airflow noted.

This feature was considered potential karst invertebrate habitat due to being humanly enterable, being similar to nearby caves, and its extent (Table 2). Presence/absence surveys were conducted in November and December 2017; notable fauna are summarized in Table 1 and Table 35. Karst invertebrate habitat was confirmed with the observation of troglobitic silverfish (*Texoreddellia* sp.); however, no listed species were detected. After surveys were complete, the cave was destroyed by the installation of the flyover pier (Figure 192). The construction activities were covered under the 281 Biological Opinion (USFWS 2015b).

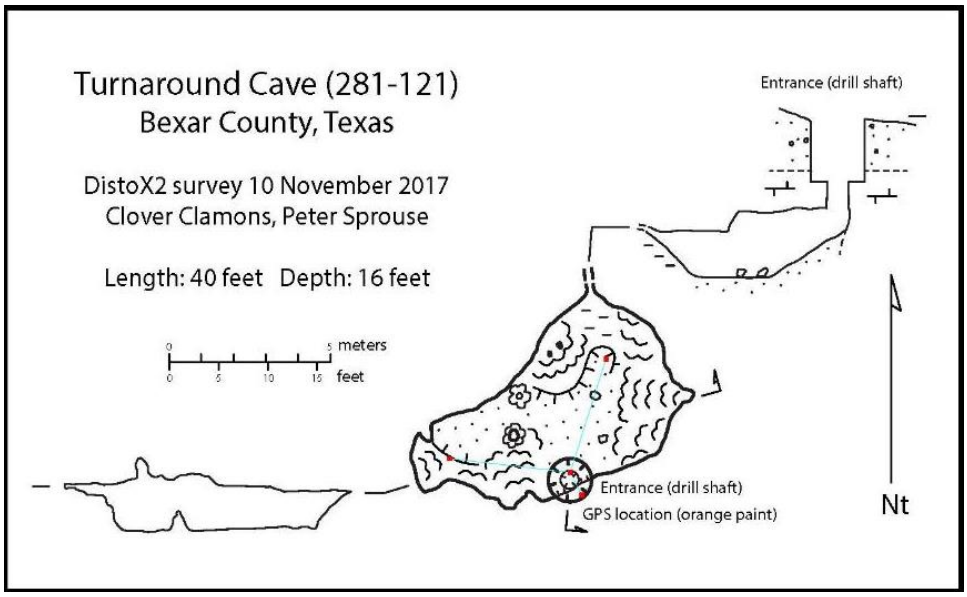

Figure 189. Cave map of feature 282-121.

Figure 190. Entrance to feature 281-121 in drilled hole.

Figure 191. Interior of feature 281-121. Note placement of climate data logger.

Figure 192. 2019 view of flyover pier at former site of feature 281-121.

Table 35. Summary of faunal observation at feature 281-121.

Common Name	Lowest Taxonomic Identification
Silverfish	*Texoreddellia* sp.
Click Beetle	Coleoptera (epigean)
Ant	*Solenopsis invicta*
Mosquito	Culicidae
Gnat	Diptera

Feature G04; Solution Cavity

This feature was located on the west side of the I-10 access road, north of Loop 1604. It was located in November 2014 as part of the I-10 managed lanes study (TxDOT 2015b) and was reassessed on September 27, 2019 as part of this study. This feature was a pair of solution cavities that was 3 m (9.8 ft) wide, 1 m (3.3 ft) in maximum length, and 0.5 m (1.6 ft) high. It contained modern soils and leaf litter. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

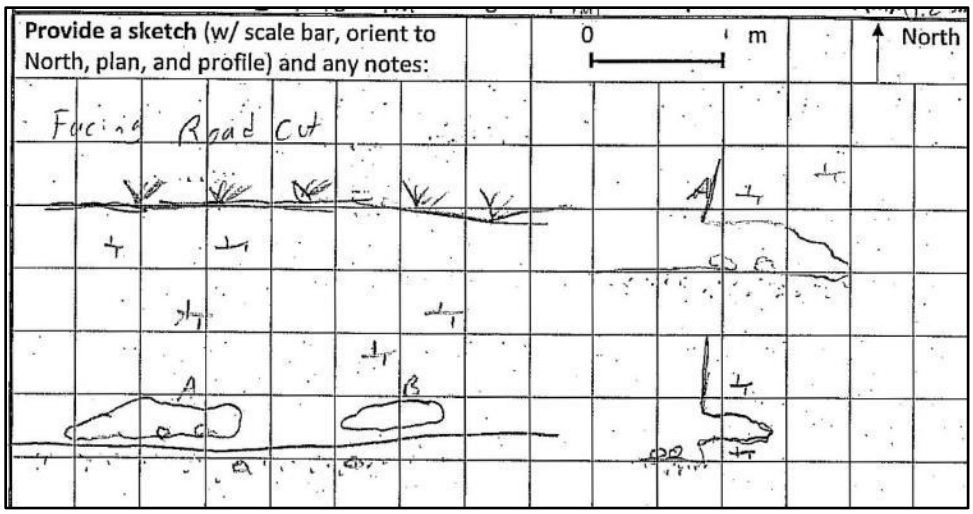

Figure 192. Field sketch of feature G04.


Figure 193. Overview of Feature G04a.

Figure 194. Interior view of feature G04a.

Figure 195. Interior view of feature G04b.

Feature HB-007; Zone with Solution Cavity and Solution-enlarged Bedding Plane

This feature was in the roadcut north of the westbound mainlanes of Loop 1604 east of Bitters Road. It was assessed on November 28, 2017 (Figure 196 - Figure 198) (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This zone consists of a solution cavity 0.5 m (1.5 ft) wide by 0.6 m (2 ft) long by 0.8 m (2.5 ft) high above a solution-enlarged bedding plane that was 2.1 m (7 ft) wide by 0.2 m (0.5 ft) long by 0.2 m (0.5 ft) high. A second solution-enlarged bedding plane that was 0.5 m (1.5 ft) wide by 0.1 m (0.3 ft) long by 0.1 m (0.3 ft) high was below and to the west. The solution cavity was developed along a fracture trending 315 degrees. This feature contained fine red-soil, cobbles, vegetation, roadside debris, and bedrock. It does not have any mesocavernous voids extending from the footprint. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

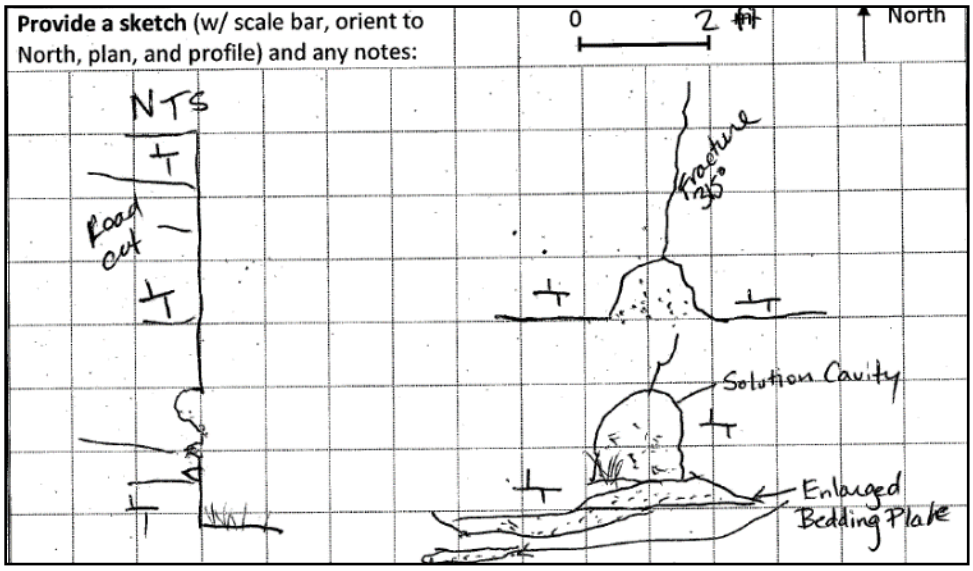

Figure 196. Field sketch of feature HB-007.

Figure 197. Overview of feature HB-007.

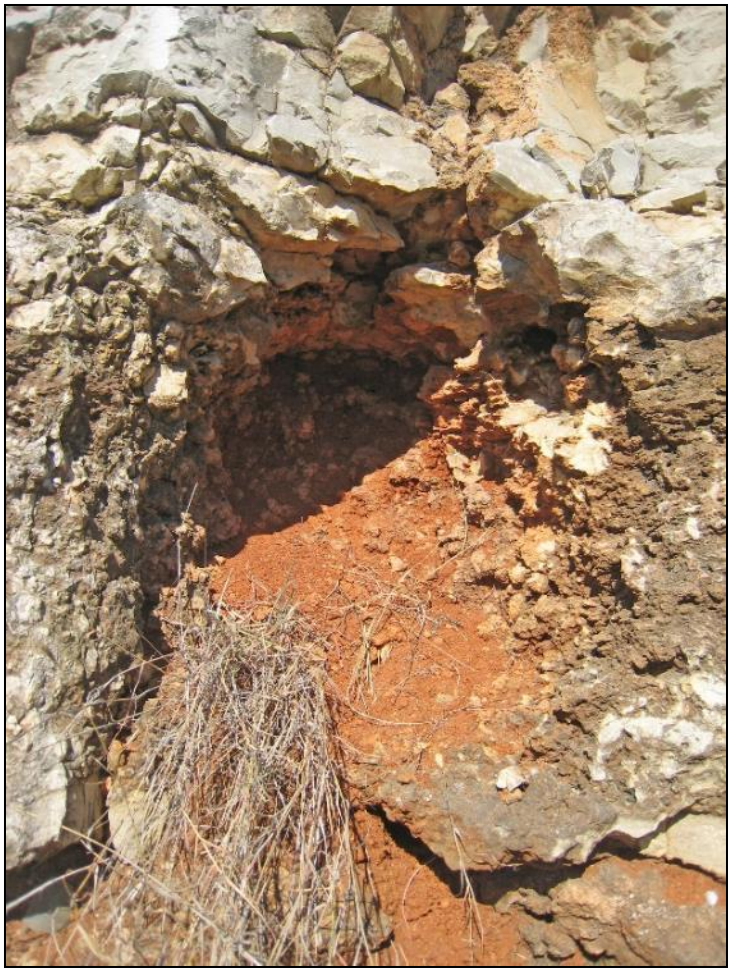

Figure 198. Interior of feature HB-007.

Feature HB-008; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Bitters Road. It was evaluated on November 28, 2017, and reconnaissance excavation was performed (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This feature was a solution-enlarged bedding plane that was 3.7 m (12 ft) wide by 0.8 m (2.5 ft) long by 2.4 m (8 ft) high that had collapsed (Figure 199 - Figure 200). This feature contained loose rocks and bedrock. Collapsed materials are accumulated below the feature along the base of the roadcut, indicating that the collapse occurred since the construction of Loop 1604 in the early 1980's. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

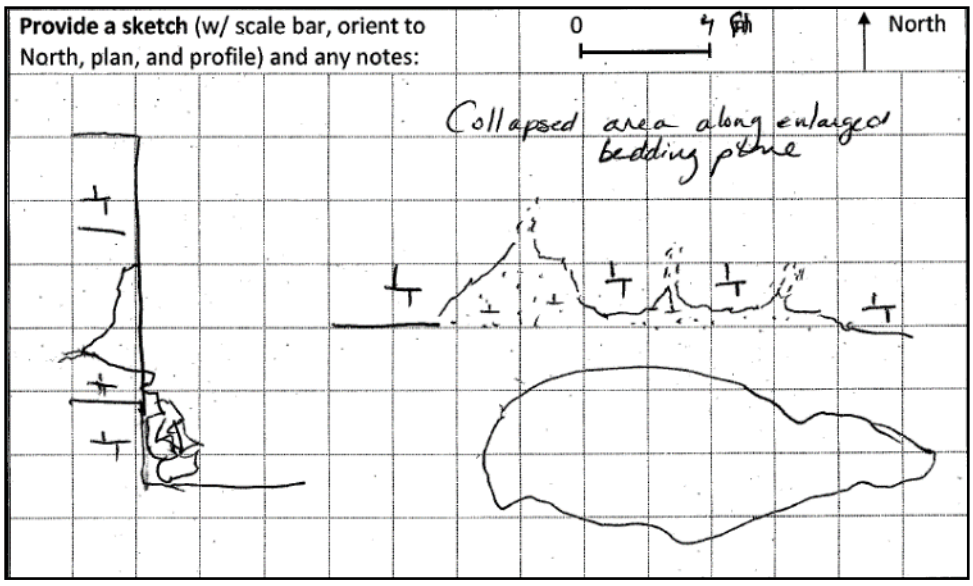

Figure 199. Field sketch of feature HB-008.


Figure 200. Overview of feature HB-008.

Feature HB-009; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Bitters Road. It was evaluated on November 28, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This was a solution-enlarged bedding plane 2.4 m (8 ft) wide by 0.5 m (1.5 ft) long by 1.1 m (3.75 ft) tall that had collapsed (Figure 201 - Figure 203). The collapsed materials are accumulated below the feature along the base of the roadcut, indicating that the collapse occurred since the construction of Loop 1604 in the early 1980's. This feature contained stones, vegetation, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

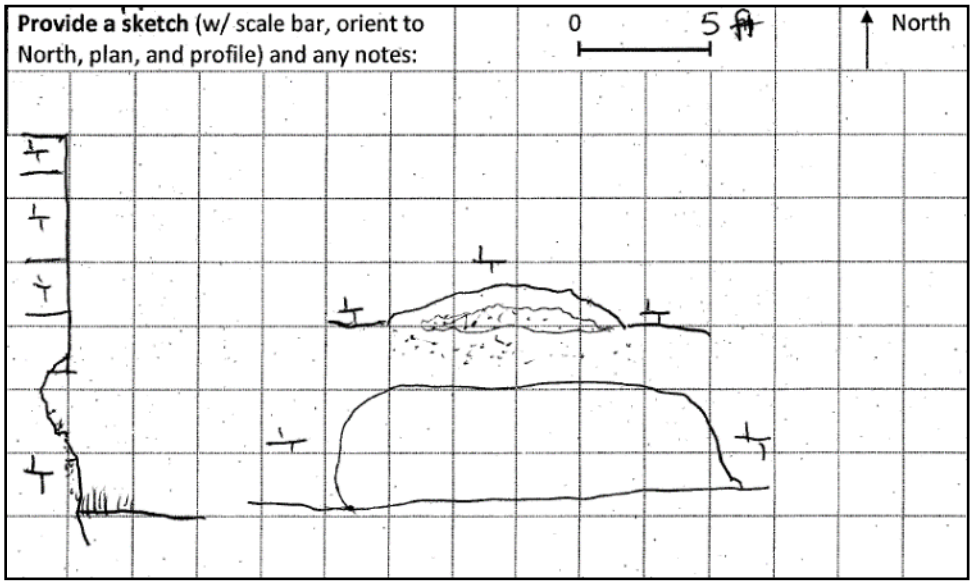

Figure 201. Field sketch of feature HB-009.

Figure 202. Overview of feature HB-009.

Figure 203. Interior of feature HB-009.

Feature HB-010; Solution Cavity

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Bitters Road. It was evaluated on November 28, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution cavity was 0.3 m (1 ft) wide by 0.5 m (1.75 ft) long by 0.3 m (1 ft) high (Figure 204 - Figure 206). This feature contained fine red-tan soils and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

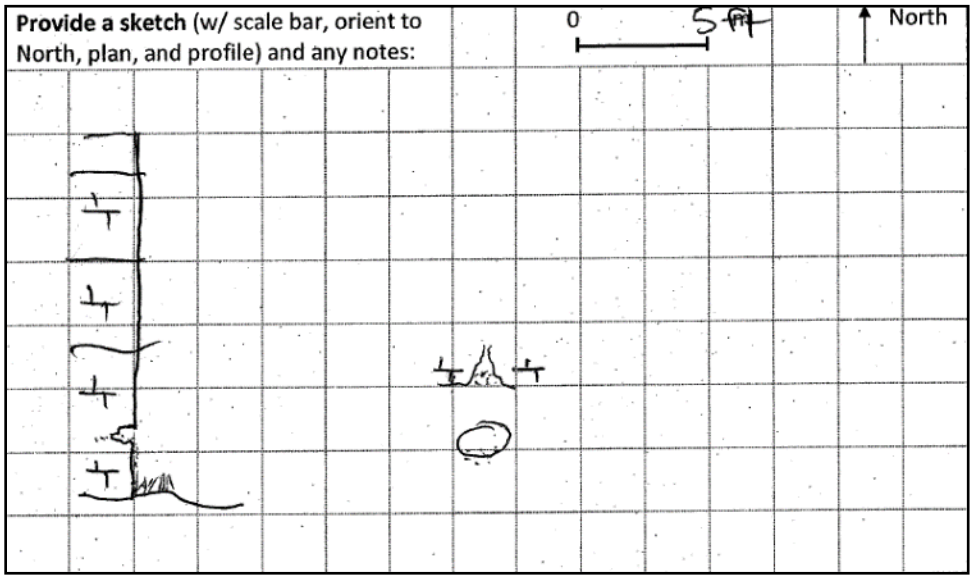

Figure 204. Field sketch of feature HB-010.

Figure 205. Overview of feature HB-010.

Figure 206. Interior of feature HB-010.

Feature HB-013; Zone with Solution Cavity and Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Bitters Road. It was evaluated on November 28, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This zone includes a solution cavity that was 0.6 m (2 ft) wide by 0.6 m (2 ft) long by 1.1 m (3.5 ft) high and a solution-enlarged bedding plane that was 1.2 m (4 ft) wide by 0.6 m (2 ft) long by 0.3 m (1 ft) high (Figure 207 - Figure 209). This feature contained red fine soils, cobbles, vegetation, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

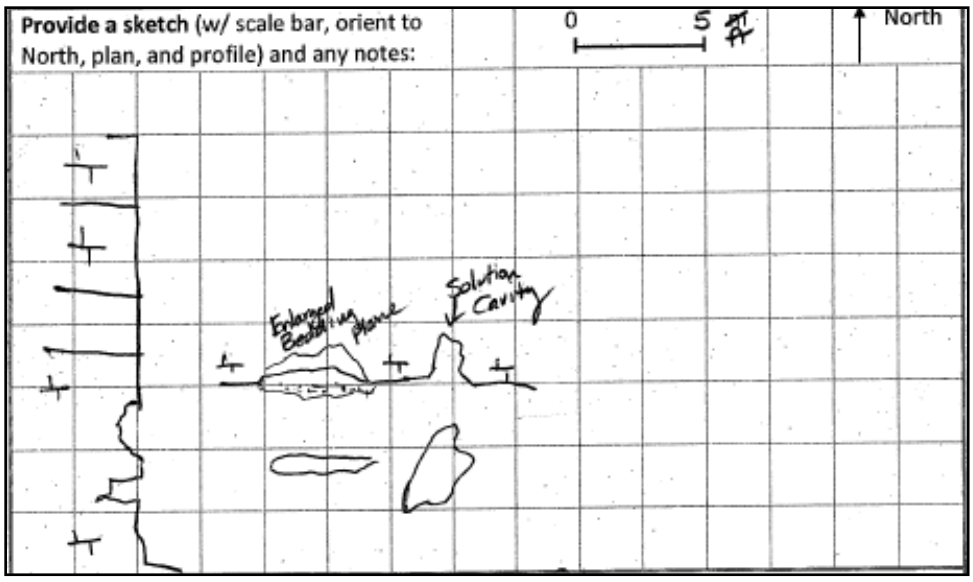

Figure 207. Field sketch of feature HB-013.


Figure 208. Overview of feature HB-013.

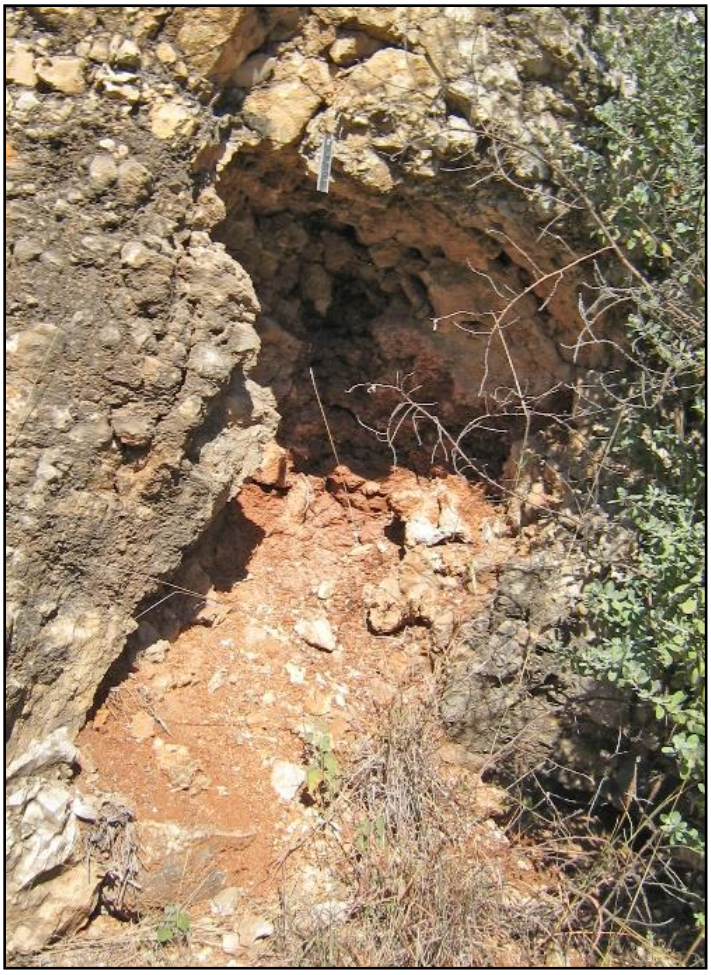

Figure 209. Interior of feature HB-013.

Feature HB-014; Zone with Sinkhole and Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Bitters Road. This feature was originally described as 1604-W07; however, due to the distance from the original GPS point, the feature was re-described as HB-014 on November 28, 2017 (TxDOT 2018a). In 2019, the original data were examined to verify whether the feature met current USFWS habitat criteria. This feature was a zone containing a bisected collapsed sinkhole and a solution-enlarged bedding plane. The zone containing the features was 4.6 m (15 ft) wide by 1.2 m (4 ft) long by 3.7 m (12 ft) high (Figure 210 - Figure 213). Both features appear to have collapsed after the original construction of Loop 1604, based on the materials accumulated below the features. This zone of features was infilled with coarse soils, cobbles, vegetation, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

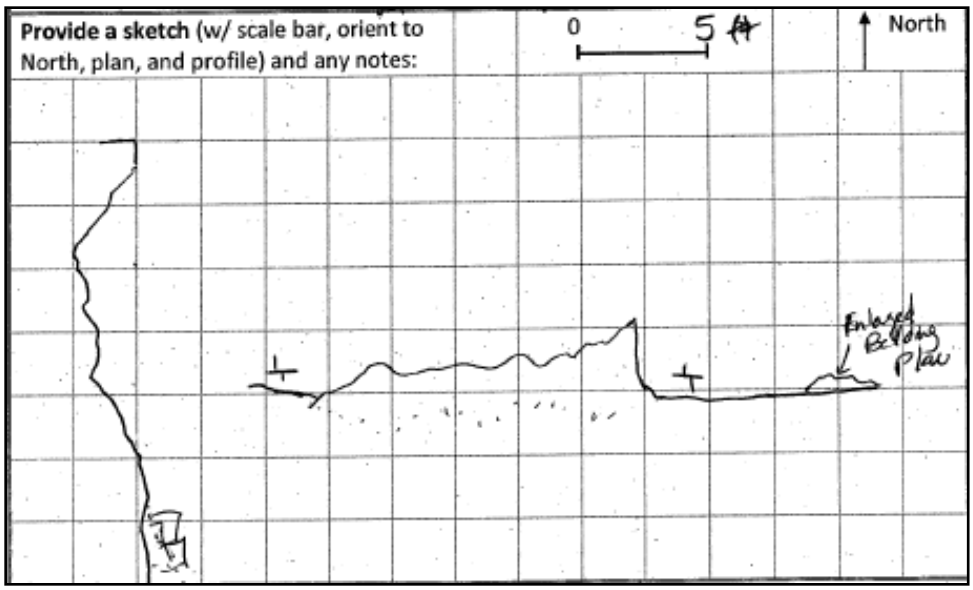

Figure 210. Field sketch of feature HB-014.


Figure 211. Overview of feature HB-014.

Figure 212. Overview of the sinkhole portion of HB-014.

Figure 213. Interior of the solution-enlarged bedding plane portion of feature HB-014.

Feature HB-016; Zone with Solution Cavities

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 west of Bitters Road. It was evaluated on November 28, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This zone includes two solution cavities, the largest of which was 1.5 m (5 ft) wide by 0.5 m (1.5 ft) long by 0.9 m (3 ft) high (Figure 214 - Figure 215). The solution cavities are infilled with fine red clay and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

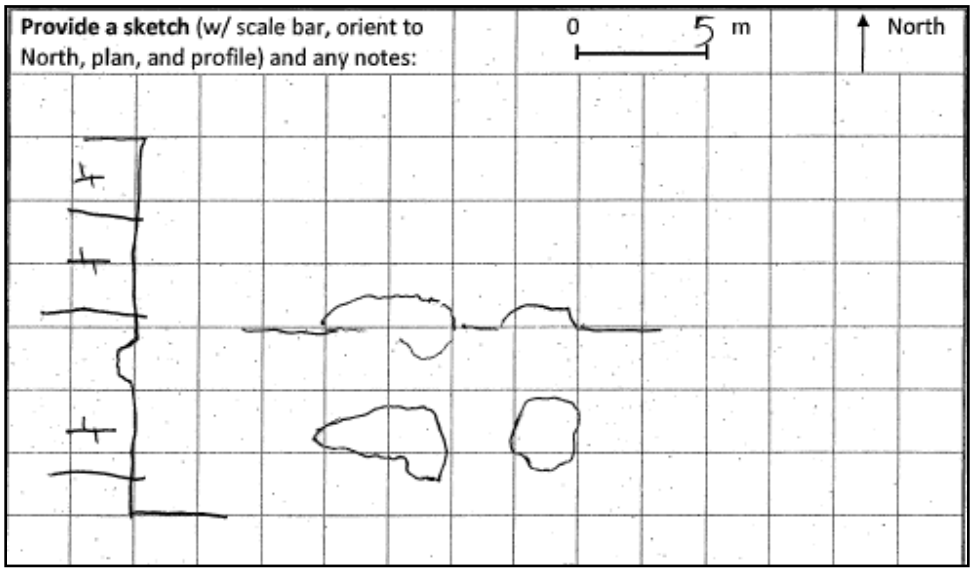

Figure 214. Field sketch of feature HB-016.

Figure 215. Overview of feature HB-016.

Feature HB-018; Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Bitters Road. It was evaluated on November 28, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution-enlarged bedding plane was 1.5 m (5 ft) wide by 0.6 m (2 ft) long by 0.6 m (2 ft) tall (Figure 216 - Figure 217). This feature contained fine red soils, cobbles, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

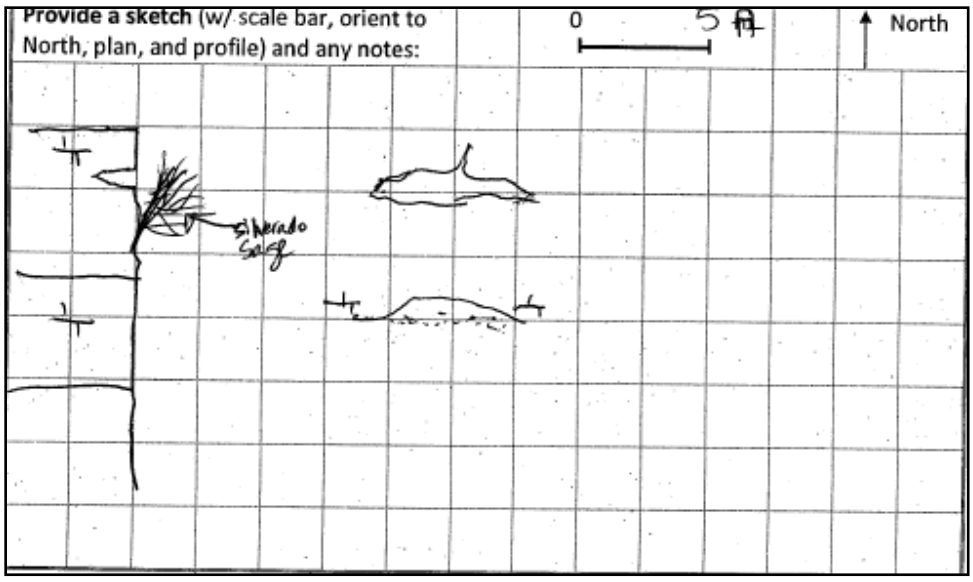

Figure 216. Field sketch of feature HB-018.


Figure 217. Overview of feature HB-018.

Feature HB-019; Solution Cavity

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Bitters Road and originally assessed as part of another study (TxDOT 2018a). The data from that study were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution cavity was 0.8 m (2.5 ft) wide by 0.5 m (1.5 ft) long by 1.8 m (6 ft) high (Figure 218 - Figure 220). This feature contained fine red soils, cobbles, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

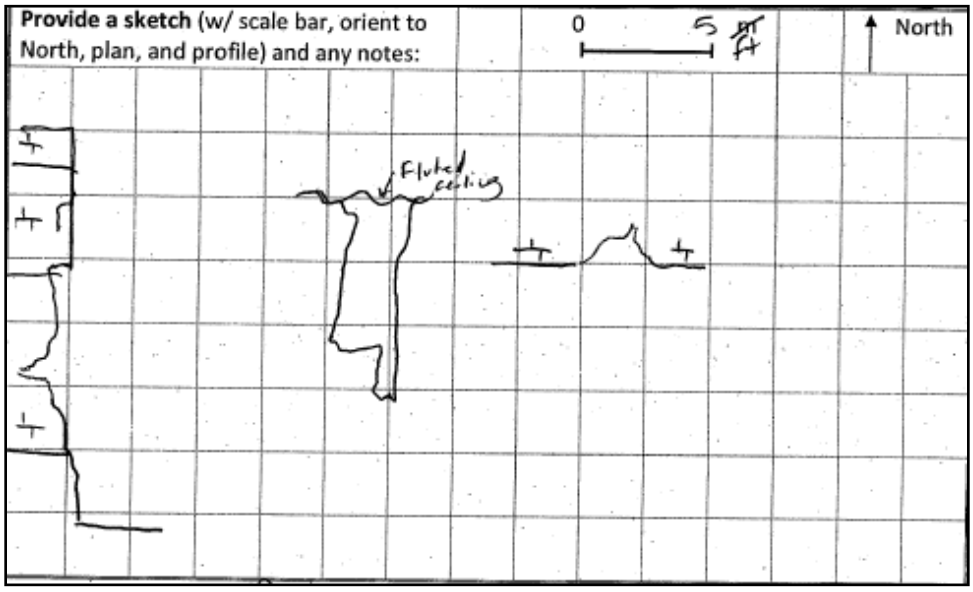

Figure 218. Field sketch of feature HB-019.

Figure 219. Overview of feature HB-019.

Figure 220. Close up of feature HB-019.

Feature HB-020; Solution Cavity

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 west of Bitters Road and originally assessed as part of another study (TxDOT 2018a). The data from that study were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution cavity was 0.8 m (2.5 ft) wide by 0.8 m (2.5 ft) long by 1.2 m (4 ft) high (Figure 221 - Figure 222). This feature contained fine to coarse red soils, cobbles, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

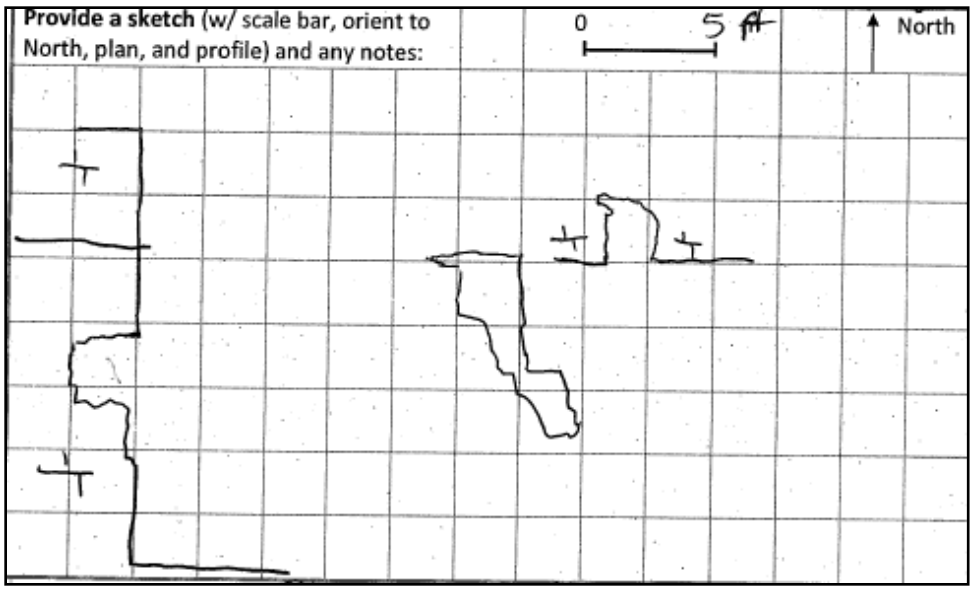

Figure 221. Field sketch of feature HB-020.


Figure 222. Overview of feature HB-020.

Feature HB-021; Zone with Solution Cavity and Solution-enlarged Bedding Plane

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 west of Bitters Road. It was evaluated on November 28, 2017 (TxDOT 2018a) and July 3, 2019. This feature was a zone containing a solution cavity and a solution-enlarged bedding plane. The zone containing the features was 1.5 m (5 ft) wide by 0.8 m (2.5 ft) long by 0.5 m (1.5 ft) high with the largest void aperture at 0.5 m (1.5 ft) (Figure 223 - Figure 225). These features contain coarse to fine red clay, cobbles, vegetation, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

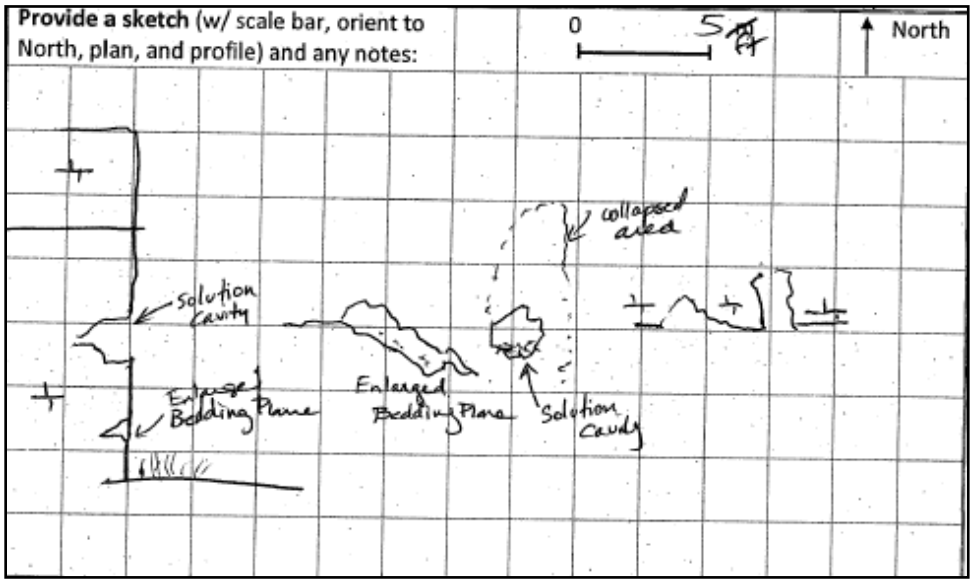

Figure 223. Field sketch of feature HB-021.

Figure 224. Overview of feature HB-021.

Figure 225. Interior of the solution cavity portion of feature HB-021, showing red terra rosa clay.

Feature HB-022; Sinkhole

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Bitters Road and originally assessed as part of another study (TxDOT 2018a). The data from that study were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This collapsed sinkhole, bisected by the roadcut was 3.7 m (12 ft) wide by 0.9 m (3 ft) long by 3.7 m (12 ft) high (Figure 226 - Figure 227). It appears to have collapsed after the roadcut was made for the original construction of Loop 1604 in the early 1980's. This feature contained coarse to fine red soils, cobbles, flowstone on the interior wall, vegetation, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

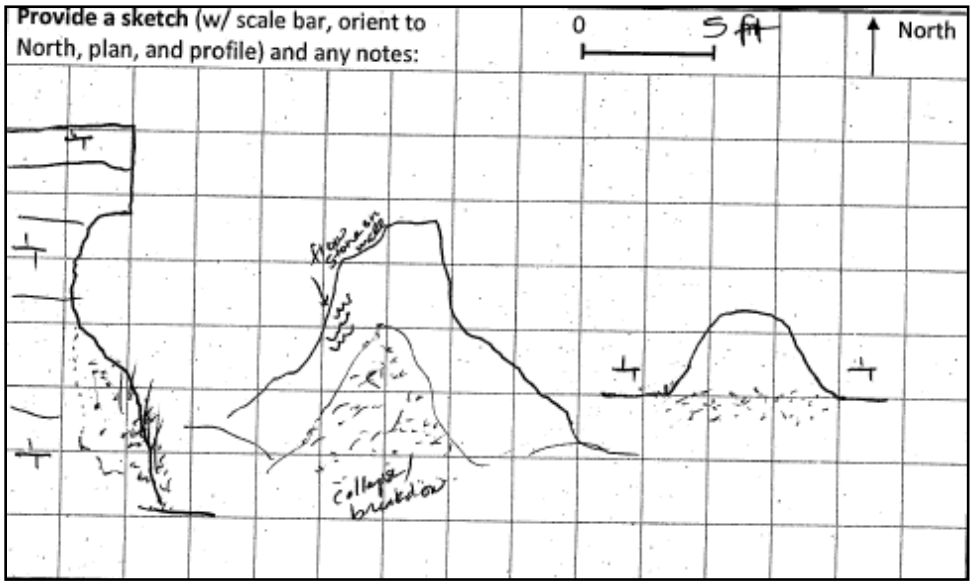

Figure 226. Field sketch of feature HB-022.

Figure 227. Overview of feature HB-022.

Feature HB-023; Solution Cavity

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Huebner Road (Figure 228 - Figure 230). It was evaluated on November 29, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution cavity measured 0.3 m (1 ft) wide by 0.4 m (1.25 ft) long by 0.2 m (0.5 ft) high and contained breakdown, fine soil, and exposed bedrock. The feature was located 0.5 m (1.5 ft) above the base of the roadcut and appears to have a mesocavernous extension into the roadcut (Figure 230). This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

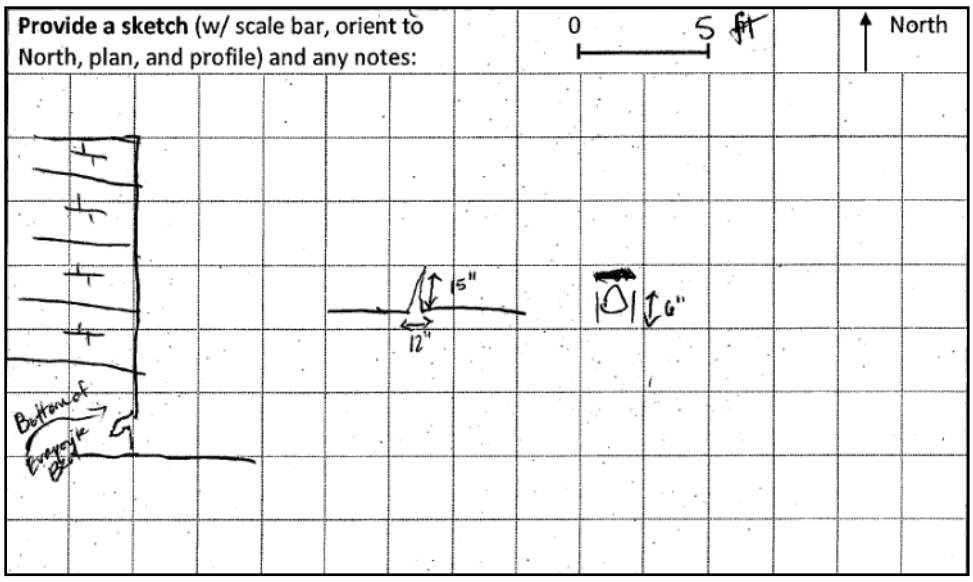

Figure 228. Field sketch of feature HB-023.


Figure 229. Overview of feature HB-023.

Figure 230. Interior of feature HB-023.

Feature HB-024; Sinkhole

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, west of Huebner Road (Figure 231 - Figure 232). It was evaluated on November 29, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This sinkhole, which was bisected by the roadcut, measured 1.8 m (6 ft) wide by 0.9 m (3 ft) long by 3.7 m (12 ft) high. It was located and contained breakdown, fine red clay, cobbles, vegetation, and exposed bedrock. The feature was located approximately 2.1 m (7 ft) above the base of the roadcut. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

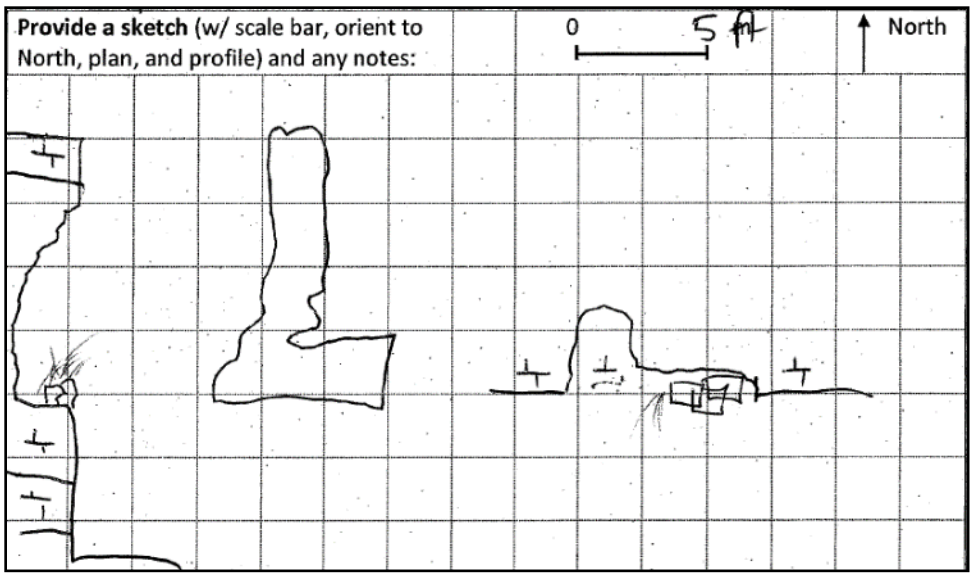

Figure 231. Field sketch of feature HB-024.

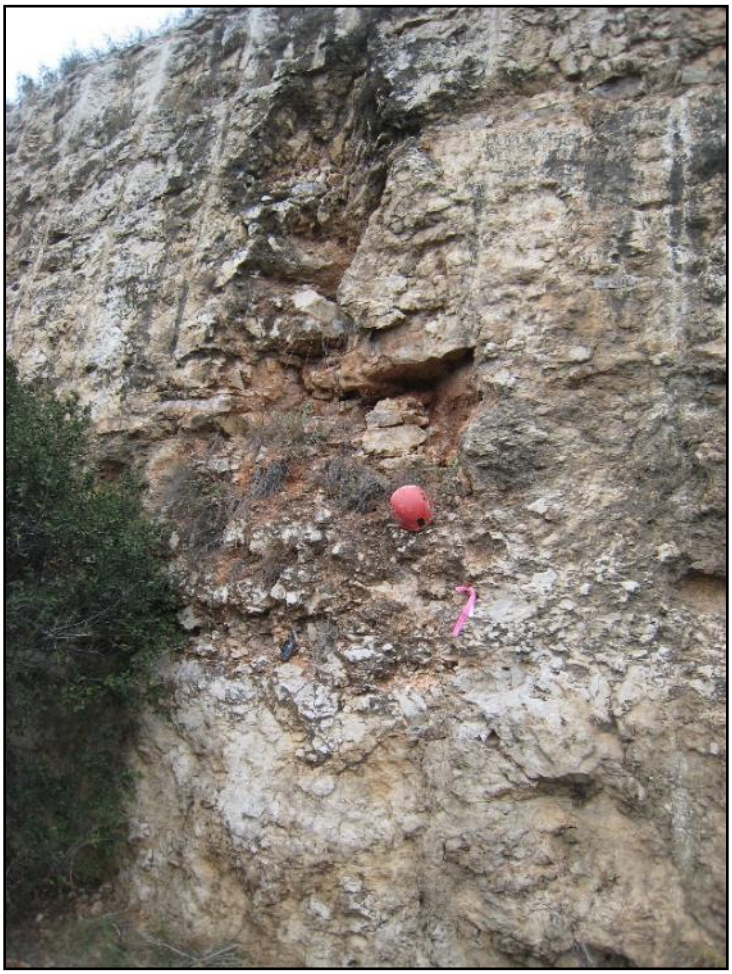
Figure 232. Overview of feature HB-024.

Feature HB-026; Solution Cavity

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, west of Bitters Road. It was evaluated on November 29, 2017(TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria.\. This solution cavity was 0.1 m (0.3 ft) wide by 0.6 m (2 ft) long by 0.5 m (1.5 ft) high and trends into the roadcut at 180 degrees (Figure 233 - Figure 235). This feature contained fine red soils and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

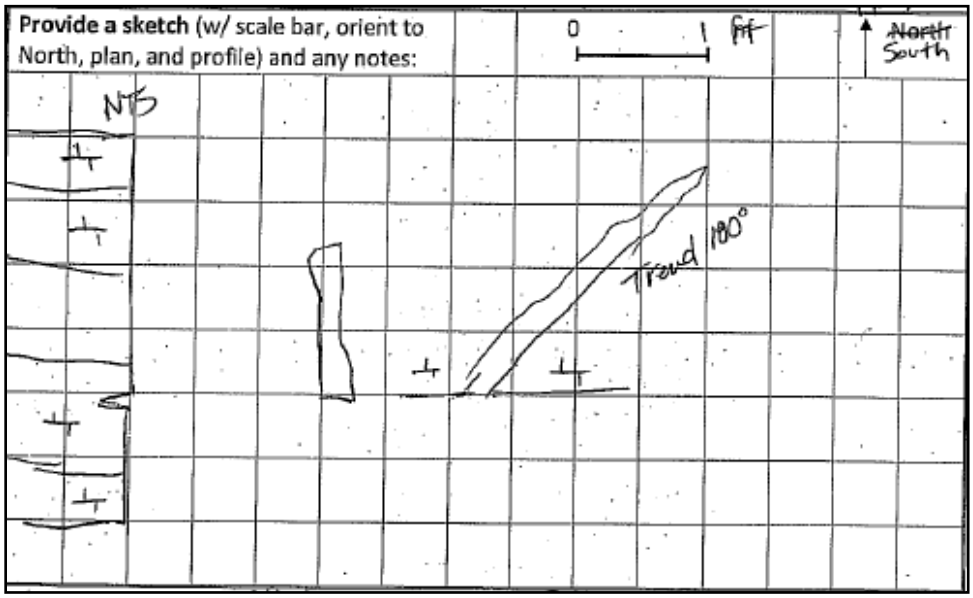

Figure 233. Field sketch of feature HB-026.

Figure 234. Overview of feature HB-026.

Figure 235. Interior of feature HB-026.

Feature HB-027; Solution Cavity

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604 west of Bitters Road. It was evaluated on November 29, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution cavity, developed on a solution-enlarged bedding plane was 4.6 m (15 ft) wide by 1.5 m (5 ft) long by 3.7 m (12 ft) high (Figure 236 - Figure 238). This feature contained coarse to fine red-tan soils, cobbles, vegetation, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

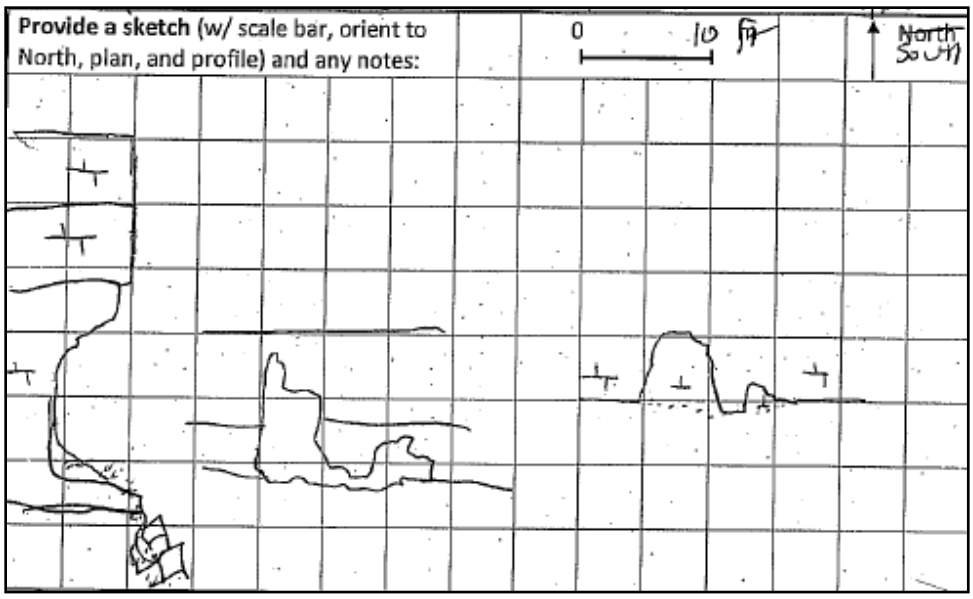

Figure 236. Field sketch of feature HB-027.


Figure 237. Overview of feature HB-027.

Figure 238. Interior of feature HB-027.

Feature HB-029; Solution-enlarged Bedding Plane

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, east of Bitters Road. It was evaluated on November 29, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution-enlarged bedding plane was 1.8 m (6 ft) wide by 0.9 m (3 ft) long by 0.4 m (1.25 ft) tall (Figure 239 - Figure 240). This feature contained cobbles and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

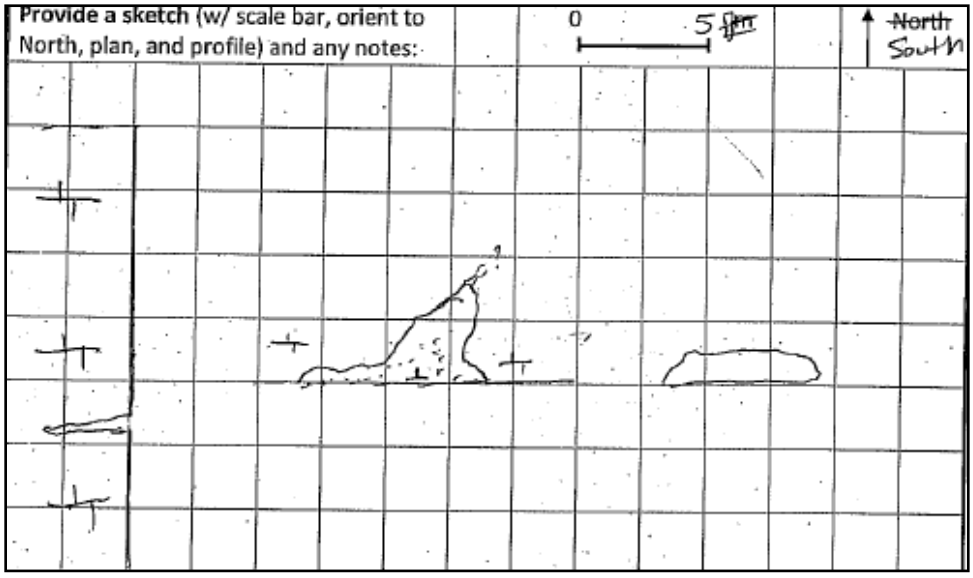

Figure 239. Field sketch of feature HB-029.

Figure 240. Overview of feature HB-029.

Feature HB-030; Solution-enlarged Bedding Plane

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, east of Bitters Road. It was evaluated on November 29, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution-enlarged bedding plane was 2.4 m (8 ft) wide by 1.1 m (3.6 ft) long by 0.2 m (0.75 ft) tall (Figure 241 - Figure 242). This feature contained only exposed bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

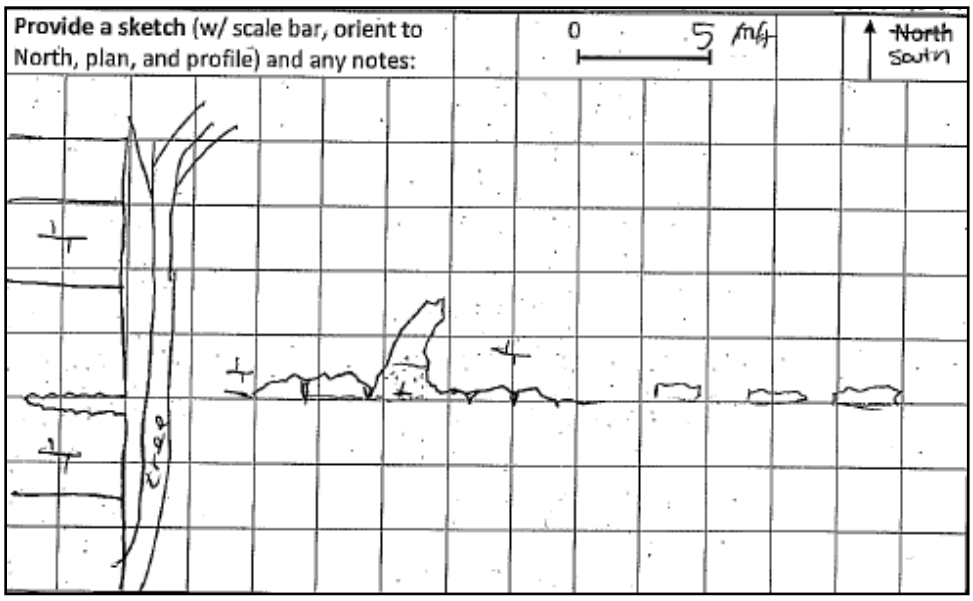

Figure 241. Field sketch of feature HB-030.


Figure 242. Overview of feature HB-030.

Feature HB-031; Sinkhole

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, west of Huebner Road (Figure 243 - Figure 245) and originally assessed as part of another study (TxDOT 2018a). The data from that study were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This sinkhole, which was bisected by the roadcut, measured 2.1 m (7 ft) wide by 1.1 m (3.5 ft) long by 2.9 m (9.5 ft) high. It contained breakdown, fine red clay, cobbles, vegetation, and exposed bedrock. The feature had no visible mesocavernous extensions, but appears to be developed laterally along a bedding plane. The feature was located approximately 0.8 m (2.5 ft) above the base of the roadcut. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

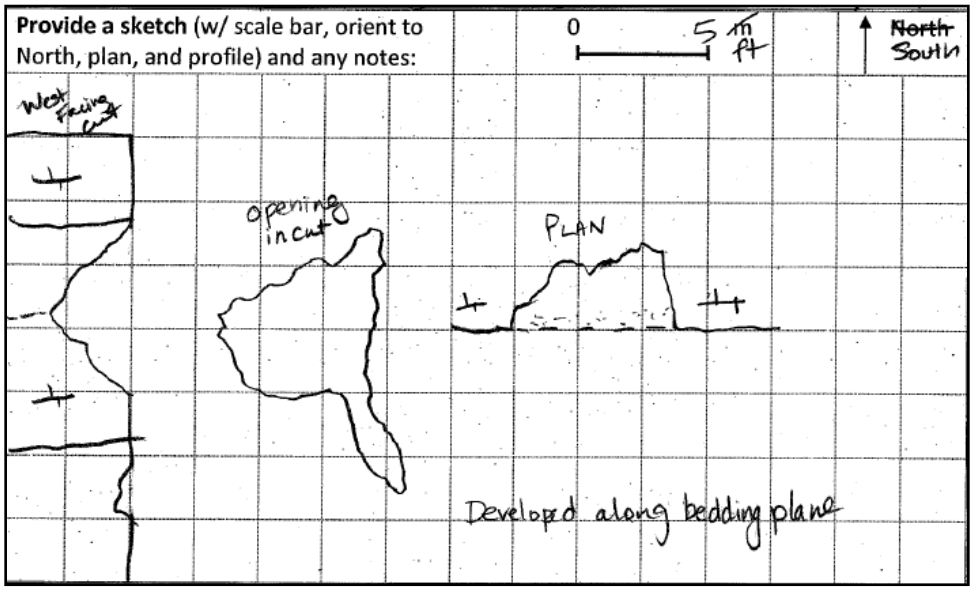

Figure 243. Field sketch of feature HB-031.

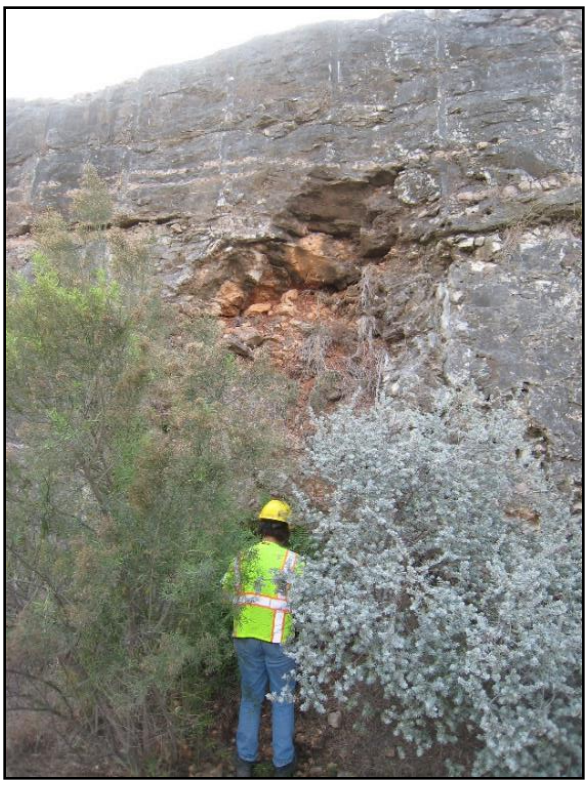

Figure 244. Overview of feature HB-031.

Figure 245. Infill and interior of feature HB-031.

Feature HB-032; Solution Cavities

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, west of Huebner Road (Figure 246 - Figure 247). It was evaluated on November 30, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This feature includes two solution cavities bisected by the roadcut, the largest of which measured 1.5 m (5 ft) wide by 1.2 m (4 ft) long by 1.2 m (4 ft) high. The features contain, fine red-brown clay, cobbles, vegetation, and exposed bedrock. The feature had no visible mesocavernous extensions, but appears to be developed laterally along a bedding plane. The feature was located approximately 2.3 m (7.5 ft) above the base of the roadcut. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

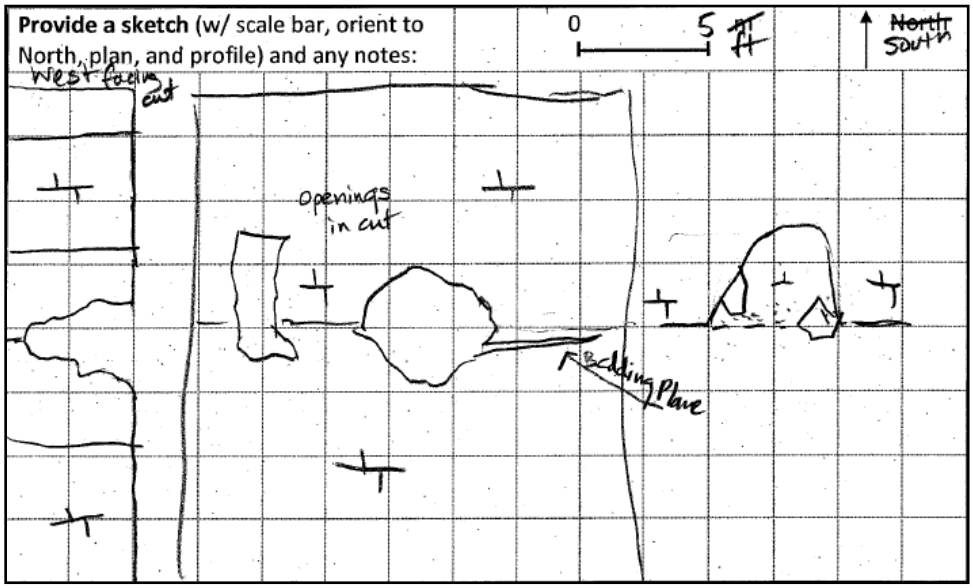

Figure 246. Field sketch of feature HB-032.

Figure 247. Overview of feature HB-032.

Feature HB-033; Solution Cavities

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604 west of Huebner Road (Figure 248 - Figure 249). It was evaluated on November 30, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This feature includes two solution cavities bisected by the roadcut that are connected along a solution-enlarged bedding plane 6 m (20 ft) wide by 0.9 m (3 ft) long by 1.5 m (5 ft) high. The features contain fine red-brown clay, cobbles, vegetation, and exposed bedrock. The feature was located approximately 2 m (6.5 ft) above the base of the roadcut. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

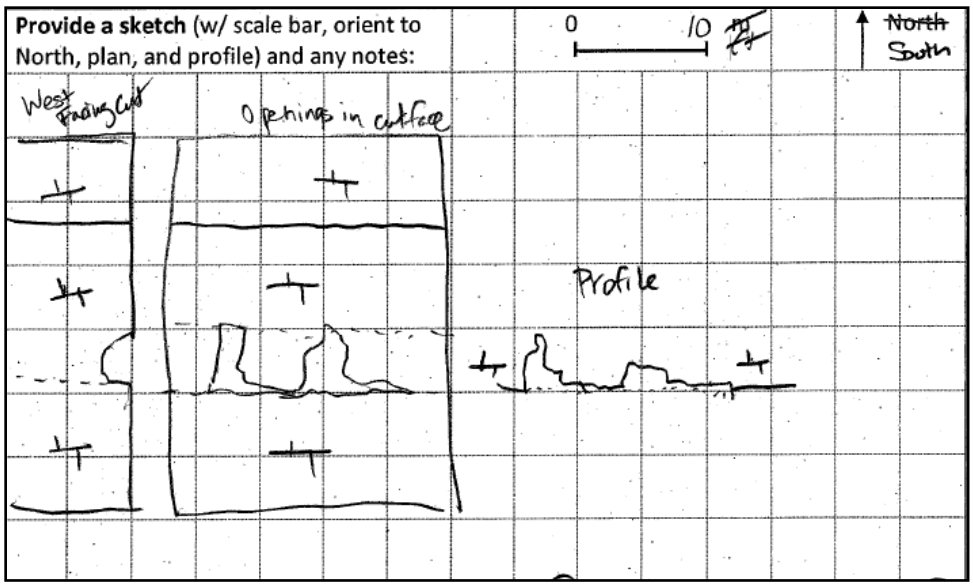

Figure 248. Field sketch of feature HB-033.


Figure 249. Overview of feature HB-033.

Feature HB-034; Solution-enlarged Bedding Plane

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, west of Huebner Road (Figure 250 - Figure 252). It was evaluated on November 30, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This feature was in the area originally described as feature 1604-W06 (Zara 2010a); however, it was located with enough distance from other features to re-describe it a distinct feature. This solution-enlarged bedding plane measured 0.3 m (1 ft) wide by 0.8 m (2.5 ft) long by 0.1 m (0.3 ft) high. It narrows as it extends into the roadcut and appears to terminate in bedrock. This feature was infilled with fine brown soil, loose rocks, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

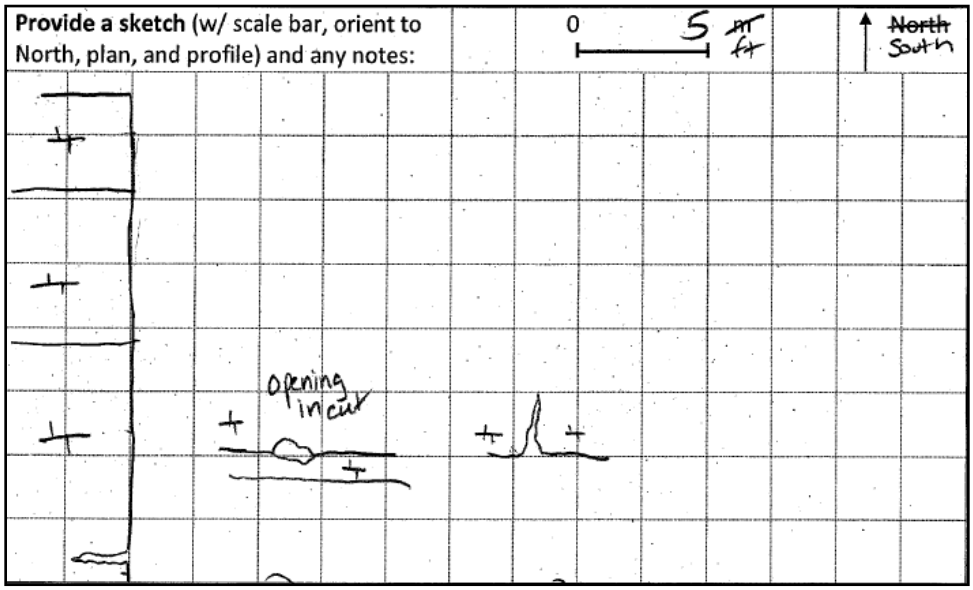

Figure 250. Field sketch of feature HB-034.

Figure 251. Overview of feature HB-034.

Figure 252. Interior of feature HB-034.

Feature HB-035; Solution-enlarged Bedding Plane

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, west of Huebner Road (Figure 253 - Figure 254). It was evaluated on November 30, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This feature was in the area originally described as feature 1604-W06 (Zara 2010a); however, it was located with enough distance from other features to re-describe it a distinct feature. This solution-enlarged bedding plane measured 6.1 m (20 ft) wide by 1.2 m (4 ft) long by 0.6 m (2 ft) high. It narrows as it extends into the roadcut and appears to terminate in bedrock. This feature was infilled with fine red-tan soil, loose rocks, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

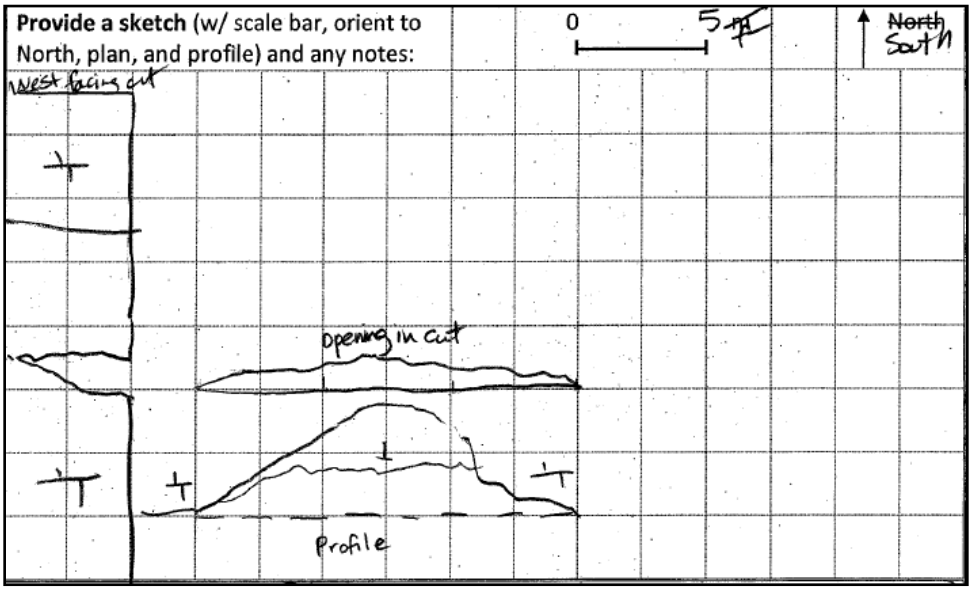

Figure 253. Field sketch of feature HB-035.

Figure 254. Overview of feature HB-035.

Feature HB-036; Zone with Solution-enlarged Bedding Plane and Solution Cavities

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604 immediately east of the Huebner Road overpass (Figure 255 - Figure 257). It was evaluated on November 30, 2017 (TxDOT 2018a), then those data were examined in 2019 to verify whether the feature met current USFWS habitat criteria. The feature was determined to be a solution-enlarged bedding plane that was 4.6 m (15 ft) wide by 0.6 m (2 ft) long by 1.2 m (4 ft) high. The solution-enlarged bedding plane contained approximately eight solution cavities, the largest of which had an aperture of 0.2 m (0.5 ft) in diameter. This feature contained fine red-brown soil, cobbles, vegetation, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

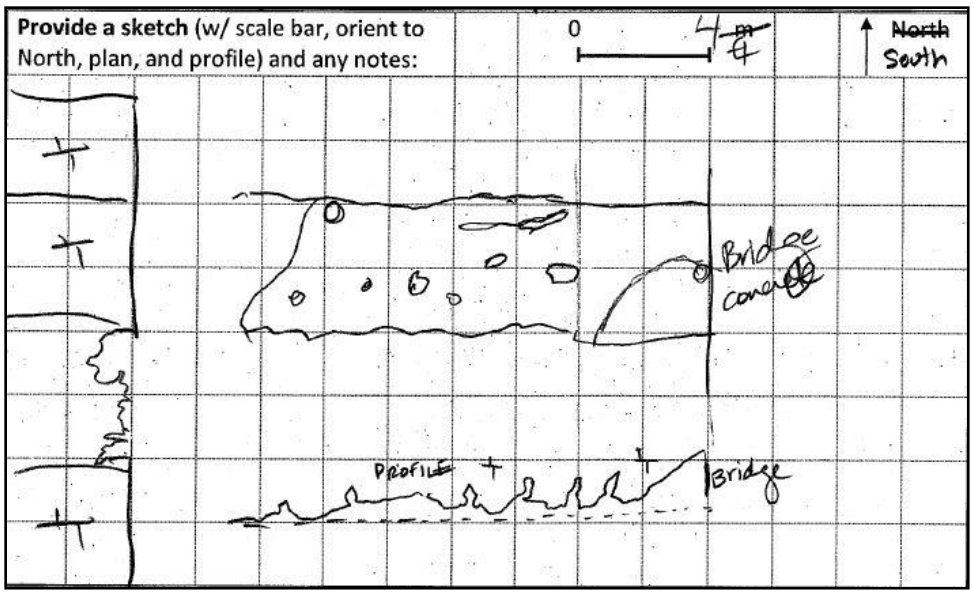

Figure 255. Field sketch of feature HB-036.


Figure 256. Overview of feature HB-036. Note the concrete apron of the Huebner Road bridge on the right side of the photo.

Figure 257. Close-up of feature HB-036 showing ferns growing from feature.

Feature HB-037; Solution-enlarged Bedding Plane

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604 east of Huebner Road (Figure 258 - Figure 259) and originally assessed as part of another study (TxDOT 2018a). The data from that study were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This feature was a solution-enlarged bedding plane 21.3 m (70 ft) wide by 0.6 m (2 ft) long by 0.9 m (3 ft) high. The feature contained fine red clay soil, rocky breakdown, vegetation, and exposed bedrock. The feature was located approximately 1.8 m (6 ft) above of the base of the roadcut. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

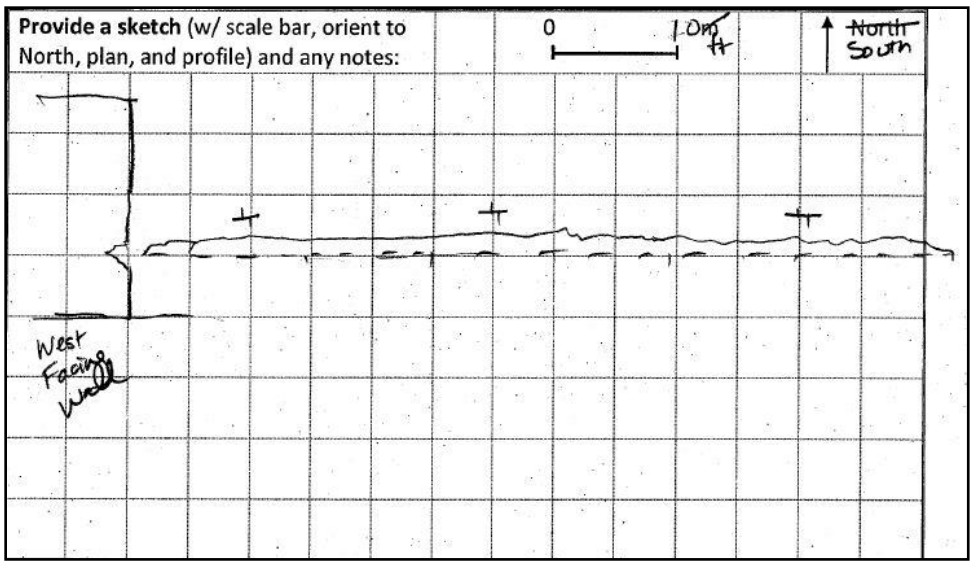

Figure 258. Field sketch of feature HB-037.


Figure 259. Overview of feature HB-037.

Feature HB-038; Solution Cavity

This feature was located in the roadcut south of the eastbound mainlanes of Loop 1604, east of Huebner Road (Figure 260 - Figure 262) and originally assessed as part of another study (TxDOT 2018a). The data from that study were examined in 2019 to verify whether the feature met current USFWS habitat criteria. This solution cavity measured 0.3 m (1 ft) wide by 0.7 m (2.2 ft) long and was 0.3 m (1 ft) high. This feature contained loose rocks and exposed bedrock (Figure 262). This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

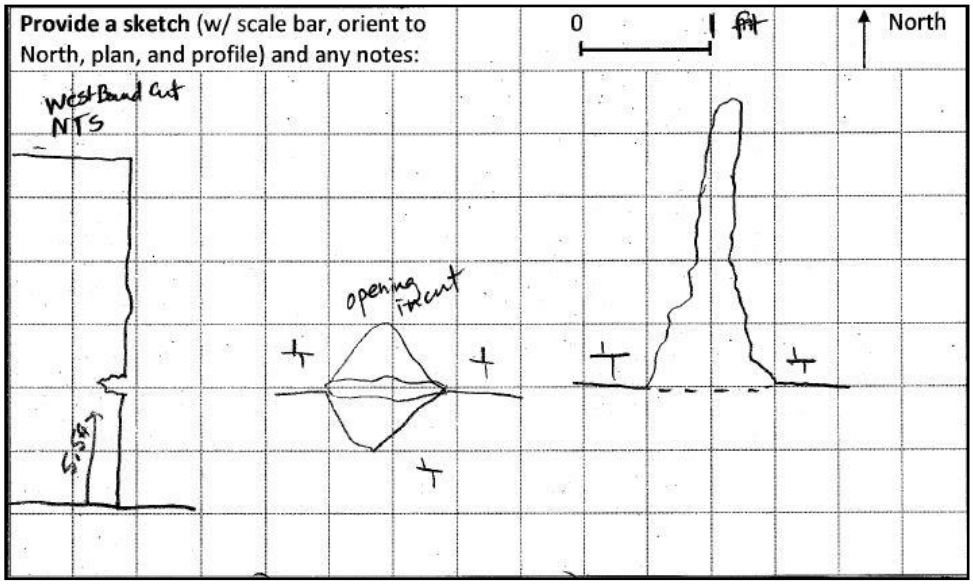

Figure 260. Field sketch of feature HB-038.


Figure 261. Overview of feature HB-038.

Figure 262. Interior of feature HB-038.

Feature JCT-26-NB (5); Solution-enlarged Fracture

This feature was located on the south side of the eastbound Loop 1604 mainlanes, west of US 281. It was encountered during utility trench excavations for the construction of the Loop 1604/US 281 interchange in 2011 (Figure 263 - Figure 266). It was a conduit formed along a fracture. Some rocks were removed from the entrance to the feature, enabling biologists to partially enter it (Figure 264) and determine that it was humanly-traversable for about 1.5 m, then it continued an unknown distance at sub-human size (Figure 265). The feature was not excavated further because potential karst invertebrate habitat suitable for sampling was present (Table 2). Biological surveys were performed on November 11, 18, and 25, 2011. Baited glue traps retrieved from this feature contained subterranean silverfish (*Texoreddellia* sp.) and an adult male eyeless spider (*Cicurina* sp., Figure 266), which was examined by taxonomist James Cokendolpher (Texas Tech University), but the lack of comparative material or a key for males of the genus kept the specimen from being identified using morphology. The original report provides details of the setting (Zara 2012a). The species in this feature and others nearby were addressed under informal consultation number 21450-2010-I-0085 when the Alamo Regional Mobility Authority constructed direct connectors for the 1604 and 281 intersection. The feature was destroyed or sealed as part of the construction process, images of the likely location are available (TxDOT 2015a); the feature was not available for 2019 surveys. In 2020, the material collected in 2011 was analyzed using mtDNA and found to align with *Cicurina puentecilla*, a non-listed species (Appendix C).

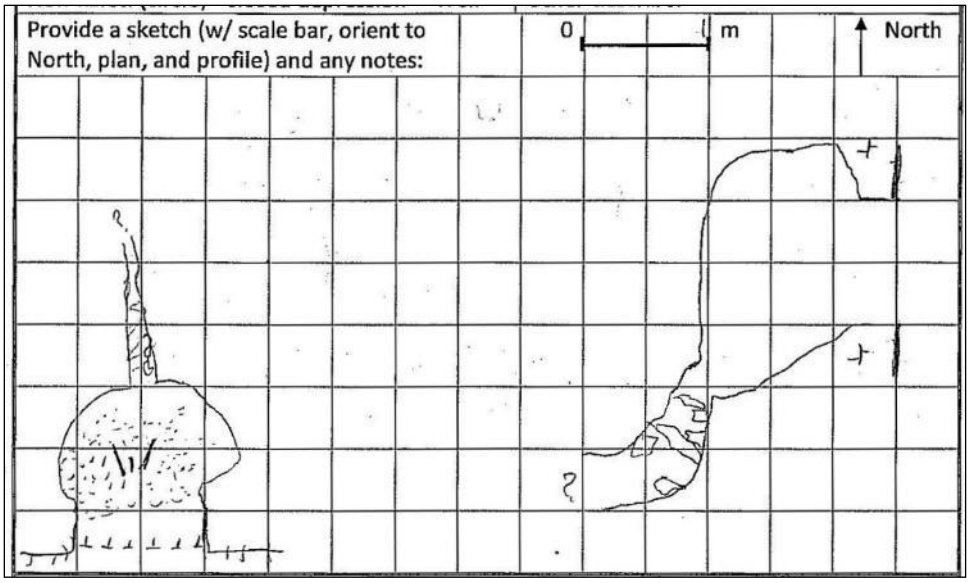

Figure 263. Field sketch of feature Junction 26 North B.


Figure 264. Entrance to feature Junction 26 North B.

Figure 265. Interior of feature Junction 26 North B showing mesocavernous passage leading off.

Figure 266. This eyeless adult male *Cicurina* sp. was collected on a glue trap from feature Junction 26 North B during surveys in 2011.

Feature LOOP-005; Sinkhole

This feature was located in a median south of the eastbound mainlanes of Loop 1604 and east of Judson Road (Figure 267 - Figure 269). It was evaluated on June 4, 2019. The feature was a sinkhole that measured 2.5 ft in diameter and 0.8 ft deep. This feature contained loose soil, gravel, and vegetation. Reconnaissance excavation revealed a bedrock floor. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

Figure 267. Overview of feature LOOP-005.

Figure 268. Close-up of feature LOOP-005.

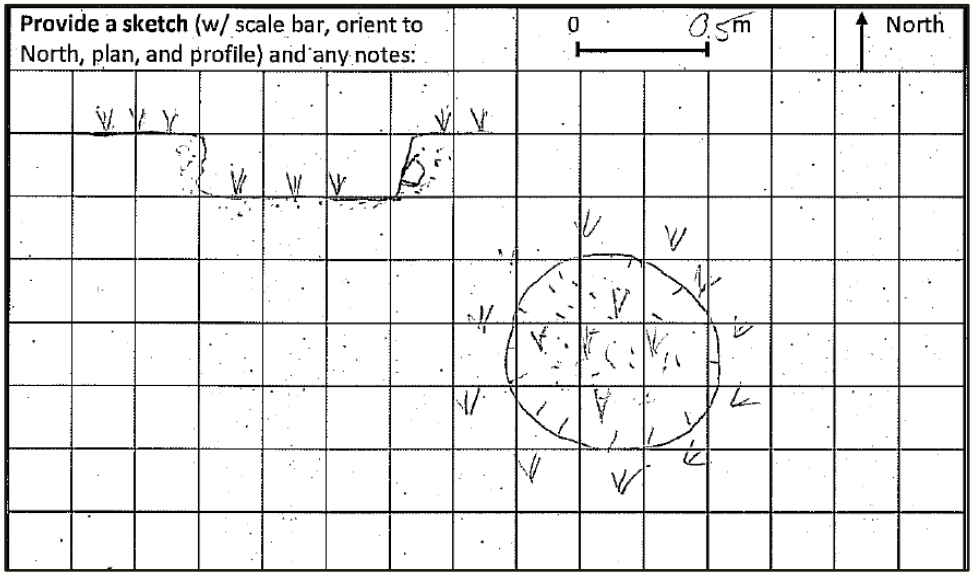

Figure 269. Field sketch of feature LOOP-005.

Feature LOOP-009; Solution Cavity

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604 east of Highway 281 (Figure 270 - Figure 273). A feature evaluation was performed on June 17, 2019. This 0.8 m (2.6 ft) wide and 0.98 m (3.2 ft) wide solution cavity was bisected by the roadcut. It extended downward for 1.1 m (3.6 ft) and had a floor depth of approximately 1.98 m (6.5 ft) below the original land surface. In June 2019, 2.25 person hours were spent removing 1.6 m^3 (56 ft^3) of material using hand tools. Mesocavernous drains continued downwards, with no noticeable airflow. This feature contained rocks, cobbles, and bedrock.

Feature LOOP-009 was considered potential karst invertebrate habitat due to void size greater than or equal to 1 m (3.3 ft) and presence of mesocavernous voids (Table 2). Presence/absence surveys were conducted in July 2019 (Table 36); notable fauna are summarized in Table 1 and Table 37. Troglobitic species recorded from this feature include *Brackenridgia* sp. No listed species were observed or collected.

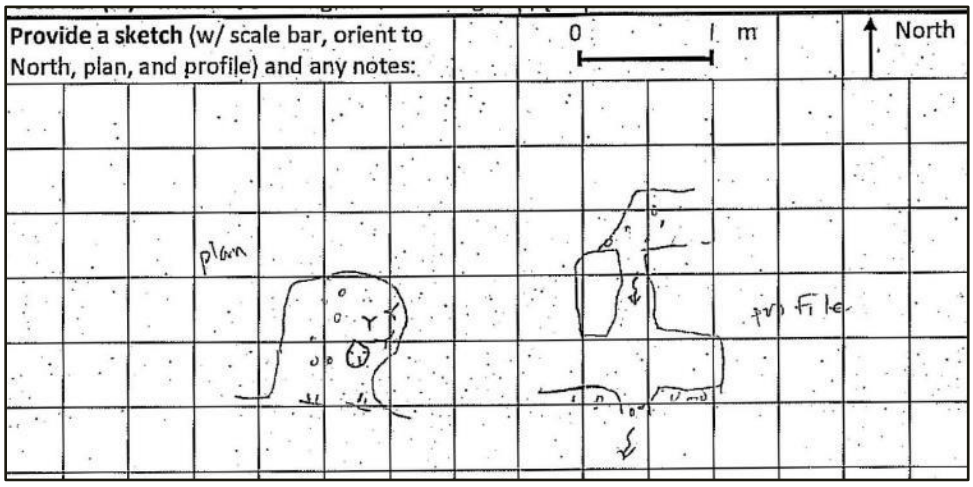

Figure 270. Pre-excavation field sketch of feature LOOP-009.

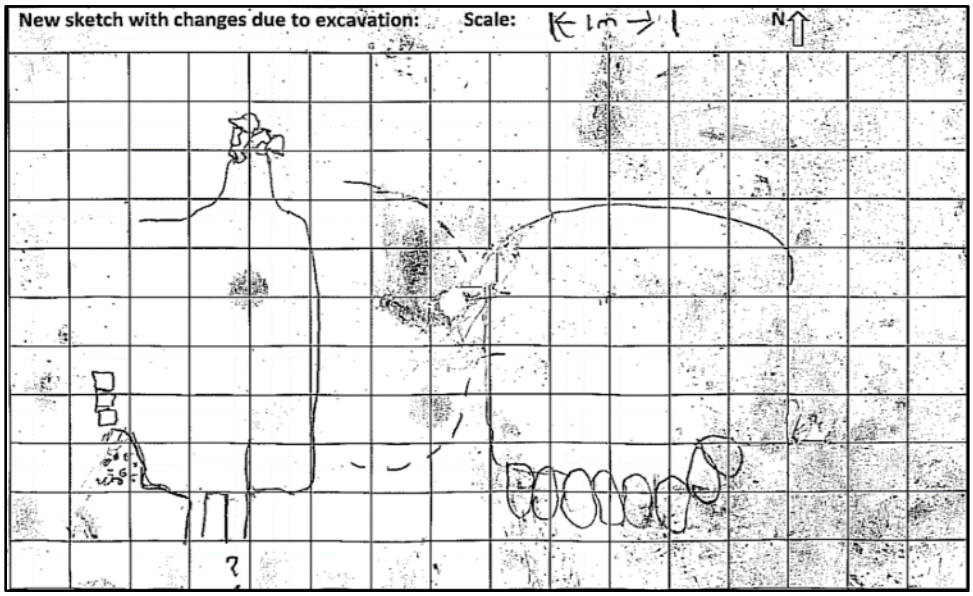

Figure 271. Post-excavation field sketch of feature LOOP-009.

Figure 272. Overview of feature LOOP-009.

Figure 273. Interior of feature LOOP-009.

Table 36. Summary of survey activity at feature LOOP-009.

Date	Time	Effort (minutes)	Comments
06/27/2019	08:00	90	Set traps and data logger
07/01/2019	09:40	30	Checked and reset traps
07/03/2019	09:45	30	Checked and reset traps
07/05/2019	09:08	17	Checked and reset traps
07/08/2019	10:20	40	Checked and reset traps
07/10/2019	09:40	20	Checked and reset traps
07/12/2019	08:00	30	Checked and reset traps
07/15/2019	09:51	30	Checked and reset traps
07/17/2019	09:40	20	Checked and reset traps
07/19/2019	09:10	30	Checked and reset traps
07/22/2019	09:50	20	Checked and reset traps
07/24/2019	15:15	20	Checked and reset traps
07/26/2019	09:28	20	Checked and reset traps
07/29/2019	16:36	20	Checked and reset traps
07/31/2019	18:22	16	Checked traps; removed traps and data logger

Table 37. Summary of fauna observations at feature LOOP-009.

Common Nam	Lowest Taxonomic Identification
Woodlice	*Brackenridgia* sp.
Cricket	Gryllidae
Earwig	Dermaptera
Cockroach	Blattaria
Ant	Formicidae
Moth	Lepidoptera
Fly / Gnat	Diptera

Feature LOOP-010; Solution Cavity

This feature was located in the roadcut north of the westbound mainlanes of Loop 1604, east of Highway 281 (Figure 274 - Figure 278). The feature was evaluated on June 17, 2019. This 1.5 m (4.9 ft) wide, 1.4 m (4.5 ft) long, 1.2 m (3.9 ft) high solution cavity was bisected by the roadcut and was 2.4 m (7.8 ft) below the original land surface. This feature contained fine, compact, reddish sediment. A void extending 0.4 m (1.3 ft) into the feature was discovered after recon excavation was performed. On 25 June 25, 2019, 3 person-hours were spent removing 0.25 m^3 (8.8 ft^3) of material using hand tools. A distinct terminus was reached when the back wall of the feature was visible (Figure 278). No airflow or fauna were observed. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

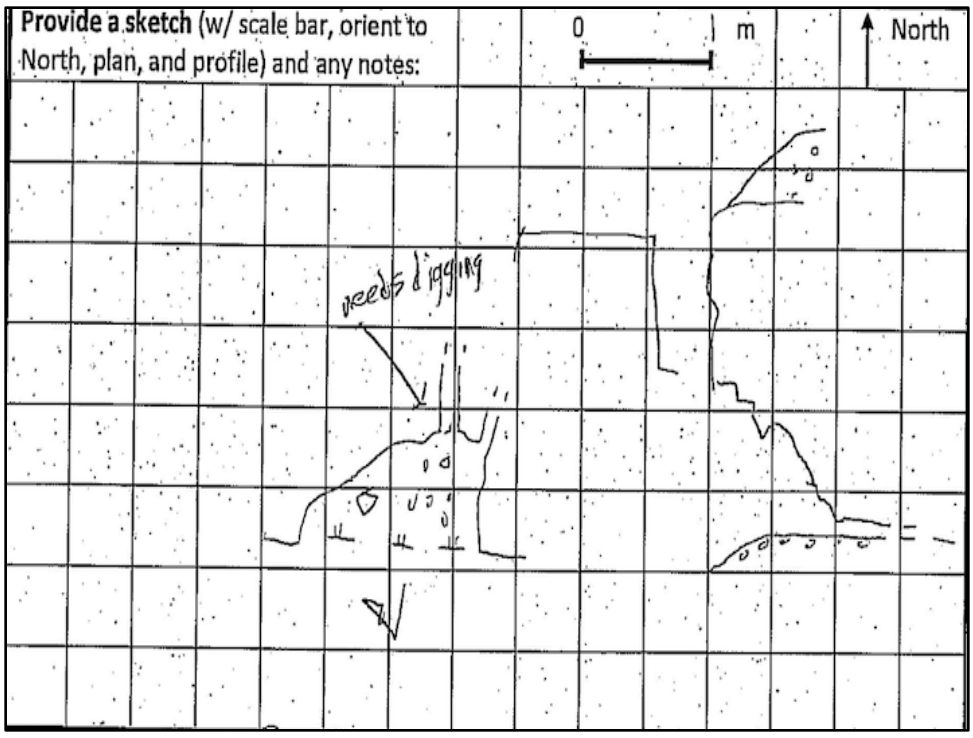

Figure 274. Pre-excavation field sketch of feature LOOP-010.

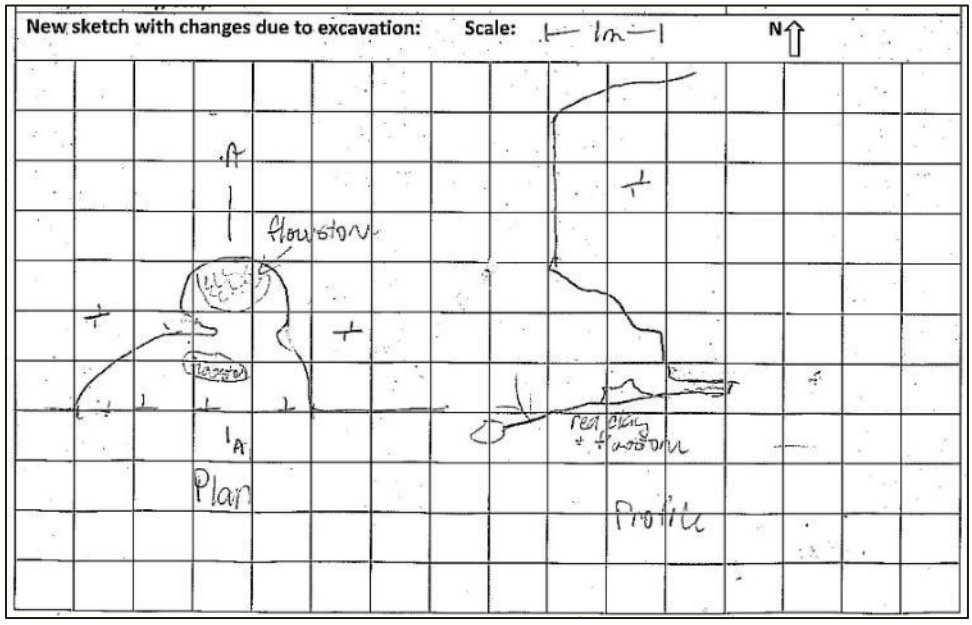

Figure 275. Post-excavation field sketch of feature LOOP-010.

Figure 276. Overview of feature LOOP-010.

Figure 277. Material excavated from feature LOOP-010.

Figure 278. Interior of feature LOOP-010 after excavation, showing flowstone terminus.

Feature LOOP-011; Plugged Feature

This feature was located on the north side of the eastbound mainlanes of Loop 1604, west of Gold Canyon Road (Figure 279 - Figure 280). It was an apparent karst feature that was presumably plugged with grout under the 281/1604 interchange WPAP. Due to this plug, it could not be assessed.

Figure 279. Overview of feature LOOP-011.

Figure 280. Close-up of feature LOOP-011, showing grout plug.

Feature LOOP-102 (Fiesta Cave); Paleospring

This feature was located in a cliff along a streambed west of the southbound mainlanes of I-10 north of Loop 1604 (Figure 281 - Figure 283). A feature evaluation was performed on May 31, 2019 and July 8, 2019. The feature was a paleospring that measured 4.0 m (13.1 ft) wide by 3.0 m (9.8 ft) long and 0.49 m (1.6 ft) high. The feature was humanly enterable and had mesocavernous voids. This feature contained rocks, cobbles, and fine, tan clay sediment. The feature was reported as Fiesta Cave from the TSS database.

Feature LOOP-102 was considered potential karst invertebrate habitat due to length, an enterable void, and modern soil (Table 2). Presence/absence surveys were conducted in July and August 2019 (Table 38); notable fauna are summarized in Table 1. Troglobitic species recorded from this feature include *Brackenridgia* sp. No listed species were observed or collected.

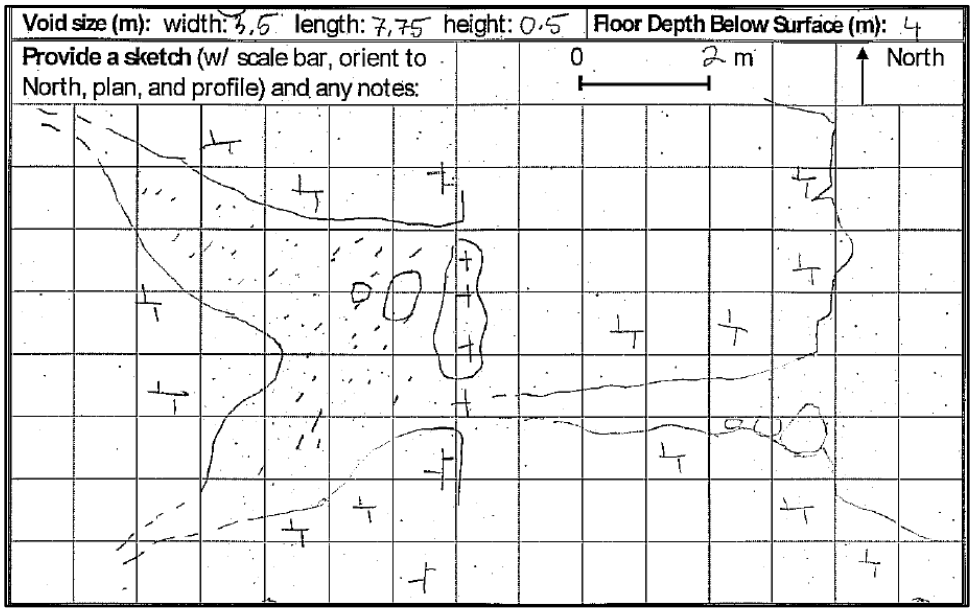

Figure 281. Field sketch of feature LOOP-102 (Fiesta Cave).

Figure 282. Overview of feature LOOP-102 (Fiesta Cave).

Figure 283. Interior of feature LOOP-102 (Fiesta Cave).

Table 38. Summary of survey activity at feature LOOP-102 (Fiesta Cave).

Date	Time	Effort (minutes)	Comments
06/27/2019	13:05	75	Set traps and data logger
07/01/2019	11:00	40	Checked and reset traps
07/03/2019	13:00	30	Checked and reset traps
07/08/2019	12:00	50	Checked and reset traps
07/10/2019	11:31	20	Checked and reset traps
07/12/2019	09:40	20	Checked and reset traps
07/15/2019	10:50	30	Checked and reset traps
07/17/2019	11:43	20	Checked and reset traps
07/19/2019	11:00	30	Checked and reset traps
07/22/2019	11:22	20	Checked and reset traps
07/24/2019	17:05	20	Checked and reset traps
07/26/2019	11:48	20	Checked and reset traps
07/29/2019	17:08	20	Checked and reset traps
07/31/2019	18:52	20	Checked and reset traps
08/02/2019	16:32	24	Checked traps; removed traps and data logger

Table 39. Summary of fauna observations at feature LOOP-102 (Fiesta Cave).

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae *Brackenridgia* sp.
Soft tick	Argasidae
Harvestman	*Leiobunum townsendi*
Centipede	Scolopendromorpha
Cricket	Gryllidae *Ceuthophilus cunicularis* *Ceuthophilus secretus*
Cockroach	Blattaria
Beetle	Coleoptera
Bee	Apocrita
Fly/Gnat	Diptera
Mosquito	Culicidae
Gulf Coast toad	*Incilius nebulifer*
Canyon wren	*Catherpes mexicanus*
Mouse	*Mus* sp.
Porcupine	*Erethizon dorsatum*

Feature LOOP-103; Solution Cavity

This feature was located in an exposed cliff along Leon Creek, west of the southbound mainlanes of I-10 north of Loop 1604 (Figure 284 - Figure 286). Feature evaluations were performed on May 31 and August 27, 2019. The feature was a non-enterable solution cavity that measured 0.4 m (1.3 ft) wide by 2 m (6.5 ft) long and 0.4 m (1.3 ft) high. Excavation was conducted on August 27, 2019, removing some silt from the floor. Due to its length and the presence of a mesocavernous void at the back, it was considered to be potential karst invertebrate habitat (Table 2). Presence/absence surveys were performed in August and September 2019 (Table 40); however, no troglobites were found (Table 1, Table 41).

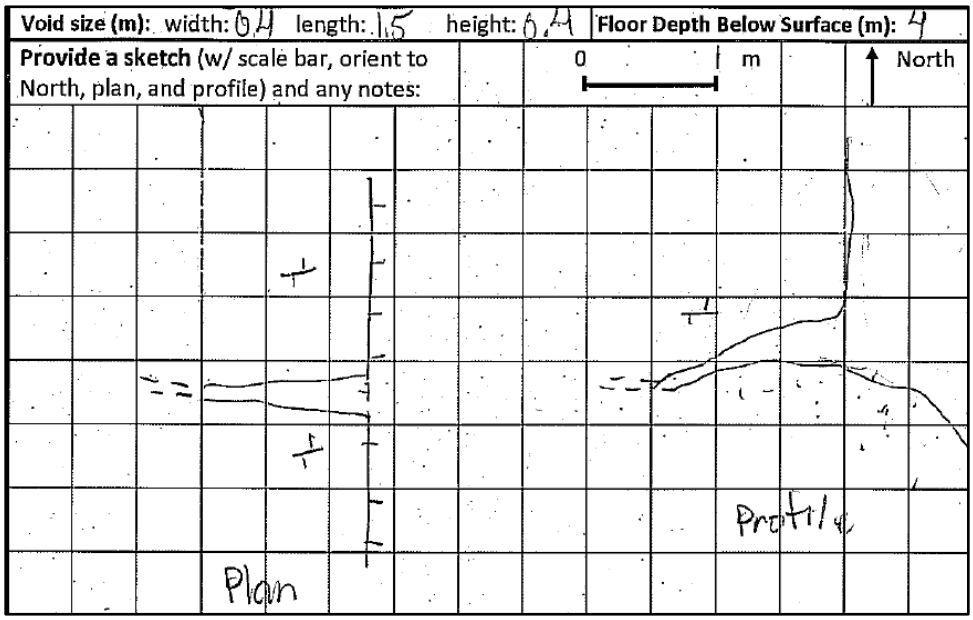

Figure 284. Field sketch of feature LOOP-103.

Figure 285. Overview of feature LOOP-103.

Figure 286. Interior of feature LOOP-103.

Table 40. Summary of survey activity at feature LOOP-103.

Date	Time	Effort (minutes)	Comments
08/28/2019	12:01	12	Set traps and data logger
08/30/2019	10:18	8	Checked and reset traps
09/01/2019	09:36	8	Checked and reset traps
09/03/2019	11:03	12	Checked and reset traps
09/05/2019	12:15	21	Checked and reset traps
09/07/2019	09:43	12	Checked and reset traps
09/09/2019	17:11	8	Checked and reset traps
09/11/2019	16:40	8	Checked and reset traps
09/13/2019	10:24	8	Checked and reset traps
09/15/2019	09:02	10	Checked and reset traps
09/17/2019	14:28	12	Checked and reset traps
09/19/2019	14:09	10	Checked and reset traps
09/21/2019	09:47	8	Checked and reset traps
09/23/2019	09:35	9	Checked and reset traps
09/25/2019	10:45	18	Checked traps; removed traps and data logger

Table 41. Summary of fauna observations at feature LOOP-103.

Common Name	Lowest Taxonomic Identification
Isopoda	Armadillidae *Porcellio* sp.
Harvestman	*Leiobunum townsendi*
Mite	Acarina
Soft Tick	Argasidae
Centipede	Diplopoda
House Centipede	Scutigeromorpha
Springtail	Collembola
Cricket	Gryllidae *Ceuthophilus secretus*
Earwig	Dermaptera
Cockroach	Blattaria
Beetle	Coleoptera
Wasp	Hymenoptera
Ant	Formicidae *Solenopsis invicta*
Moth	Lepidoptera
Fly / Gnat	Diptera
Mosquito	Culicidae
Mediterranean gecko	*Hemidactylus turcicus*
Checkered garter snake	*Thamnophis marcianus*
Mammal fur	Mammalia

Feature LOOP-104; Other, Flowing seep/sewage leak

This feature was located east of the northbound mainlanes of I-10, south of Loop 1604 (Figure 287 - Figure 289). It was evaluated on June 4, 2019. The feature was a non-enterable spring or sewage leak approximately 0.9 m (3 ft) wide and 0.01 m (0.02 ft) high with an unknown length extending underneath concrete. This feature had no mesocavernous voids and contained soft loose soil and vegetation which had a foul odor when disturbed. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

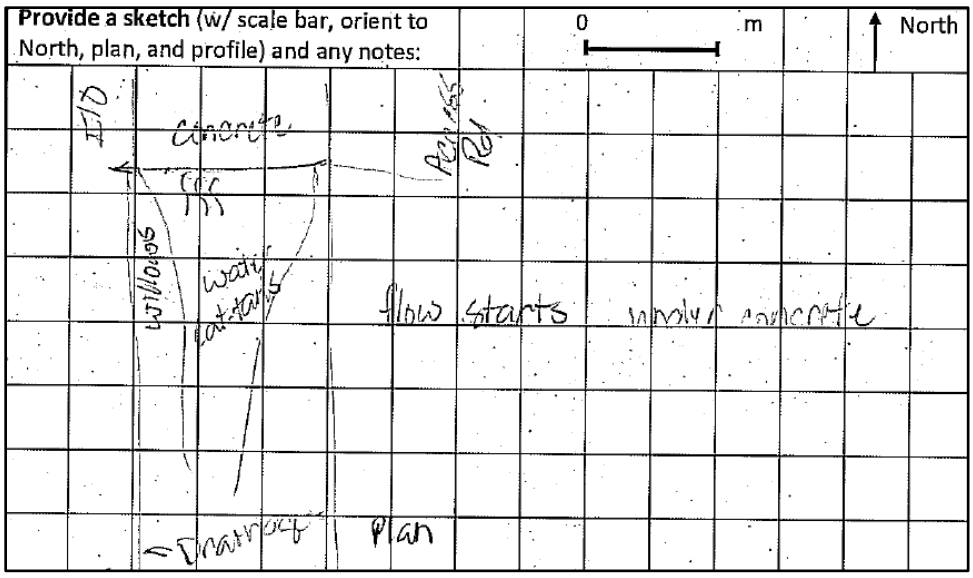

Figure 287. Field sketch of feature LOOP-104.


Figure 288. Overview of feature LOOP-104.

Figure 289. Close-up of feature LOOP-104.

Feature LOOP-105; Solution Cavity

This feature was in an exposed road cut west of the southbound mainlanes of I-10, north of Loop 1604 (Figure 290 - Figure 293). It was evaluated on June 6, 2019. The feature was a non-enterable solution cavity that measured 0.4 m (1.3 ft) wide by 1.2 m (4.1 ft) long and 0.4 m (1.3 ft) high. The feature had no airflow and no mesocavernous voids. It was approximately 5.0 m (16.4 ft) below the original land surface. This feature contained cobble-sized rocks. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

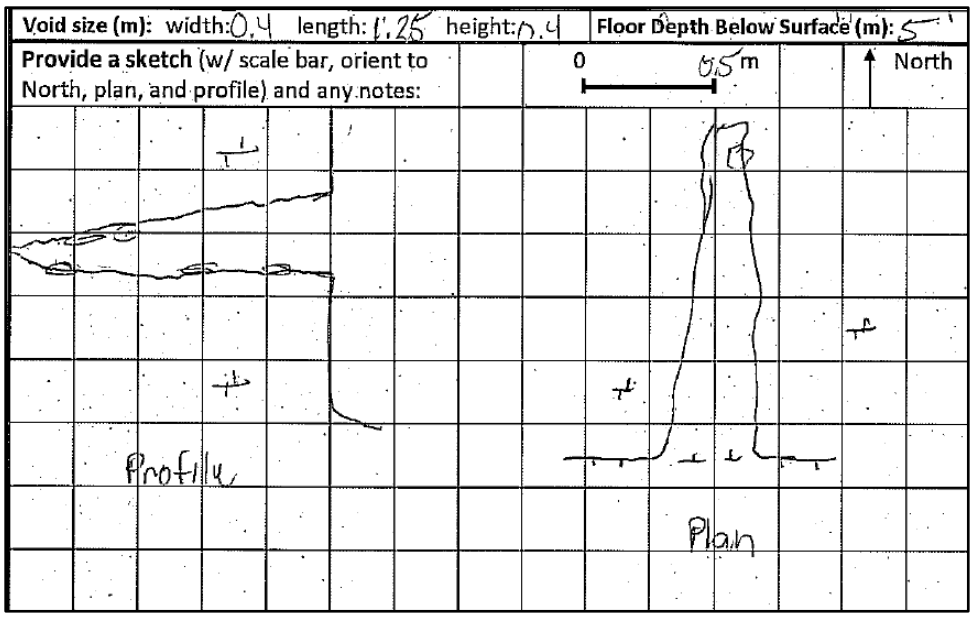

Figure 290. Field sketch of feature LOOP-105.


Figure 291. Overview of feature LOOP-105.

Figure 292. Close-up of feature LOOP-105.


Figure 293. View to the north from feature LOOP-105.

Feature LOOP-107; Solution-enlarged bedding plane

This feature was located in a roadcut north of the westbound mainlanes of Loop 1604, east of US 281 North (Figure 294 - Figure 296). It was evaluated on July 24, 2019. This solution-enlarged bedding plane was 1.5 m (4.9 ft) wide by 0.2 m (0.65 ft) long by 0.2 m (0.7 ft) tall. This feature was non-enterable with no airflow and no mesocavernous voids. The feature contained only exposed bedrock and some calcite. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

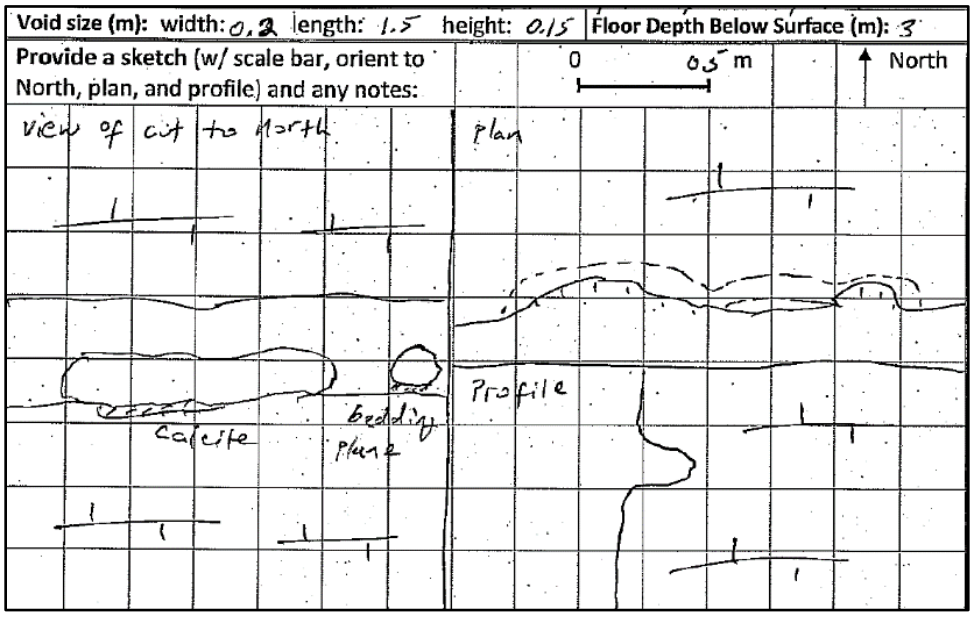

Figure 294. Field sketch of feature LOOP-107.

Figure 295. Overview of feature LOOP-107.

Figure 296. Close-up of feature LOOP-107.

Feature LOOP-110; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, east of Gold Canyon (Figure 297 - Figure 299). This feature was evaluated on July 24, 2019. This solution cavity was 0.50 m (1.6 ft) wide by 0.50 m (1.6 ft) long by 0.7 m (2.3 ft) tall. This feature contained exposed bedrock, calcite surfaces, and some gravel-sized rocks. There was no airflow and no fauna were observed, and it was found to definitively end. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

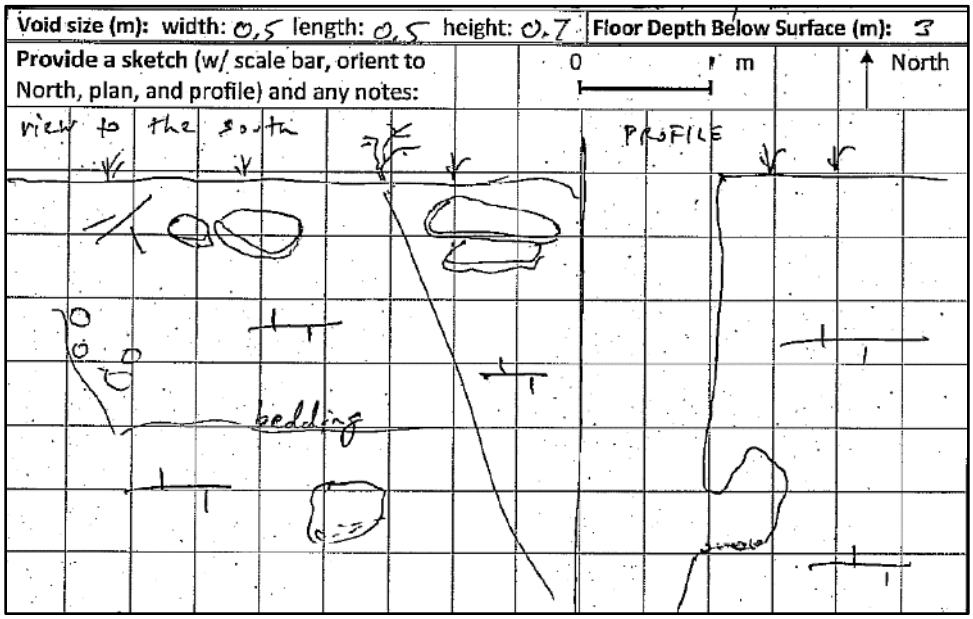

Figure 297. Field sketch of feature LOOP-110.

Figure 298. Overview of feature LOOP-110.

Figure 299. Close-up of entrance to feature LOOP-110, with ruler for reference.

Feature LOOP-111; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Gold Canyon Road (Figure 300 - Figure 302). It was evaluated on July 24, 2019. This solution cavity was 0.3 m (1.0 ft) wide by 0.3 m (1.0 ft) long by 1.0 m (3.3 ft) tall (Figure 300 - Figure 302). It contained exposed bedrock with orange staining, gravel-sized rocks, and some grass. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

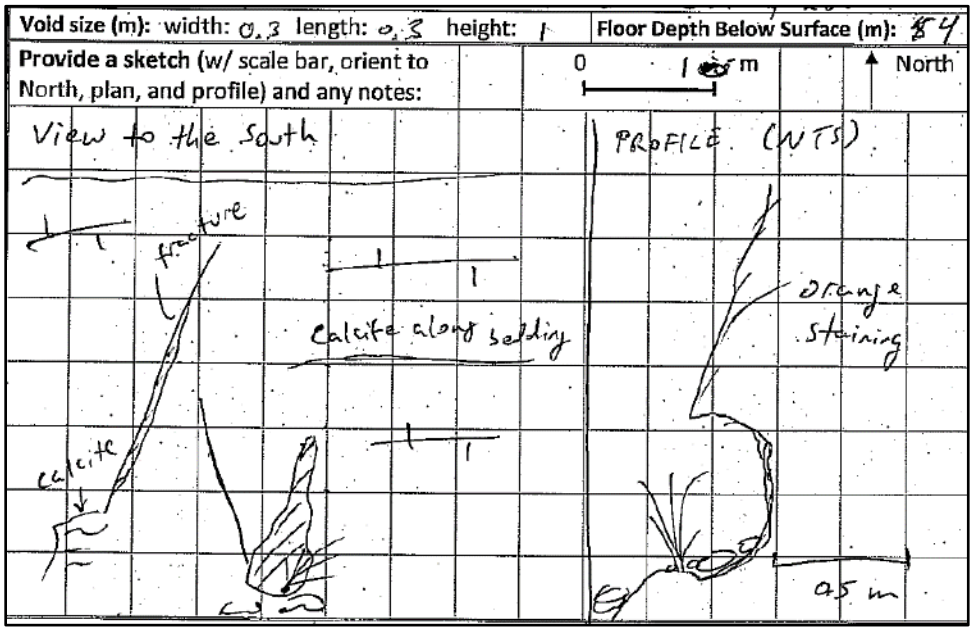

Figure 300. Field sketch of feature LOOP-111.

Figure 301. Overview of feature LOOP-111.

Figure 302. Close-up of feature LOOP-111, with a ruler for reference.

Feature LOOP-112; Solution Cavity

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604 to the west of Gold Canyon Road (Figure 303 - Figure 305). It was evaluated on July 24, 2019. This solution cavity was 0.3 m (1.0 ft) wide by 0.3 m (1.0 ft) long by 0.2 m (0.7 ft) tall (Figure 303 - Figure 305). This feature contained exposed bedrock, calcite surfaces, and gravel-sized rocks. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

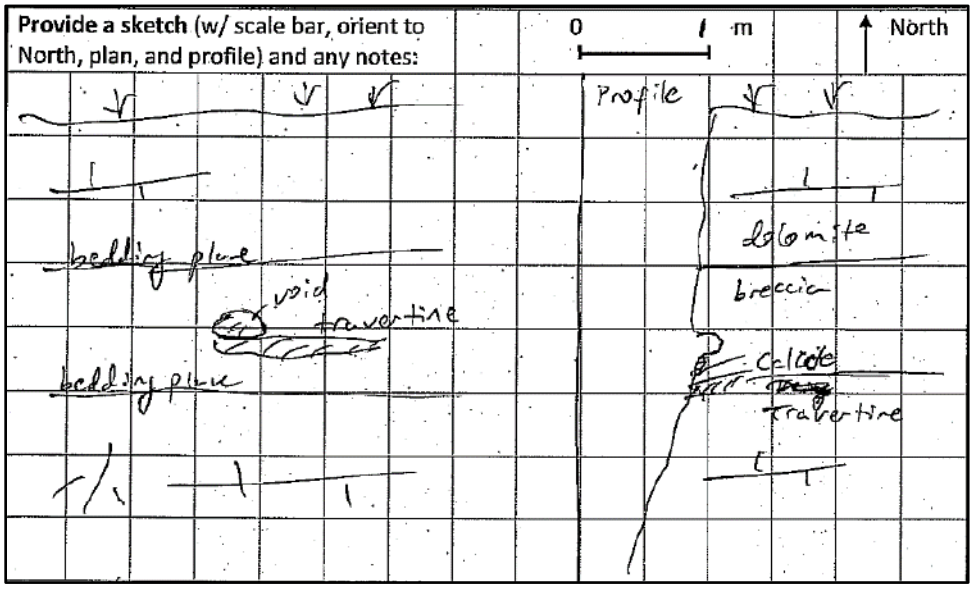

Figure 303. Field sketch of feature LOOP-112.

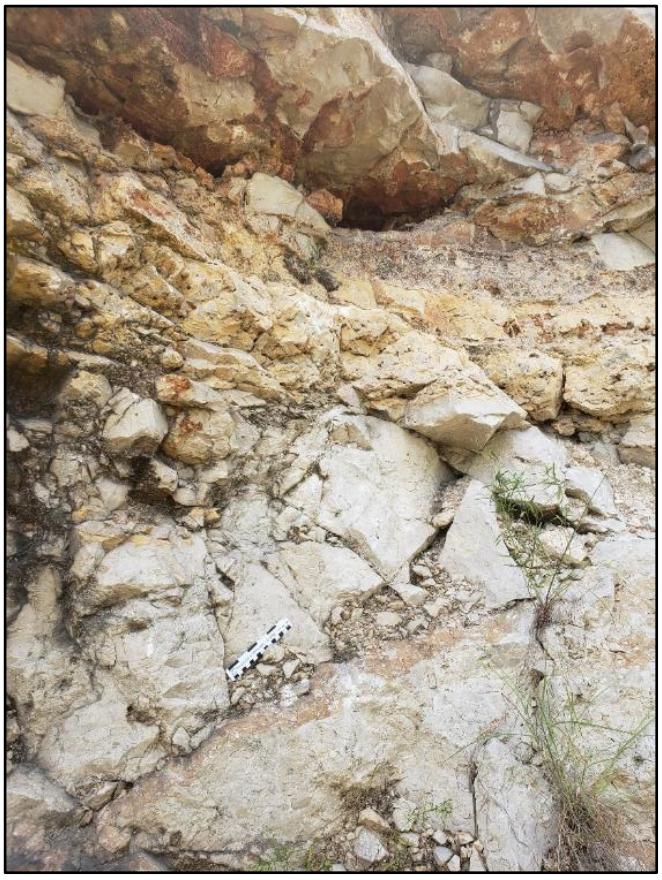

Figure 304. Overview of feature LOOP-112.

Figure 305. Close-up of feature LOOP-112.

Feature LOOP-202; Sinkhole

This feature was located in a streambed under the westbound access road of Loop 1604, southwest of Kyle Seale Parkway (Figure 306 - Figure 309). The feature was evaluated on June 7, 2019 and determined that further excavation was needed. Excavation was performed on June 19, 2019, and 0.5 person hours were spent removing 0.03 m^3 (0.3 ft^3) of material using hand tools. A distinct terminus was reached at the end of day. The feature was a non-enterable sinkhole that measured 0.5 m (1.6 ft) long by 0.2 m (0.7 ft) wide and 0.3 m (1.0 ft) deep with no noticeable airflow and no mesocavernous voids. This feature contained rocks, cobbles, fine loose sediment, and leaf litter. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

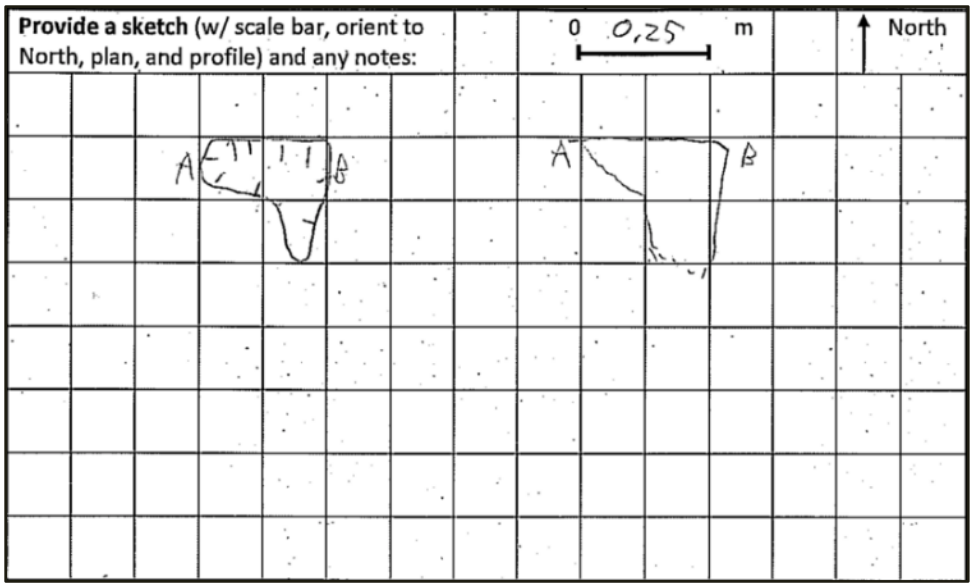

Figure 306. Pre-excavation field sketch of feature LOOP-202.

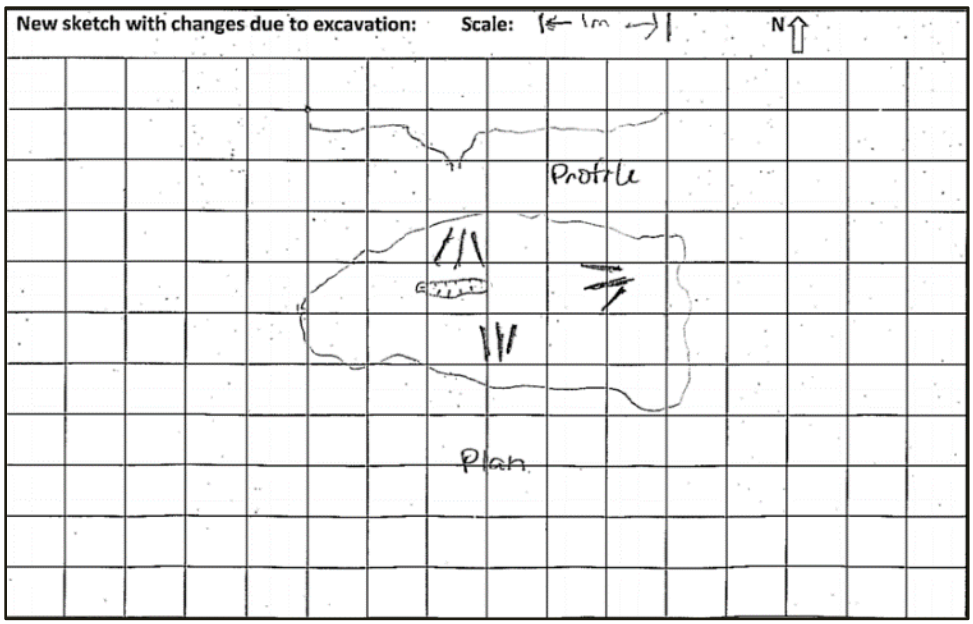

Figure 307. Post-excavation field sketch of feature LOOP-202.


Figure 308. Overview of feature LOOP-202.

Figure 309. Overview of location of feature LOOP-202.

Feature LOOP-204; Solution-enlarged Fracture

This feature was located south of the eastbound mainlanes of Loop 1604 west of Stone Oak Parkway within a drainage (Figure 310 - Figure 312). It was evaluated on July 16, 2019. The feature was a solution-enlarged fracture that measured 1.5 m (5 ft) wide by 2.4 m (8 ft) across, and 0.1 m (0.4) ft deep, had no airflow and no mesocavernous voids. Minimal excavation was performed using hand tools. This feature was filled with coarse rocks, cobbles, compact soils, calcite, and bedrock. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

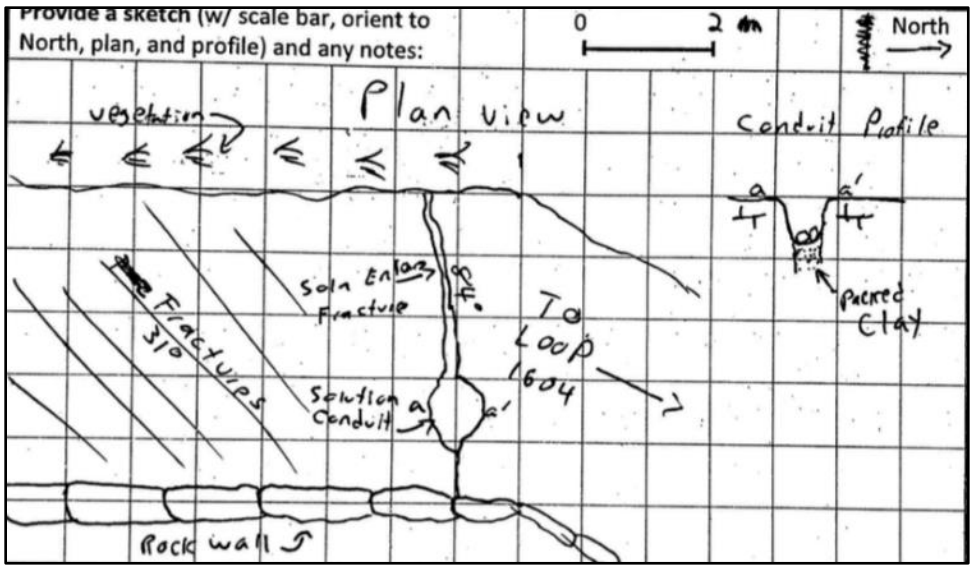

Figure 310. Field sketch of feature LOOP-204.


Figure 311. Overview of feature LOOP-204.

Figure 312. Close-up of feature LOOP-204.

Feature LOOP-207; Solution Cavity/Solution-enlarged Fracture

This feature was located in a streambed on an easement west of the southbound lanes of I-10, north of Loop 1604 (Figure 313 - Figure 315). The feature was evaluated on July 23, 2019. It was a solution cavity that measured 0.8 m (2.5 ft) wide by 1.8 m (6 ft) long and 0.3 m (1 ft) deep. The solution cavity was exposed at the base of a cliff, 9.5 m (31 ft) below the top of the cliff. The feature had no airflow and no human-sized void. The feature had mesocavernous voids and was filled with loose soils, leaf litter, cobbles, and fine sediment. No excavation was performed.

Feature LOOP-207 was considered potential karst invertebrate habitat due to development along a fracture, void length greater than 1 m (3.3 ft) that continued (Table 2). Presence/absence surveys were conducted in July and August 2019 (Table 42); however, no troglobites were found (Table 1, Table 43).

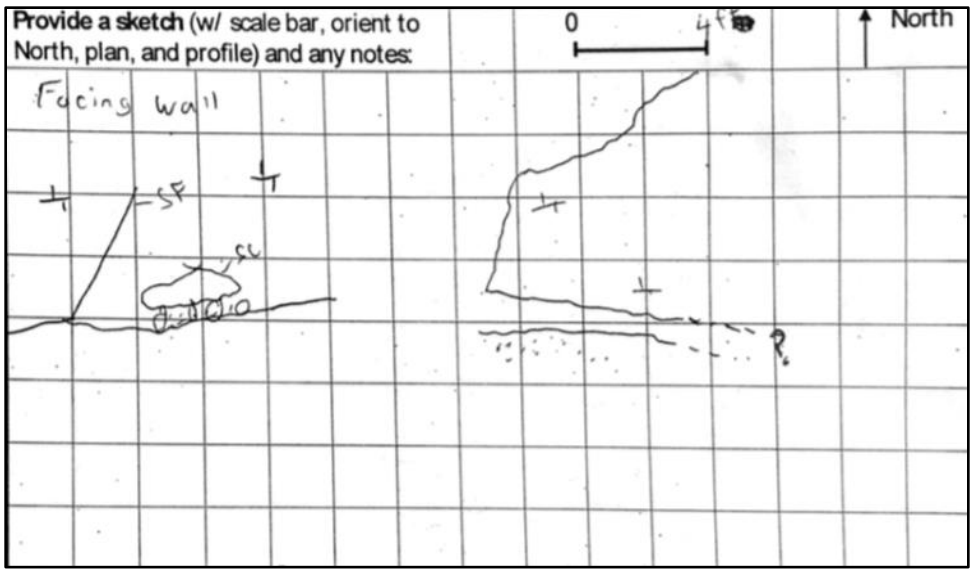

Figure 313. Field sketch of feature LOOP-207.


Figure 314. Overview of feature LOOP-207.

Figure 315. Close-up of feature LOOP-207.

Table 42. Summary of survey activity at feature LOOP-207.

Date	Time	Effort (minutes)	Comments
07/26/2019	11:35	22	Set traps and data logger
07/29/2019	17:20	20	Checked and reset traps
07/31/2019	19:05	20	Checked and reset traps
08/02/2019	21:41	27	Checked and reset traps
08/09/2019	-	-	Checked and reset traps
08/12/2019	11:02	10	Checked and reset traps
08/14/2019	11:15	10	Checked and reset traps
08/19/2019	11:06	12	Checked and reset traps
08/21/2019	10:14	10	Checked and reset traps
08/23/2019	12:18	10	Checked and reset traps
08/26/2019	11:35	10	Checked and reset traps
08/28/2019	11:31	6	Checked and reset traps
08/30/2019	10:25	18	Checked and reset traps
09/01/2019	09:41	10	Checked traps; removed traps and data logger

Table 43. Summary of fauna observations at feature LOOP-207.

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae
Soft tick	Argasidae
Harvestman	Opiliones *Leiobunum townsendi*
Spider	Araneae
Centipede	Scutigeromorpha
Millipede	Diplopoda
Cricket	*Ceuthophilus cunicularis* *Ceuthophilus secretus*
Earwig	Dermaptera
Cockroach	Blattaria
Beetle	Coleoptera
Ant	Formicidae
Moth	Lepidoptera
Fly/Gnat	Diptera
Mosquito	Culicidae
Gulf Coast toad	*Incilius nebulifer*
Cliff chirping frog	*Eleutherodactylus marnockii*
Snake	Colubridae

Feature LOOP-213; Solution Cavity/Solution-enlarged Fracture

This feature was located south of the eastbound mainlanes of Loop 1604, east of Babcock Road (Figure 316 - Figure 318). It was evaluated on July 24, 2019. The feature was a solution-enlarged fracture that measured 0.9 (3 ft) wide by 0.9 (3 ft) long and 0.06 (0.2 ft) deep, with a maximum aperture of 0.1 m (0.3 ft). This feature was filled with loose soils, leaf litter, vegetation, and bedrock. Due to the presence of a downward void, it was excavated on July 29, 2019, and 0.2 m^3 (2 ft^3) of material was removed. Excavation was halted when a red clay plug was encountered. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

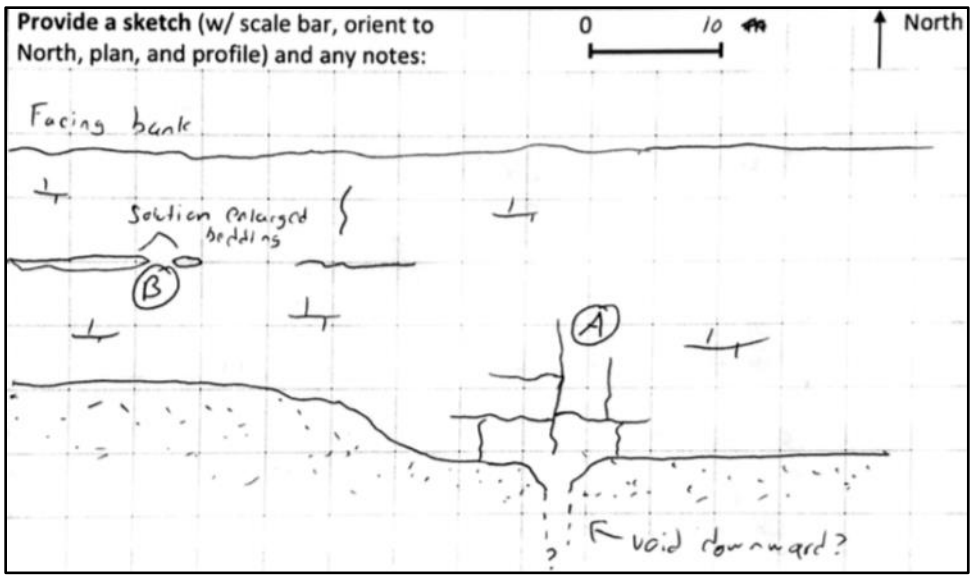

Figure 316. Field sketch of feature LOOP-213.


Figure 317. Overview of feature LOOP-213.

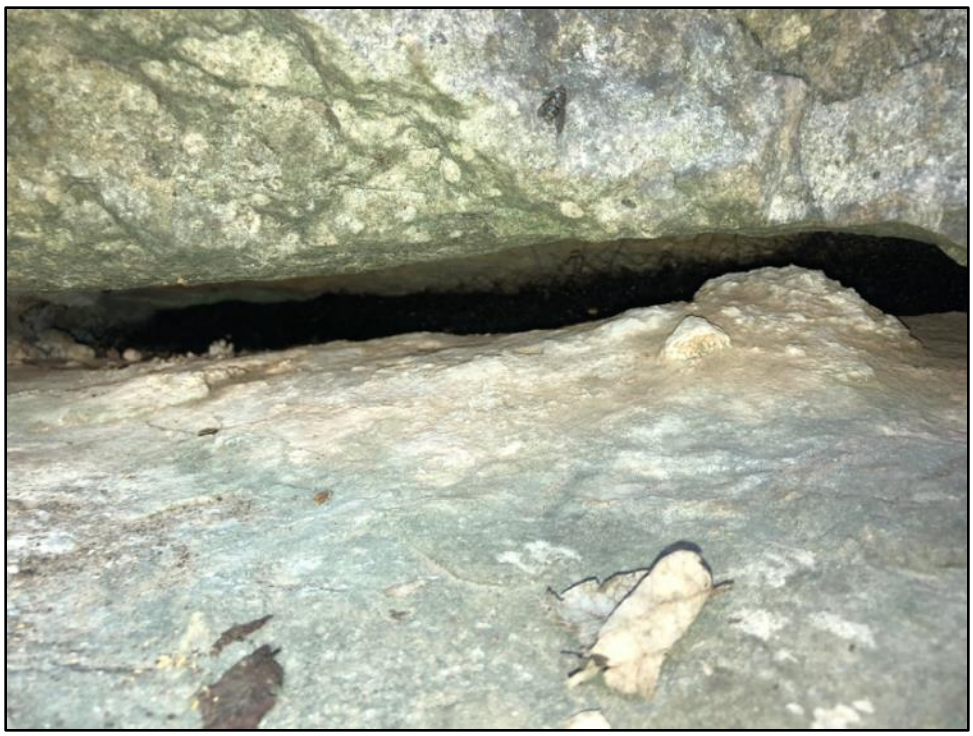

Figure 318. Interior of enlarged bedding plane at feature LOOP-213.

Feature LOOP-214; Solution Cavity/Solution-enlarged Fracture

This feature was located south of the eastbound mainlanes of Loop 1604 and west of West Bitters Road (Figure 319 - Figure 323). It was evaluated on July 25, 2019. The feature was a zone of solution-enlarged fractures and solution cavities within a streambed that measured 9.1 m (30 ft) wide by 54.9 m (180 ft) long and 0.6 (2 ft) deep. There was no airflow, no mesocavernous voids, and no human-sized void. This feature was filled with fine compact soils, calcite, and bedrock. Excavation was not warranted because the feature was nearly entirely bedrock with very little loose debris available to move. This feature was determined not to provide potential habitat for listed karst invertebrate species and no fauna surveys were performed (Table 2).

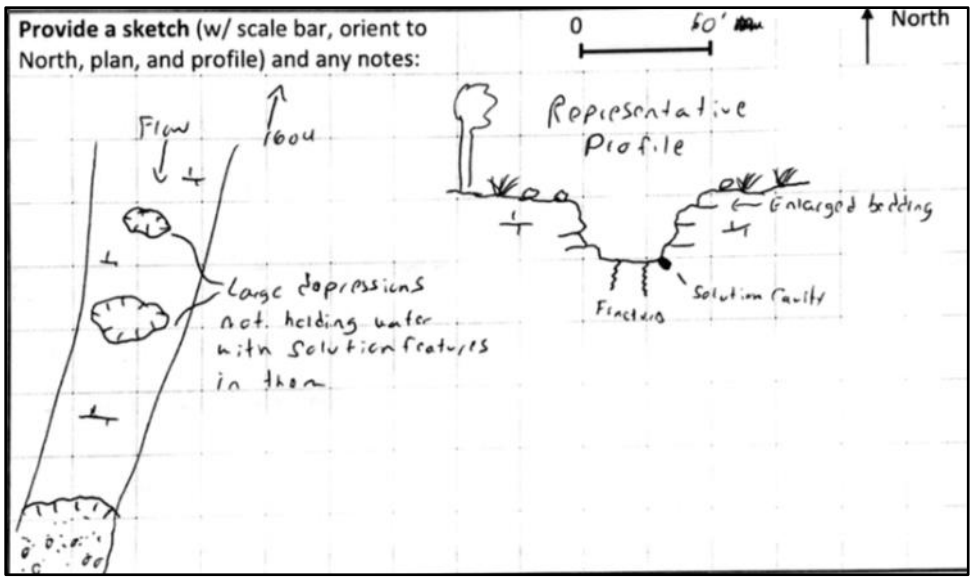

Figure 319. Field sketch of feature LOOP-214.


Figure 320. Overview of feature LOOP-214.

Figure 321. Fracture in bedrock on feature LOOP-214.

Figure 322. Solution cavities in bedrock on feature LOOP-214.

Figure 323. Solution-enlarged fracture in bedrock of feature LOOP-214.

Feature LOOP-215; Solution Cavity/Solution-enlarged Fracture

This feature was located on a natural cliff face of Leon Creek, west of the southbound lanes of I-10 and south of La Cantera Road (Figure 324 - Figure 327). The feature was evaluated on July 23, 2019 and August 5, 2019. It was a solution-enlarged fracture with no airflow that measured 1.2 m (1.2 ft) wide by 1.9 m (6.0 ft) long and 0.8 m (2.6 ft) tall. This feature had a floor depth of 3.0 m (9.8 ft) below the top of the cliff, and the entrance was approximately 4.0 m (13.1 ft) above the base of the cliff. The floor consisted of loose soil, rocks, and bedrock. The interior of the feature was bedrock and no excavation was performed. The feature was similar to other features in the area and had mesocavernous voids.

Feature LOOP-215 was considered potential karst invertebrate habitat due to similarity to nearby caves, void size greater than or equal to 1.0 m (3.3 ft), and modern soils and leaf litter (Table 2). Presence/absence surveys were conducted in August and September 2019 (Table 44); however, no troglobites were found (Table 1, Table 45).

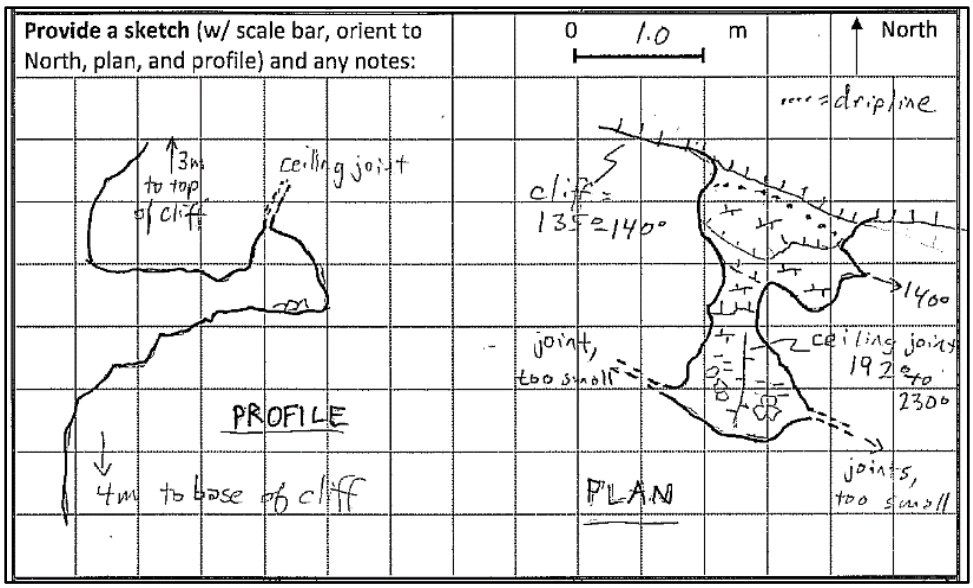

Figure 324. Field sketch of feature LOOP-215.

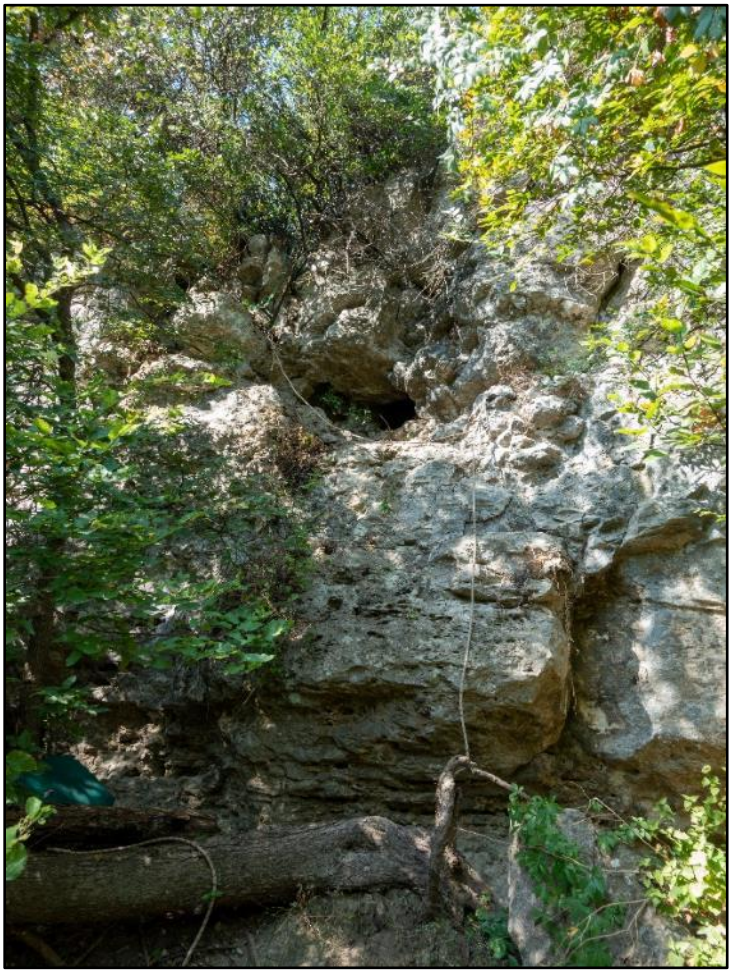
Figure 325. Overview of feature LOOP-215. The rope was used for surveyors to access the feature.

Figure 326. Entrance of feature LOOP-215. Scale bar points north.

Figure 327. Close up of farthest extent of feature LOOP-215. Scale bar points north, and voids extend in both directions laterally at the back wall, as well as vertically into the ceiling.

Table 44. Summary of survey activity for feature LOOP-215.

Date	Time	Effort (minutes)	Comments
08/05/2019	-	-	Feature evaluation; set traps and data logger
08/09/2019	10:10	16	Checked and reset traps
08/12/2019	10:55	10	Checked and reset traps
08/14/2019	11:09	10	Checked and reset traps
08/16/2019	10:03	7	Checked and reset traps
08/19/2019	10:55	14	Checked and reset traps
08/21/2019	10:08	10	Checked and reset traps
08/23/2019	12:11	10	Checked and reset traps
08/26/2019	11:27	10	Checked and reset traps
08/28/2019	11:14	12	Checked and reset traps
08/30/2019	10:07	18	Checked and reset traps
09/01/2019	09:29	12	Checked and reset traps
09/03/2019	10:55	6	Checked and reset traps
09/05/2019	11:07	24	Checked and reset traps
09/07/2019	09:25	10	Checked traps; removed traps and data logger

Table 45. Summary of fauna observations at feature LOOP-215.

Common Name	Lowest Taxonomic Identification
Woodlice	Armadillidae
Spider	Araneae
Millipede	Diplopoda
Cricket	*Ceuthophilus secretus*
Cockroach	Blattaria
Ant	Formicidae
Moth	Lepidoptera
Fly/Gnat	Diptera
Canyon wren	*Catherpes mexicanus*
Mouse	*Mus* sp.

Feature LOOP-217; Solution Cavity/Solution-enlarged Bedding Plane

This feature was located in a roadcut south of the eastbound mainlanes of Loop 1604, west of Blanco Road (Figure 328 - Figure 330). This feature was found on September 25, 2019. The surface expression of this feature was very subtle and was detected only because surveyors could discern that water had flowed into the drilled shaft at the base of the roadcut. The feature itself was a solution cavity or solution-enlarged bedding plane located at the bottom of the drill hole that was made during the original construction of Loop 1604. The feature was situated approximately 1 m (3.3 ft) below the grade and was visible only by looking down the drilled hole. Excavation was concluded on September 30, 2019 removing loose rocks and soil until bedrock was encountered. No mesocavernous voids continued into bedrock, and the natural part of the feature below the drill hole was less than 1 m in length, so it was not considered to contain karst invertebrate habitat (Table 2).

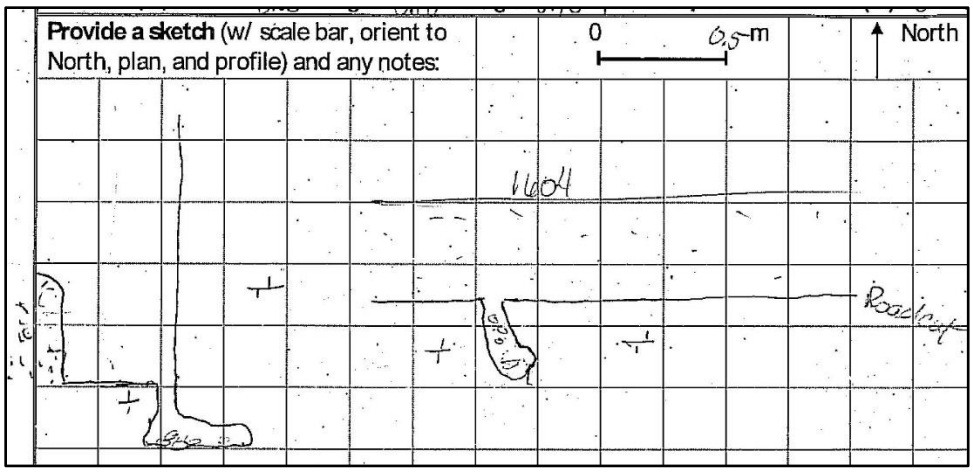

Figure 328. Field sketch of feature LOOP-217.

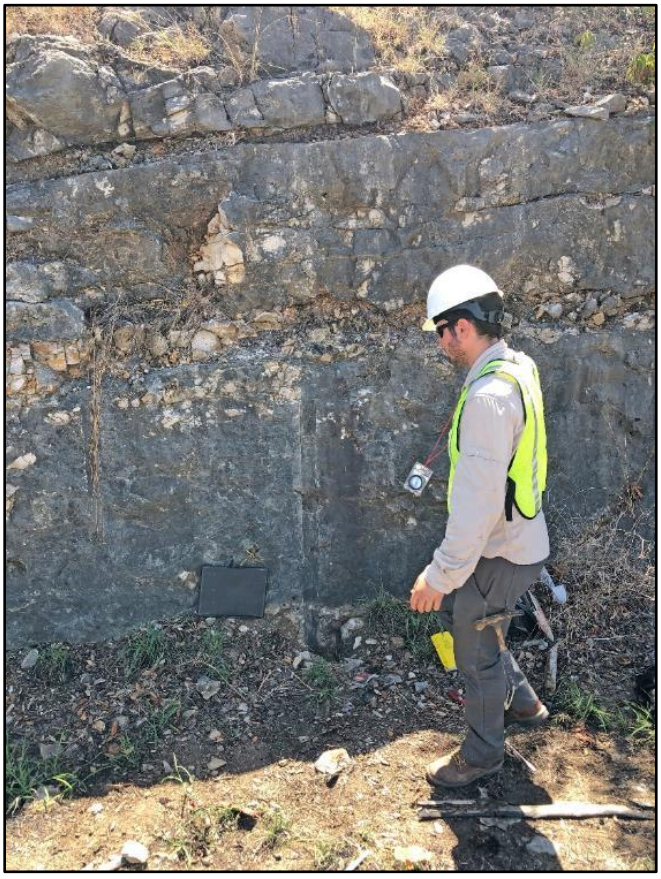
Figure 329. Overview of feature LOOP-217.

Figure 330. Close-up of feature LOOP-217.

Discussion

In the 1535 ac Project Area 48 new features were found, and most of those were in the easements which have had less study. Previously studied sites were re-surveyed to meet the current protocol requirements of 14 surveys. In most cases, new records were found, such as *Cicurina platypus/bullis* from feature 1604-FZ7 and a *Cambala* sp. millipede from feature 1604-L16 (12A Cave). In at least one case, there were no new records for troglobites (1604-R06). Green Mountain Road Cave, which previously had five biological surveys, was also re-surveyed. This current effort yielded new records including what is likely the troglobitic spider, *Eidmannella* sp., and a range extension for a troglobitic schizomid.

Some locations did not meet the criteria for habitat in the 2009 and 2010 assessments, but the slightly changed current criteria put a few locations over that threshold, so they were sampled during this effort. Examples include 1604-FZ4, 1604-R05. In both instances, presence/absence surveys revealed no troglobites.

While surveys did not yield any new localities for listed species, three previously known sites occur in the Action Area, including Green Mountain Road Cave (1604-E09), La Cantera Cave No. 1, and La Cantera Cave No. 2 (Table 1, Figure 2). Critical Habitat Unit 9 also overlaps with the Action Area, however the occupied caves and features in that unit do not occur in the Action Area. The only occupied site that occurs in the Project Area is Green Mountain Road Cave (1604-E09).

Literature Cited

Barrett, M.E. 1999. Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices: TCEQ, Field Operations Divisions, RG-348.

George Veni & Associates. 1994. Geologic controls on cave development and the distribution of endemic cave fauna in the San Antonio, Texas, region. Report prepared for Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service. Revised February 1994. 99 p.

George Veni & Associates. 2003. Delineation of Hydrogeologic Areas and Zones for the Management and Recovery of Endangered Karst Invertebrate Species in Bexar County, Texas. Prepared for U.S. Fish and Wildlife Service. Submitted 21 December 2002. Revised April 2003. 76 p.

Hedin M, Derkarabetian S, Blair J, Paquin P. 2018. Sequence capture phylogenomics of eyeless *Cicurina* spiders from Texas caves, with emphasis on US federally-endangered species from Bexar County (Araneae, Hahniidae). ZooKeys 769: 49-76. https://doi.org/10.3897/zookeys.769.25814

SWCA, Inc. Environmental Consultants. 2000. Results of a karst invertebrate habitat assessment of five karst features between N.W. Military Drive and Bitters Road on Loop 1604, San Antonio, Bexar County, Texas. CSJ: 2452-02-061. Report prepared for Texas Department of Transportation San Antonio District on September 22, 2000. 18 pp.

Texas Commission on Environmental Quality (TCEQ). 2004. Instructions to Geologists for Geological Assessments on the Edwards Aquifer Recharge/Transition Zone. TCEQ RG-0508. 34 pp. Revised October 1, 2004.

Texas Department of Transportation (TxDOT). 2015a. Final: Karst Invertebrate Technical Report for Loop 1604 from Interstate Highway 35 to State Highway 90, Bexar County, Texas. Technical Report prepared by Zara Environmental LLC, 27 March 2015. 271 pp. plus appendices A- K.

_____. 2015b. Geologic Assessment and Karst Feature Survey. I-10 Managed Lanes From FM 3351 (Ralph Fair Rd) to La Cantera Parkway, Bexar County, Texas. CSJ: 0072-07-041 and 0072-08-089. August 2015. 38 pp.

_____. 2017. Geologic Assessment. State Loop 1604 at Farm to Market (FM) 1535, Bexar County, CSJ 2452-02-118. September 25, 2017. 24 pp.

_____. 2018a. Geologic Assessment. State Loop 1604 at Bitters Road and Huebner Road, Bexar county, CSJ 2452-02-119. February 09, 2018. 126 pp.

_____. 2018b. Geologic Assessment. State Loop 1604 from Redland Road to Bulverde Road, Bexar county, CSJ 2452-03-118. February 28, 2018. 47 pp.

_____. 2018c. Karst Terrain Feature Survey Report. Loop 1604 at FM 2696 (Blanco Rd). CSJ: 2452-02-117. August 2018. 29 pp.

_____. 2019a. Final Karst Technical Report. Loop 1604 at Farm-to-Market Road 2696 (Blanco Road), Bexar County, Texas. CSJ: 2454-02-117. May 29, 2019. 46 pp.

_____. 2019b. Draft Biological Assessment (BA) for Consultation with the USFWS. Loop 1604 at Farm-to-Market Road (FM) 2696 (Blanco Road), Bexar County, Texas. CSJ: 2454-02-117. February 2019. 409 pp.

_____. 2019c. Interim Karst Technical Report. Construction Monitoring for US 281 from Loop 1604 to the Comal County Line, Bexar County, Texas. CSJ: 0253-04-138. July 26, 2019. 218 pp.

United States Fish and Wildlife Service (USFWS). 2011. Bexar County Karst Invertebrate Distribution. USFWS Ecological Services Field Office, Austin, Texas. 28 July 2011. 13 pp.

_____. 2012. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates. Federal Register 77(30) 8450-8523.

_____. 2015a. Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas. USFWS Ecological Services Field Office, Austin, Texas. Revised 21 May 2015. Available at: https://www.fws.gov/southwest/es/Documents/R2ES/Karst_Survey_Procedures_20150528.pdf

_____. 2015b. Biological Opinion for Improvements to US 281 from Loop 1604 north to the Comal County line in San Antonio, Bexar County, Texas. Consultation Number: 02ETAU00-2015-F-0031. USFWS Ecological Services Field Office, Austin, Texas. 12 March 2015.

_____. 2016. Biological Opinion for Loop 1604 from IH 35 to SH 16 in San Antonio, Bexar County, Texas. 16 June 2016. 40 pp.

_____. 2019. Biological Opinion for Loop 1604 at FM 2696 (Blanco Road). CSJ: 2453-02-117, Bexar County, Texas. 17 July 2019. 21 pp.

Veni, G. and J.R. Reddell. 2002. Protocols for Assessing Karst Features for Endangered Invertebrate Species. Report by George Veni and Associates, San Antonio, Texas. 7 pp.

Zara Environmental LLC. 2010a. Draft: Geologic Assessment for Loop 1604 from Interstate Highway 35 to State Highway 90, Bexar County, Texas. Draft report prepared for Michael Baker Jr., Inc. 7700 Chevy Chase Drive, Bldg. 1, Suite 210. Austin, Texas 78752. Dated 19 November 2010. 33pp.

_____. 2010b. Draft Karst Invertebrate Technical Report for Loop 1604 From Interstate Highway 35 to State Highway 90, Bexar County, Texas. Technical report prepared for Michael Baker Jr., Inc., Arlington, TX, 8 December 2010. 238 pp. plus appendices A – I.

_____. 2012. Karst invertebrate technical report for voids discovered during construction at Loop 1604, Bexar County, Texas. Prepared for Hicks & Company, 12 January 2012. 54 pp.

Appendix A. Non-habitat Features and Features Not Evaluated

Table A-1. GA-only Features, and
Table A-2. Historic, Destroyed, Not Found, Not Evaluated Features

Table A-1. Summary table of features in the Project Area that are mentioned in the GA performed concurrently with the current study but are not considered potential karst invertebrate habitat.

Feature ID	Feature type	Latitude (NAD 83)	Longitude (NAD83)
1604-002	Non-karst closed depression	29.60178	-98.39433
1604-F057	Fracture zone in creekbed/bedrock scour	29.60151	-98.53895
1604-T01	Solution cavity/bisected roadcut sinkhole	29.60559	-98.45509
1604-T02	Solution cavity/bisected roadcut sinkhole	29.6057	-98.45572
1604-T04	Bisected roadcut sinkhole	29.607994	-98.525234
1604-T05	Fault	29.603564	-98.534041
1604-T06	Solution cavity/bisected roadcut sinkhole	29.602691	-98.534679
1604-T07	Fault	29.602761	-98.534457
1604-T08	Solution-enlarged fracture zone	29.602843	-98.53414
1604-T09	Bisected roadcut sinkhole	29.602991	-98.533825
1604-T11	Bisected roadcut sinkhole	29.605028	-98.530001
1604-T12	Solution-enlarged bedding plane/ bisected roadcut sinkhole	29.607441	-98.525634
1604-T17	Mapped Fault	29.6026	-98.3813
1604-T18	Mapped Fault	29.6025	-98.3857
1604-T22	Mapped Fault	29.6009	-98.4189
1604-T25	Mapped Fault	29.5991	-98.5651
1604-T27	Mapped Fault	29.592	-98.5881
1604-T34	Mapped Fault	29.5464	-98.674
1604-W05	Zone of karst	29.608466	-98.523442
1604-W08	Zone of karst	29.603074	-98.533352
F056	Enlarged fracture in streambed	29.6029	-98.539
G01	Non-karst closed depression	29.592528	-98.597487
G14	Fault	29.614088	-98.605183
HB--012	Bisected roadcut sinkhole	29.603786	-98.533114
HB-017	Bisected roadcut sinkhole	29.603008	-98.535008

Table A-1. (Continued) Summary table of features in the Project Area that are mentioned in the GA performed concurrently with the current study but are not considered potential karst invertebrate habitat.

Feature ID	Feature type	Latitude (NAD 83)	Longitude (NAD83)
HB-025	Bisected roadcut sinkhole	29.602464	-98.535399
LOOP-001	Fractured bedrock	29.60124	-98.40352
LOOP-002	Fractured bedrock	29.60341	-98.53891
LOOP-003	Zone of fractures in creek bed	29.56273	-98.65813
LOOP-004	Void in fill	29.60163	-98.38293
LOOP-006	Vuggy bedrock	29.60151	-98.39114
LOOP-007	Fractured bedrock	29.60203	-98.39027
LOOP-008	Geotech borehole	29.60178	-98.40454
LOOP-012	Fractured bedrock/sinking stream	29.60986	-98.48728
LOOP-013	Fractured bedrock	29.61021	-98.48101
LOOP-014	Fractured bedrock	29.60921	-98.51984
LOOP-015	Fractured bedrock	29.60717	-98.52825
LOOP-016	Fractured bedrock	29.60781	-98.51811
LOOP-017	Fractured bedrock	29.6077	-98.51674
LOOP-101	Non-karst closed depression	29.59939	-98.59891
LOOP-106	Fractured bedrock	29.60139	-98.39579
LOOP-108	Enlarged fracture	29.60579	-98.456
LOOP-109	Enlarged fracture	29.60573	-98.45537
LOOP-113	Fractured bedrock	29.60793	-98.50007
LOOP-114	Fractured bedrock	29.60777	-98.49595
LOOP-115	Fractured bedrock	29.60849	-98.48663
LOOP-116	Vuggy bedrock	29.60893	-98.48083
LOOP-201	Geotech borehole	29.55824	-98.66204
LOOP-203	Enlarged fracture	29.60913	-98.496
LOOP-205, F092	Fractured bedrock/sinking stream	29.60862	-98.48667
LOOP-208	Enlarged fracture and contact	29.61892	-98.60857

Table A-1. (Continued) Summary table of features in the Project Area that are mentioned in the GA performed concurrently with the current study but are not considered potential karst invertebrate habitat.

Feature ID	Feature type	Latitude (NAD 83)	Longitude (NAD83)
LOOP-209	Enlarged fracture	29.58197	-98.64213
LOOP-211	Well or test hole	29.57528	-98.64575
LOOP-212	Enlarged fracture	29.57942	-98.64146
LOOP-216	Fault	29.60887	-98.51072
North Wall C(33)	Solution cavity	29.606639	-98.458194
RB-008	Well	29.599748	-98.42524
RB-009	Non-karst closed depression	29.599683	-98.427468
RB-010	Non-karst closed depression	29.599593	-98.430772
RB-013	Non-karst closed depression	29.599944	-98.426155

Table A-2. Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former Geologic Assessments, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
34	29.589442	-98.616792		TSS 2019	x	
43746	29.592	-98.5967	not found	TSS	x	
04WB 21/22	29.61051	-98.47786	Not found in 2019, destroyed. Void with habitat in a trench for a ramp footing - 3 p/a surveys done; no listed spp. Found.	Zara 2012a	x	
04-WB-30(10)	29.6105	-98.477667	Not found in 2019, destroyed. Solution cavity with habitat in a trench for ramp footing - 3 p/a surveys done; no listed spp. Found	Zara 2012a	x	
1604-001	29.60173	-98.39302	Non-karst closed depression	TSS 2019	x	
1604-039	29.60103	-98.40665	Undetermined - access for excavation not granted in 2009, not found in 2015; outside of ROW	TxDOT 2015a	x	
1604-901	29.60649	-98.4596	Not habitat in 2010, not reported in 2019	TxDOT 2015a	x	
1604-BC28	29.58816	-98.6272	Not found in 2019, sewer line in creek - manmande feature	TxDOT 2015a	x	
1604-CE2	29.59086	-98.60202	Not found, see feature description in Zara 2019	TxDOT 2015a	x	
1604-D04	29.60834	-98.51379	Not found in 2019, likely was animal burrow, historic	TxDOT 2015a	x	
1604-D14	29.60826	-98.52278	Not found in 2019, not found in Zara 2017 GA. See TxDOT 2015a.	TxDOT 2015a	x	
1604-D21	29.60259	-98.36423	Exposed bedrock/non-karst closed depression	TSS 2019	x	
1604-E02	29.60812	-98.50642	Not found in 2019, utility trench	TxDOT 2015a	x	
1604-E06	29.60845	-98.46796	Not found in 2019, utility trench subsidence in 2010	TxDOT 2015a	x	
1604-E08	29.60766	-98.46423	Not found in 2019, non-karst closed depression	TxDOT 2015a	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former Geologic Assessments, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
1604-F097	29.60714	-98.46152	Not habitat in 2009, not located in 2015, probably mined away during 1604/281 interchange construction	TxDOT 2015a	x	
1604-F098	29.60692	-98.46077	Not habitat in 2009, not located in 2015, probably mined away during 1604/281 interchange construction	TxDOT 2015a	x	
1604-F099	29.60679	-98.46038	Enlarged bedding plane with P/A surveys in 2009 (troglobites but no ES found), destroyed for 281/1604 interchange: see TxDOT 2015	TxDOT 2015a	x	
1604-F101 (Tally Ho Cave)	29.60644	-98.45923	Cave in 2009, had P/A surveys in 2009 (troglobites incl. *Cicurina platypus* found but no endangered species found), destroyed for 281/1604 interchange: see TxDOT 2015	TxDOT 2015a	x	
1604-F102	29.60673	-98.45863	Enlarged fracture destroyed for 281/1604 interchange: see TxDOT 2015	TxDOT 2015a	x	
1604-F103	29.60667	-98.45843	Enlarged fracture destroyed for 281/1604 interchange: see TxDOT 2015	TxDOT 2015a	x	
1604-FZ2	29.607	-98.45955	Enlarged Fracture in 2009, had P/A surveys in 2009 (no ES found), destroyed for 281/1604 interchange: see TxDOT 2015	TxDOT 2015a	x	
1604-K40	29.60549	-98.45633	Not found in 2019, found in 2009 at base of the roadcut, probably filled with debris.	TxDOT 2015a	x	
1604-L08	29.60265	-98.54061	Stream scour	TSS 2019	x	
1604-M33	29.6016	-98.53948	Manmade feature (gas line)	TxDOT 2015a	x	
1604-M39	29.60128	-98.548	Not found in 2019, non-karst closed depression in 2015	TxDOT 2015a	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former Geologic Assessments, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
1604-Q44	29.5895	-98.60843	Not found, soil piping feature into a karst feature that was excavated in the past: see TxDOT 2015	TxDOT 2015a	x	
1604-T03	29.605953	-98.456369	Not found in 2019	TxDOT 2015a	x	
1604-T10	29.603046	-98.533657		TSS 2019	x	
1604-T13	29.608411	-98.512622	Bisected roadcut sinkhole	TSS 2019	x	
1604-T14	29.608415	-98.512348	Bisected roadcut sinkhole	TSS 2019	x	
1604-T15	29.606951	-98.460643		TSS 2019	x	
1604-T16	29.6065	-98.459167	Grouted	TxDOT 2015a	x	
1604-T19	29.6022	-98.3993	Mapped fault	TSS 2019	x	
1604-T20	29.6017	-98.4061	Mapped fault	TSS 2019	x	
1604-T23	29.6002	-98.4276	Mapped Fault	TSS 2019	x	
1604-T24	29.6016	-98.5491	Not found in 2019/Mapped fault	TxDOT 2015a	x	
1604-T28	29.5895	-98.6088	Not found in 2019/mapped fault	TxDOT 2015a	x	
1604-T29	29.5893	-98.6109	Not found in 2019/mapped fault	TxDOT 2015a	x	
1604-T30	29.5888	-98.6162	Mapped fault	TSS 2019	x	
1604-T31	29.5873	-98.6314	Mapped fault	TSS 2019	x	
1604-T32	29.5768	-98.6448	Mapped fault	TSS 2019	x	
1604-T33	29.5757	-98.6457	Mapped fault	TSS 2019	x	
1604-W01	29.606295	-98.457536	Zone of karst	TSS 2019	x	
1604-W02	29.605898	-98.457715	Zone of karst	TSS 2019	x	
1604-W03	29.608809	-98.509286	Zone of karst	TSS 2019	x	
1604-W04	29.608348	-98.509337	Zone of karst	TSS 2019	x	
1604-W06	29.607992	-98.52332	Zone of karst	TSS 2019	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former Geologic Assessments, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
1604-W07	29.603486	-98.533579	Zone of karst	TSS 2019	x	
281-117	29.608655	-98.464733		TSS 2019	x	
281-121 (Turnaround Cave)	29.6091	-98.4692		TSS 2019	x	
AA-5-A	29.60878	-98.48938	Not found in 2019, destroyed. Originally classified as "vugs" and determined to not be habitat	Zara 2012a	x	
AA-6-A	29.60884	-98.48907	Not found in 2019, destroyed.	Zara 2012a	x	
AA-6-B	29.608889	-98.488889	Not found in 2019, destroyed.	Zara 2012a	x	
Aqualogic Cave	29.610123	-98.475342	Not found in 2019, destroyed. Located in within a stormwater treatment facility, received P/A surveys in 2012 and found Mixojapyx sp., a rare troglobite; See TxDOT 2015a	Zara 2012e	x	
Blanco 1 (46)	29.608944	-98.507583	Not found in 2019, this site was mined away during 281 @ 1604 intersection construction. Solution cavity found during construction on 17 July 2012, P/A surveys and no listed spp. found		x	
Blanco 2 (47)	29.60888	-98.50764	Not found in 2019, this site was mined away (TxDOT 2019b). Solution cavity found during construction on 17 July 2012, P/A surveys and no listed spp. found	Zara 2012d	x	
Blanco 3 (48)	29.608917	-98.507417	Not found in 2019, this site was mined away during 281 @ 1604 intersection construction. Solution cavity found during construction on 17 July 2012, P/A surveys and no listed spp. found		x	
Dezavala Sinkhole	29.567523	-98.591154		TSS 2019	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
F027	29.5427	-98.6767	not found	TxDOT 2007	x	
F030	29.5794	-98.6414	no access - not located	TxDOT 2007	x	
F036	29.5879	-98.6306	parking lot (destroyed)	TxDOT 2007	x	
F042	29.5907	-98.6046	1604-R03	TxDOT 2007	x	
F043	29.5905	-98.6041	1604-R06	TxDOT 2007	x	
F044	29.5897	-98.6038	not found	TxDOT 2007	x	
F047	29.5995	-98.5626	no access - not located	TxDOT 2007	x	
F048	29.6008	-98.5626	paved (destroyed)	TxDOT 2007	x	
F051	29.6026	-98.5411	graded (destroyed)	TxDOT 2007	x	
F057	29.6015	-98.539	1604-F057	TxDOT 2007	x	
F058	29.6027	-98.5343	1604-L16	TxDOT 2007	x	
F059	29.6027	-98.5343	1604-L16	TxDOT 2007	x	
F061	29.6051	-98.5298	1604-F061	TxDOT 2007	x	
F062	29.6077	-98.526	1604-F063	TxDOT 2007	x	
F063	29.6077	-98.526	1604-F063	TxDOT 2007	x	
F064	29.6079	-98.5257	1604-F064	TxDOT 2007	x	
F066	29.6082	-98.5249	1604-F066	TxDOT 2007	x	
F067	29.608	-98.5237	1604-D15	TxDOT 2007	x	
F068	29.6085	-98.5238	1604-F069	TxDOT 2007	x	
F069	29.6085	-98.5238	1604-F069	TxDOT 2007	x	
F070	29.6083	-98.5223	1604-F070	TxDOT 2007	x	
F071	29.6088	-98.5219	1604-F071	TxDOT 2007	x	
F072	29.6083	-98.5213	1604-F072	TxDOT 2007	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
F073	29.6084	-98.5206	1604-F073	TxDOT 2007	x	
F074	29.6084	-98.5203	1604-F074	TxDOT 2007	x	
F075	29.6084	-98.52	not located	TxDOT 2007	x	
F076	29.6088	-98.5132	1604-F076	TxDOT 2007	x	
F077	29.6088	-98.5132	1604-F077	TxDOT 2007	x	
F078	29.6083	-98.513	1604-F078	TxDOT 2007	x	
F079	29.6088	-98.5126	1604-F079	TxDOT 2007	x	
F081	29.6088	-98.512	not found	TxDOT 2007	x	
F083	29.6084	-98.5112	1604-F083	TxDOT 2007	x	
F084	29.6084	-98.5108	1604-F084	TxDOT 2007	x	
F085	29.6084	-98.5094	1604-F085	TxDOT 2007	x	
F092	29.6082	-98.4867	no access - not located	TxDOT 2007	x	
F094	29.6108	-98.4781	graded (destroyed)	TxDOT 2007	x	
F096	29.6071	-98.4615	1604-F096 (synonym with 1604-F097)	TxDOT 2007	x	
F097	29.6071	-98.4615	1604-F097	TxDOT 2007	x	
F098	29.6069	-98.4608	1604-F098	TxDOT 2007	x	
F099	29.6068	-98.4604	1604-F099	TxDOT 2007	x	
F10	29.60843	-98.50942	1604-F085	TxDOT 2009	x	
F-10	29.5995	-98.5626	no access - not located	SWCA 2005 (A)	x	
F100	29.6069	-98.4593	not found	TxDOT 2007	x	
F101	29.6064	-98.4592	1604-F101	TxDOT 2007	x	
F102	29.6067	-98.4586	1604-F102	TxDOT 2007	x	
F103	29.6067	-98.4584	1604-F103	TxDOT 2007	x	
F104	29.6007	-98.4261	drainage channel, scour	TxDOT 2007	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
F105	29.6024	-98.3717	1604-E09	TxDOT 2007	x	
F-11	29.6008	-98.5626	paved (destroyed)	SWCA 2005 (A)	x	
F13	29.60512	-98.52982	1604-F061	TxDOT 2009	x	
F-14	29.6027	-98.5343	not found	SWCA 2005 (A)	x	
F-14a	29.6027	-98.5343	not found	SWCA 2005 (A)	x	
F-14b	29.6026	-98.5411	graded (destroyed)	SWCA 2005 (A)	x	
F-14c	29.6051	-98.5298	1604-F061	SWCA 2005 (A)	x	
F-15	29.6077	-98.526	1604-F063	SWCA 2005 (A)	x	
F15-a	29.6077	-98.526	1604-F063	SWCA 2005 (A)	x	
F15-b	29.6079	-98.5257	1604-F064	SWCA, 2005 (A)	x	
F15-c	29.6082	-98.5249	1604-F066	SWCA, 2005 (A)	x	
F15-d	29.6085	-98.5238	1604-F069	SWCA, 2005 (A)	x	
F15-e	29.608	-98.5237	1604-D15	SWCA, 2005 (A)	x	
F15-f	29.6083	-98.5223	1604-F070	SWCA, 2005 (A)	x	
F15-g	29.6088	-98.5219	1604-F071	SWCA, 2005 (A)	x	
F15-h	29.6083	-98.5213	1604-F072	SWCA, 2005 (A)	x	
F15-I	29.6084	-98.5206	1604-F073	SWCA, 2005 (A)	x	
F15-j	29.6084	-98.5203	1604-F074	SWCA, 2005 (A)	x	
F15-k	29.6084	-98.52	not found	SWCA, 2005 (A)	x	
F16	29.60882	-98.51197	1604-F076	TxDOT 2009	x	
F-16	29.6088	-98.5132	1604-F076	SWCA, 2005 (A)	x	
F-16a	29.6088	-98.5132	1604-F077	SWCA, 2005 (A)	x	
F-16b	29.6083	-98.513	1604-F078	SWCA, 2005 (A)	x	
F-16c	29.6088	-98.5126	1604-F079	SWCA, 2005 (A)	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former Geologic Assessments, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
F-16d	29.6085	-98.5238	1604-F069	SWCA, 2005 (A)	x	
F-16e	29.6088	-98.512	not found	SWCA, 2005 (A)	x	
F-16f	29.6084	-98.5112	1604-F083	SWCA, 2005 (A)	x	
F-16g	29.6084	-98.5108	1604-F084	SWCA, 2005 (A)	x	
F-16h	29.6084	-98.5094	1604-F085	SWCA, 2005 (A)	x	
F17	29.60878	-98.51262	1604-F079	TxDOT 2009	x	
F-17	29.6071	-98.4615	1604-F096 (synonym with 1604-F097)	SWCA, 2005 (A)	x	
F-17a	29.6071	-98.4615	1604-F097	SWCA, 2005 (A)	x	
F-17b	29.6069	-98.4608	1604-F098	SWCA, 2005 (A)	x	
F-17c	29.6068	-98.4604	1604-F099	SWCA, 2005 (A)	x	
F-17d	29.6069	-98.4583	no access - not located	SWCA, 2005 (A)	x	
F-17f	29.6067	-98.4586	1604-F102	SWCA, 2005 (A)	x	
F-17g	29.6067	-98.4584	1604-F103	SWCA, 2005 (A)	x	
F18	29.60878	-98.51318	1604-F077	TxDOT 2009	x	
F19	29.60875	-98.52185	1604-F071	TxDOT 2009	x	
F-2	29.5879	-98.6306	under parking lot (destroyed)	SWCA, 2005 (A)	x	
F20	29.60847	-98.52375	1604-F069	TxDOT 2009	x	
F21	29.60815	-98.52488	1604-F066	TxDOT 2009	x	
F22	29.60787	-98.52572	1604-F064	TxDOT 2009	x	
F23	29.60773	-98.52603	1604-F063	TxDOT 2009	x	
F24	29.60802	-98.52373	1604-D15	TxDOT 2009	x	
F25	29.60825	-98.52231	1604-F070	TxDOT 2009	x	
F26	29.60833	-98.52133	1604-F072	TxDOT 2009	x	
F27	29.60835	-98.52063	1604-F073	TxDOT 2009	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
F28	29.60837	-98.52027	1604-F074	TxDOT 2009	x	
F29	29.6084	-98.52	1604-F075 (feature not located)	TxDOT 2009	x	
F-3	29.5907	-98.6046	1604-R03	SWCA, 2005 (A)	x	
F30	29.60667	-98.45843	1604-F103	TxDOT 2009	x	
F31	29.60673	-98.45863	1604-F102	TxDOT 2009	x	
F32	29.60693	-98.45928	not located	TxDOT 2009	x	
F33	29.60714	-98.46152	1604-F097	TxDOT 2009	x	
F34	29.60692	-98.46077	1604-F098	TxDOT 2009	x	
F35	29.60679	-98.46038	1604-F099	TxDOT 2009	x	
F-4	29.5905	-98.6041	1604-R06	SWCA, 2005 (A)	x	
F-5	29.5897	-98.6038	not found	SWCA, 2005 (A)	x	
F6	29.60833	-98.51303	1604-F078	TxDOT 2009	x	
F7	29.60838	-98.51222	not located	TxDOT 2009	x	
F8	29.6084	-98.51117	1604-F083	TxDOT 2009	x	
F9	29.60842	-98.51075	1604-F084	TxDOT 2009	x	
Fiasco Texas Cave No. 6	29.603984	-98.601139	Cave, sealed in 1990 per TSS	TSS 2019	x	
Fiasco Texas Cave No. 7	29.604242	-98.600789	Cave, sealed in 1990 per TSS	TSS 2019	x	
G05	29.613154	-98.605463	LOOP-105	TxDOT 2015b	x	
G09	29.604027	-98.601965	not found	TxDOT 2015b	x	
G14	29.614088	-98.605183	not found	TxDOT 2015b	x	
HH-2-B	29.610579	-98.47774	Not found in 2019, destroyed. Enlarged fracture discovered during trenching in 2012. Had P/A surveys, troglobites but no listed spp.	Zara 2012a	x	

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
HH-2-C	29.6105	-98.47825	Not found in 2019, destroyed. Enlarged fracture discovered during trenching in 2012. Had P/A surveys, troglobites but no listed spp.	Zara 2012a	x	
HH3-30	29.61048	-98.47766	Not found in 2019, destroyed. Solution cavity discovered during trenching in 2012. Had P/A surveys done, troglobites but no listed spp.	Zara 2012b	x	
HH-4-B	29.610472	-98.478389	Not found in 2019, destroyed. Enlarged fracture discovered during trenching in 2011. Had P/A surveys done, troglobites but no listed spp.	Zara 2012a	x	
I-1	29.6061	-98.5274	natural drainage	SWCA, 2005 (B)	x	
IH 10 Karst Feature 3	29.592017	-98.596734		TSS 2019	x	
IH 10 Karst Feature 4	29.590192	-98.596329		TSS 2019	x	
JCT 26 North B	29.60897	-98.4886	Not found in 2019, destroyed. Enlarged fracture discovered during trenching in 2011. Had P/A surveys done, eyeless adult male *Cicurina puentecilla* found (see Appendix C).	Zara 2012a.	x	
North Wall A (31)	29.607389	-98.460361	Cave uncovered during excavation along the north wall of Loop 1604. It had 3 P/A surveys done, no listed species were found.	Zara 2012c	x	
North Wall B (32)	29.607278	-98.460111	Cave uncovered during excavation along the north wall of Loop 1604. It had 3 P/A surveys done, no listed species were found.	Zara 2012c	x	
North Wall C (33)	29.606639	-98.458194	Cave uncovered during excavation along the north wall of Loop 1604. It had 3 P/A surveys done, no listed species were found.	Zara 2012c	x	

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
Polaroid Pit	29.605977	-98.457633		TSS 2019	x	
Quikrete Cave	29.600852	-98.562496		TSS 2019	x	
RB-001	29.602023	-98.440787	Manmade feature	TxDOT 2017	x	
RB-002	29.60029	-98.433425	Manmade feature	TxDOT 2017	x	
RB-003	29.600762	-98.41878	Manmade feature	TxDOT 2017	x	
RB-004	29.600959	-98.418547	Manmade feature	TxDOT 2017	x	
RB-005	29.600444	-98.418528	Manmade feature	TxDOT 2017	x	
RB-006	29.600411	-98.418597	Manmade feature	TxDOT 2017	x	
RB-007	29.60003	-98.42166	Manmade feature	TxDOT 2017	x	
RB-011	29.601641	-98.440668	Manmade feature	TxDOT 2017	x	
RB-012	29.599953	-98.433097	Manmade feature	TxDOT 2017	x	
RB-015	29.601071	-98.418722	Manmade feature	TxDOT 2017	x	
RB-016	29.60084	-98.422111	Manmade feature	TxDOT 2017	x	
RB-017	29.600566	-98.433587	Manmade feature	TxDOT 2017	x	
RB-018	29.602376	-98.440868	Manmade feature	TxDOT 2017	x	
Roadcut Crystal Cave	29.606426	-98.458689		TSS 2019	x	
S-1	29.5884	-98.6245	parking lot (destroyed)	Frost, 2005 (A)	x	
S-1	29.6011	-98.5501	graded (destroyed)	Pape-Dawson, 2004	x	
S-1	29.5964	-98.5717	graded (destroyed)	Pape-Dawson, 2008 (B)	x	
S-1	29.5698	-98.6506	utility trench	Raba-Kistner, 2001	x	
S-1	29.5871	-98.6351	graded (destroyed)	Raba-Kistner, 2009	x	

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
S-2	29.601	-98.5608	graded (destroyed)	Frost, 2009	x	
S-2	29.6001	-98.5636	under highway (destroyed)	Pape-Dawson, 2003 (A)	x	
S-2	29.5898	-98.6004	parking lot (destroyed)	Pape-Dawson, 2007 (A)	x	
S-2	29.5698	-98.6506	utility trench	Raba-Kistner, 2001	x	
S-2	29.5907	-98.5962	under highway (destroyed)	Raba-Kistner, 2008	x	
S-25	29.6096	-98.4869	under highway, paved (destroyed)	Frost, 2004 (B)	x	
S-26	29.6096	-98.4884	parking lot (destroyed)	Frost, 2004 (B)	x	
S-3	29.6001	-98.5635	under highway (destroyed)	Pape-Dawson, 2003 (A)	x	
S-3	29.6107	-98.4803	graded (destroyed)	Pape-Dawson, 2003 (B)	x	
S-3	29.6107	-98.4803	graded (destroyed)	Pape-Dawson, 2006 (B)	x	
S-3	29.5698	-98.6506	utility trench	Raba-Kistner, 2001	x	
S-4	29.5884	-98.6248	parking lot (destroyed)	Frost, 2005 (A)	x	
S-4	29.5889	-98.5996	parking lot (destroyed)	Pape-Dawson, 2007 (A)	x	
S-4	29.5698	-98.6506	electric line	Raba-Kistner, 2001	x	
S-5	29.6007	-98.5629	graded (destroyed)	Frost, 2004 (A)	x	
S-5	29.5869	-98.6353	graded (destroyed)	Raba-Kistner, 2009	x	
S-6	29.5874	-98.6343	parking lot (destroyed)	Raba-Kistner, 2009	x	
S-8	29.5873	-98.6346	graded (destroyed)	Raba-Kistner, 2009	x	
Shot-and-a-Prayer Cave	29.590308	-98.604076		TSS 2019	x	

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
10	29.587364	-98.622626	not found	UTSA 2014		x
26	29.589538	-98.616258		TSS 2019		x
27	29.589576	-98.616029		TSS 2019		x
28	29.589633	-98.6158		TSS 2019		x
31	29.589824	-98.615762		TSS 2019		x
33	29.589518	-98.616468		TSS 2019		x
35	29.589404	-98.617269		TSS 2019		x
36	29.58969	-98.61828		TSS 2019		x
38	29.590211	-98.617159		TSS 2019		x
57	29.590568	-98.610973		TSS 2019		x
58	29.59051	-98.611169		TSS 2019		x
59	29.590599	-98.610821		TSS 2019		x
62	29.590415	-98.609676		TSS 2019		x
63	29.59051	-98.609428		TSS 2019		x
66	29.590892	-98.607139		TSS 2019		x
67	29.590739	-98.607615		TSS 2019		x
68	29.591064	-98.607539		TSS 2019		x
74	29.590644	-98.60691		TSS 2019		x
87	29.590739	-98.605326		TSS 2019		x
90	29.589021	-98.621139		TSS 2019		x
91	29.589824	-98.621275		TSS 2019		x
216	29.590606	-98.607367		TSS 2019		x
217	29.590376	-98.611634		TSS 2019		x
43747	29.5901	-98.5963	not found	TSS 2019		x
1604-012	29.60258	-98.40213	Not found in 2019, outside of the ROW	TSS 2019		x

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
1604-BC25	29.58251	-98.63919		TSS 2019		x
1604-BC27	29.58334	-98.63844		TSS 2019		x
1604-BC29	29.5881	-98.62909	not found	TxDOT 2015a		x
1604-BC32	29.59221	-98.5906	not found	TxDOT 2015a		x
1604-BC35	29.59246	-98.59108		TSS 2019		x
1604-BC39	29.60388	-98.38791		TSS 2019		x
1604-D03	29.61067	-98.48192		TSS 2019		x
1604-E03 (Fireworks Cave)	29.60754	-98.498817		TSS 2019		x
1604-E07	29.60821	-98.46716		TSS 2019		x
1604-E10	29.59448	-98.35483		TSS 2019		x
1604-E11	29.59445	-98.35488		TSS 2019		x
1604-FX2	29.60489	-98.53204		TSS 2019		x
1604-R42	29.58839	-98.62596		TSS 2019		x
1604-R46	29.58839	-98.62795		TSS 2019		x
1604-T26	29.5971	-98.5709		TSS 2019		x
A-03	29.5907	-98.6132	parking lot (destroyed)	Horizon, 2001		x
A-12	29.5895	-98.6163	not found	Horizon, 2001		x
A2	29.6024	-98.4505	no access - not located	Drash, 1997		x
Andy's Conveniently Ignored Cave	29.589209	-98.623514		TSS 2019		x
Come-Along Cave	29.609415	-98.51274		TSS 2019		x
Dirtwater Cave	29.607524	-98.508959		TSS 2019		x
Dynamite Cave	29.607518	-98.502628		TSS 2019		x

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
ES23	29.607611	-98.469167	not found	TxDOT 2015a		x
F026	29.5426	-98.6768	not found	TxDOT 2007		x
F028	29.5788	-98.6425	not found	TxDOT 2007		x
F031	29.5822	-98.6418	no access - not located	TxDOT 2007		x
F032	29.5827	-98.6421	no access - not located	TxDOT 2007		x
F033	29.5837	-98.6382	parking lot (destroyed)	TxDOT 2007		x
F034	29.5851	-98.6339	no access - not located	TxDOT 2007		x
F035	29.5849	-98.6328	no access - not located	TxDOT 2007		x
F037	29.5881	-98.614	no access - not located	TxDOT 2007		x
F038	29.5877	-98.6138	no access - not located	TxDOT 2007		x
F040	29.5902	-98.6119	no access - not located	TxDOT 2007		x
F041	29.5904	-98.6085	no access - not located	TxDOT 2007		x
F045	29.591	-98.5935	covered	TxDOT 2007		x
F046	29.5943	-98.5721	no access - not located	TxDOT 2007		x
F049	29.6012	-98.5474	graded (destroyed)	TxDOT 2007		x
F050	29.6028	-98.5415	1604-M21	TxDOT 2007		x
F052	29.6037	-98.5401	paved (destroyed)	TxDOT 2007		x
F053	29.6028	-98.5399	no access - not located	TxDOT 2007		x
F054	29.6031	-98.5394	graded (destroyed)	TxDOT 2007		x
F065	29.607	-98.525	no access - not located	TxDOT 2007		x
F080	29.6073	-98.5122	parking lot (destroyed)	TxDOT 2007		x
F082	29.6073	-98.5118	parking lot (destroyed)	TxDOT 2007		x
F086	29.6076	-98.5026	no access - not located	TxDOT 2007		x
F087	29.6075	-98.4993	1604-E03	TxDOT 2007		x
F088	29.6078	-98.4951	graded (destroyed)	TxDOT 2007		x

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
F089	29.6076	-98.4917	parking lot (destroyed)	TxDOT 2007		x
F090	29.6076	-98.491	parking lot (destroyed)	TxDOT 2007		x
F093	29.6114	-98.4792	parking lot (destroyed)	TxDOT 2007		x
F095	29.609	-98.4781	parking lot (destroyed)	TxDOT 2007		x
F1	29.6076	-98.4987	1604-E03	Extra, 2006		x
F1	29.588	-98.633	no access - not located	Hays, 2007		x
F-1	29.6075	-98.5049	parking lot (destroyed)	Aris, 2004		x
F-1	29.6076	-98.5049	parking lot (destroyed)	Aris, 2006		x
F-1	29.5822	-98.6418	no access - not located	SWCA, 2005 (A)		x
F-12	29.6012	-98.5474	graded (destroyed)	SWCA, 2005 (A)		x
F13	29.6028	-98.5415	1604-M21	SWCA, 2005 (A)		x
F13a	29.6028	-98.5399	no access - not located	SWCA, 2005 (A)		x
F-17e	29.6054	-98.4592	parking lot (destroyed)	SWCA, 2005 (A)		x
F-2	29.6079	-98.5059	parking lot (destroyed)	Aris, 2006		x
F-27	29.5907	-98.6132	parking lot (destroyed)	Horizon, 2001		x
F-4	29.6079	-98.5058	parking lot (destroyed)	Aris, 2006		x
F-9	29.591	-98.5935	covered (destroyed)	SWCA, 2005 (A)		x
Fountain Pond Cave	29.610935	-98.480405		TSS 2019		x
Hollywood Park Sinkhole	29.607057	-98.492398		TSS 2019		x
I-2	29.605	-98.5272	paved (destroyed)	SWCA, 2005 (B)		x
La Cantera Cave No. 1	29.59033	-98.611376		TSS 2019		x
La Cantera Cave No. 2	29.590803	-98.607406		TSS 2019		x

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
Lost Mine Trail Cave	29.587627	-98.613789		TSS 2019		x
Root Cave	29.601035	-98.544391		TSS 2019		x
S1	29.6052	-98.4515	no access - not located	Drash, 1997		x
S1	29.6094	-98.4752	parking lot (destroyed)	Drash, 2006		x
S-1	29.6094	-98.4785	parking lot (destroyed)	DNA, 2005		x
S-1	29.6094	-98.4752	parking lot (destroyed)	Drash, 2002		x
S-1	29.5836	-98.6376	building (destroyed)	Drash, 2005 (A)		x
S-1	29.5831	-98.6413	parking lot (destroyed)	Drash, 2005 (B)		x
S-1	29.6011	-98.404	bedrock outcrop, no karst features	Duduit, 2004		x
S-1	29.6092	-98.4786	parking lot (destroyed)	Frost, 2005 (B)		x
S-1	29.6034	-98.4423	no access - not located	Frost, 2007 (A)		x
S-1	29.6084	-98.4804	under house (destroyed)	Frost, 2007 (B)		x
S-1	29.602	-98.5603	graded (destroyed)	Frost, 2009		x
S-1	29.6078	-98.4996	parking lot (destroyed)	InTec, 2005 (A)		x
S-1	29.6072	-98.4974	no access - not located	InTec, 2005 (B)		x
S-1	29.5846	-98.6369	graded (destroyed)	Neathery, 2002		x
S-1	29.6007	-98.5402	no access - not located	Pape-Dawson, 2002 (A)		x
S-1	29.5974	-98.5635	paved (destroyed)	Pape-Dawson, 2003 (A)		x
S-1	29.6109	-98.481	graded (destroyed)	Pape-Dawson, 2003 (B)		x
S-1	29.6006	-98.5403	sewer line	Pape-Dawson, 2005 (A)		x
S-1	29.6081	-98.481	under house (destroyed)	Pape-Dawson, 2006 (B)		x
S-1	29.6073	-98.5117	parking lot (destroyed)	Pape-Dawson, 2006 (C)		x

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
S-1	29.5886	-98.6003	parking lot (destroyed)	Pape-Dawson, 2007 (A)		x
S-1	29.5895	-98.6031	sanitary sewer line	Pape-Dawson, 2008 (A)		x
S-1	29.5907	-98.593	no access - not located	Raba-Kistner, 2008		x
S-11	29.6018	-98.5575	graded (destroyed)	Frost, 2004 (A)		x
S-11	29.6069	-98.455	no access - not located	Pape-Dawson, 2009 (C)		x
S-12	29.6022	-98.5569	paved (destroyed)	Frost, 2004 (A)		x
S-13	29.6026	-98.5568	graded (destroyed)	Frost, 2004 (A)		x
S-15	29.6015	-98.5627	graded (destroyed)	Frost, 2004 (A)		x
S-18	29.5933	-98.5885	graded (destroyed)	Pape-Dawson, 2007 (D)		x
S2	29.6054	-98.451	no access - not located	Drash, 1997		x
S2	29.6094	-98.4751	parking lot (destroyed)	Drash, 2006		x
S-2	29.6094	-98.4751	parking lot (destroyed)	Drash, 2002		x
S-2	29.5836	-98.6376	building (destroyed)	Drash, 2005 (A)		x
S-2	29.5828	-98.6413	building (destroyed)	Drash, 2005 (B)		x
S-2	29.6004	-98.404	no access - not located	Duduit, 2004		x
S-2	29.5886	-98.6245	parking lot (destroyed)	Frost, 2005 (A)		x
S-2	29.6092	-98.4783	under building (destroyed)	Frost, 2005 (B)		x
S-2	29.6033	-98.4424	no access - not located	Frost, 2007 (A)		x
S-2	29.6084	-98.4803	under house (destroyed)	Frost, 2007 (B)		x
S-2	29.6078	-98.4996	parking lot (destroyed)	InTec, 2005 (A)		x
S-2	29.6072	-98.4977	no access - not located	InTec, 2005 (B)		x
S-2	29.5851	-98.6363	graded (destroyed)	Neathery, 2002		x
S-2	29.6109	-98.4803	graded (destroyed)	Pape-Dawson, 2003 (B)		x

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Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
S-2	29.6003	-98.5561	no access - not located	Pape-Dawson, 2004		x
S-2	29.6109	-98.4803	graded (destroyed)	Pape-Dawson, 2006 (B)		x
S-2	29.6073	-98.5117	parking lot (destroyed)	Pape-Dawson, 2006 (C)		x
S-2	29.6031	-98.5378	no access - not located	Pape-Dawson, 2007 (B)		x
S-2	29.5861	-98.6373	manmade feature	Raba-Kistner, 2009		x
S-20	29.5922	-98.5911	no access - not located	Pape-Dawson, 2007 (D)		x
S-21	29.5924	-98.5917	no access - not located	Pape-Dawson, 2007 (D)		x
S-22	29.6103	-98.4878	sanitary sewer line	Frost, 2004 (B)		x
S-23	29.61	-98.4877	graded (destroyed)	Frost, 2004 (B)		x
S-24	29.6099	-98.4882	parking lot (destroyed)	Frost, 2004 (B)		x
S-27	29.6098	-98.4897	parking lot (destroyed)	Frost, 2004 (B)		x
S3	29.609	-98.4752	parking lot (destroyed)	Drash, 2006		x
S-3	29.609	-98.4752	parking lot (destroyed)	Drash, 2002		x
S-3	29.5827	-98.6413	building (destroyed)	Drash, 2005 (B)		x
S-3	29.5888	-98.6249	parking lot (destroyed)	Frost, 2005 (A)		x
S-3	29.6088	-98.4787	parking lot (destroyed)	Frost, 2005 (B)		x
S-3	29.6032	-98.4424	no access - not located	Frost, 2007 (A)		x
S-3	29.6085	-98.4799	under house (destroyed)	Frost, 2007 (B)		x
S-3	29.6032	-98.4424	animal burrow	Frost, 2007 (C)		x
S-3	29.6073	-98.4997	parking lot (destroyed)	InTec, 2005 (A)		x
S-3	29.6073	-98.4981	no access - not located	InTec, 2005 (B)		x

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
S-3	29.5846	-98.6361	parking lot (destroyed)	Neathery, 2002		x
S-3	29.5946	-98.5712	stream scour	Pape-Dawson, 2002 (C)		x
S-3	29.5892	-98.5998	parking lot (destroyed)	Pape-Dawson, 2007 (A)		x
S-3	29.5908	-98.6045	1604-R03 and 1604-R04	Pape-Dawson, 2009 (B)		x
S-3	29.5909	-98.5914	no access - not located	Raba-Kistner, 2008		x
S-3	29.5909	-98.5914	no access - not located	Raba-Kistner, 2008		x
S-3	29.5863	-98.6369	manmade feature	Raba-Kistner, 2009		x
S-31	29.5904	-98.6162	parking lot (destroyed)	Horizon, 2001		x
S-3a	29.6013	-98.5626	building (destroyed)	Frost, 2004 (A)		x
S-3b	29.6013	-98.5626	building (destroyed)	Frost, 2004 (A)		x
S-4	29.6087	-98.4789	graded (destroyed)	Frost, 2005 (B)		x
S-4	29.6038	-98.4422	no access - not located	Frost, 2007 (A)		x
S-4	29.6088	-98.4799	parking lot (destroyed)	Frost, 2007 (B)		x
S-4	29.6074	-98.4997	parking lot (destroyed)	InTec, 2005 (A)		x
S-4	29.6073	-98.4986	no access - not located	InTec, 2005 (B)		x
S-4	29.5946	-98.5717	stream scour	Pape-Dawson, 2002 (C)		x
S-4	29.5969	-98.5719	no access - not located	Pape-Dawson, 2008 (B)		x
S-4	29.5848	-98.6335	no access - not located	Pape-Dawson, 2009 (A)		x
S-4	29.5909	-98.5925	no access - not located	Raba-Kistner, 2008		x
S-4	29.5909	-98.5925	no access - not located	Raba-Kistner, 2008		x

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
S-4	29.5863	-98.6367	graded (destroyed)	Raba-Kistner, 2009		x
S-45	29.591	-98.6098	under roadway (destroyed)	Pape-Dawson, 2007 (C)		x
S-46	29.5909	-98.6128	parking lot (destroyed)	Pape-Dawson, 2007 (C)		x
S-5	29.5885	-98.6249	parking lot (destroyed)	Frost, 2005 (A)		x
S-5	29.6093	-98.4789	under building (destroyed)	Frost, 2005 (B)		x
S-5	29.6041	-98.443	no access - not located	Frost, 2007 (A)		x
S-5	29.6073	-98.5	no access - not located	InTec, 2005 (A)		x
S-5	29.6069	-98.4993	no access - not located	InTec, 2005 (B)		x
S-5	29.5847	-98.6363	graded (destroyed)	Neathery, 2002		x
S-5	29.5948	-98.5722	stream scour	Pape-Dawson, 2002 (C)		x
S-5	29.6117	-98.4808	graded (destroyed)	Pape-Dawson, 2003 (B)		x
S-5	29.6117	-98.4808	graded (destroyed)	Pape-Dawson, 2006 (B)		x
S-5	29.5891	-98.5997	parking lot (destroyed)	Pape-Dawson, 2007 (A)		x
S-5	29.5972	-98.5714	no access - not located	Pape-Dawson, 2008 (B)		x
S-5	29.5848	-98.6335	no access - not located	Pape-Dawson, 2009 (A)		x
S-51	29.5926	-98.5884	graded (destroyed)	Pape-Dawson, 2007 (D)		x
S-6	29.5893	-98.6244	parking lot (destroyed)	Frost, 2005 (A)		x
S-6	29.6071	-98.4961	no access - not located	InTec, 2005 (B)		x
S-6	29.5943	-98.5722	graded (destroyed)	Pape-Dawson, 2002 (C)		x
S-6	29.5889	-98.6002	building (destroyed)	Pape-Dawson, 2007 (A)		x

Table A-2. (Continued) Features that are historic, destroyed, not found, or otherwise not described. Historic features are primarily gathered during literature review of former GAs, and those are cited as the source. Features not found were either in the Project Area and specifically searched for and not found, or outside of the Project Area where surveyors did not visit.

Feature ID	Latitude (NAD 83)	Longitude (NAD83)	Current Status and Comments	Source	In Project Area	In Action Area Only
S-6	29.5972	-98.5725	no access - not located	Pape-Dawson, 2008 (B)		x
S-7	29.6021	-98.5599	paved (destroyed)	Frost, 2004 (A)		x
S-7	29.6037	-98.4416	stream scour	Frost, 2007 (A)		x
S-7	29.5874	-98.6344	parking lot (destroyed)	Raba-Kistner, 2009		x
S-8	29.5884	-98.6255	parking lot (destroyed)	Frost, 2005 (A)		x
S-8	29.6025	-98.4397	paved (destroyed)	Frost, 2007 (A)		x
S-8a	29.6019	-98.5593	paved (destroyed)	Frost, 2004 (A)		x
S-8b	29.6019	-98.5593	paved (destroyed)	Frost, 2004 (A)		x
S-9	29.6029	-98.5568	no access - not located	Frost, 2004 (A)		x
S-9	29.6026	-98.4396	paved (destroyed)	Frost, 2007 (A)		x
S-9	29.6026	-98.4396	paved (destroyed)	Frost, 2007 (C)		x
Silo Cave	29.60025	-98.5392		TSS 2019		x
Small Intermittent Sinkhole	29.608326	-98.47062		TSS 2019		x
UTSA F48	29.588178	-98.61388		TSS 2019		x
Virgin Cave	29.607336	-98.511748		TSS 2019		x
Voight's Bat Cave	29.610859	-98.47959		TSS 2019		x

Appendix A: Literature Cited

Aris & Associates, Inc (John Kniffen). 2004. GA from SCS for Sanitary Sewer for Las Catrinas Subdivision, TCEQ files, 5 May 2004.

Aris & Associates, Inc (John Kniffen). 2006. GA from WPAP for Las Catrinas Subdivision, TCEQ files, 3 January 2006.

Drash Consulting Engineers, Inc (J Blayne Kirsch). 1997. GA from WPAP for Community Bible Church, TCEQ files, 15 August 1997.

Drash Consulting Engineers, Inc (Tomas Hernandez, Jr). 2002. GA from WPAP for Wingate Hotel, TCEQ files, 26 December 2002.

Drash Consulting Engineers, Inc (Tomas Hernandez, Jr). 2005A., GA from WPAP for Altex Retail Center, TCEQ files, 1 April 2005.

Drash Consulting Engineers, Inc (Tomas Hernandez, Jr). 2005B. GA from WPAP for Bandera Family Health Care, TCEQ files, 9 August 2005.

Drash Consulting Engineers, Inc (Nickanor Alino. 2006. GA from WPAP/SCS for Fairfield Inn at Loop 1604 and Trailcrest, TCEQ files, 19 June 2006.

Duduit, Timothy Jay, GA from WPAP for Centurion Storage Utility Easement SEC O'Connor Road & Loop 1604 San Antonio, TCEQ files, 16 June 2004.

DNA GeoSciences, Inc (Jeffery Neathery), GA from WPAP for Sunset North, TCEQ files, 26 July 2005.

Extra Environmental, Inc (Peter Schram), GA from WPAP for The Aegean Village, TCEQ files, 10 April 2006.

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for The CRT Flooring Concepts Tract – 0.9 Acres, TCEQ files, 23 August 2003.

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for Hill Country Plaza, TCEQ files, 19 January 2004 (A).

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for The Stone Oak Commercial Tract: 37 Acres, TCEQ files, 7 March 2004 (B).

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for Staybridge Suites 4.45 Acre Tract, TCEQ files, 4 April 2005 (A).

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for The Republic 1604 Mini Storage, TCEQ files, 13 August 2005 (B).

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for Redland Road Commercial 2.9 Acres, TCEQ files, 15 February 2006.

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for Redland Road Commercial 2639 LF, TCEQ files, 21 April 2007 (A).

Frost GeoSciences, Inc (Steve Frost), GA from WPAP for Staybridge Suites, TCEQ files, 11 May 2007 (B).

Frost GeoSciences, Inc (Tomas Hernandez, Jr), GA from SCS for Redland Canyon Plaza, CEQ files, 20 December 2007 (C).

Frost GeoSciences, Inc (Tomas Hernandez, Jr), GA from SCS for Hill Country Plaza Phase 2, TCEQ files, 9 October 2009.

Hays Environmental Consulting (Andrew Grubbs), GA from WPAP for 1604 North Loop Retail Center, TCEQ files, 28 November 2007.

Horizon Environmental Services, Inc (Kristin Miller), GA from WPAP/SCS for The Shops at La Cantera, TCEQ files, 28 February 2001.

InTec of San Antonio (Jeffery Neathery), GA from WPAP for Bike World, TCEQ files, 10 June 2005 (A).

InTec of San Antonio (Jeffery Neathery), GA from SCS for Espensen 1604 Commercial, TCEQ files, 10 June 2005 (B).

Neathery Environmental Services (Jeffery Neathery), GA from WPAP for AAA Alamo Mini Storage (North Hills Village), TCEQ files, 30 September 2002.

Pape-Dawson Engineers (Philip Pearce), GA from SCS for NISD Patricia J. Blattman Elementary School Offsite, TCEQ files, 10 July 2002 (A).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Shavano Park Life Family Church, TCEQ files, 16 September 2002 (B).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Shavano Business Park Entrance Road, TCEQ files, 30 September 2002 (C).

Pape-Dawson Engineers (Philip Pearce), GA from SCS for Simon Tract Sewer Extension 3, TCEQ files, 13 May 2003 (A).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Pachangas Subdivision, TCEQ files, 27 June 2003 (B).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Shavano Park Unit-19 Commercial Phase 1, TCEQ files, 28 July 2004.

Pape-Dawson Engineers (Philip Pearce), GA from SCS for Shavano Park Unit-19B Phase 1 Commercial, TCEQ files, 24 January 2005 (A).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Shavano Park Unit-18 Phase 1 Offsite Sewer, TCEQ files, 6 May 2005 (B).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for 46.25 Acre Portion of 57+ Acre Tract at Loop 1604 and Bulverde, TCEQ files, 3 February 2006 (A).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Drury/1604 Development, TCEQ files, 11 September 2006 (B).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for HEB #39 Expansion, TCEQ files, 12 October 2006 (C).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for The Drury Hotel IH-10 & Loop 1604, TCEQ files, 2 March 2007 (A).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Shavano Park Unit-18B Phase II & III, TCEQ files, 16 May 2007 (B).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for The Shops at La Cantera Expansion, TCEQ files, 8 June 2007 (C).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for South Rim Mass Grading and Demolition, TCEQ files, 26 September 2007 (D).

Pape-Dawson Engineers (Philip Pearce), GA from SCS for Shavano Park Unit-19A Phase 1 Commercial, TCEQ files, 6 December 2007 (E).

Pape-Dawson Engineers (Philip Pearce), GA from SCS for Valero Corporate Expansion, TCEQ files, 21 April 2008 (A).

Pape-Dawson Engineers (Roman Pineda), GA from WPAP for Main Event, TCEQ files, 22 September 2008 (B).

Pape-Dawson Engineers (Philip Pearce), GA from SCS for Hedad, TCEQ files, 25 February 2009 (A).

Pape-Dawson Engineers (Philip Pearce), GA from WPAP for Town Center at La Cantera, TCEQ files, 27 March 2009 (B).

Pape-Dawson Engineers (Philip Pearce), GA from SCS for Loop 1604/Gold Canyon Unit 1, TCEQ files, 2 April 2009 (C).

Professional Service Industries, Inc (David Hill), GA from SCS for La Cantera Restaurant Park, TCEQ files, 27 September 2002.

PSI (David Hill), GA from SCS for Hermansen Land Development, TCEQ files, 27 September 2002.

Raba-Kistner Consultants, Inc (Richard Klar). 2001. GA from WPAP for Montecito Apartments, TCEQ files, 30 March 2001.

Raba-Kistner Consultants, Inc (Kevin Wooster). 2002. GA from WPAP for 5.7 Acre Tract at Sonterra Place, Lots 12 and 13, TCEQ files, 8 October 2002.

Raba-Kistner Consultants, Inc (Richard Klar). 2008. GA from WPAP for The Landmark, TCEQ files, 23 April 2008.

Raba-Kistner Consultants, Inc (Richard Klar). 2009. GA from SCS for Burdick Cottontail Lots 3,4,5 Sanitary Sewer, TCEQ files, 5 January 2009.

SWCA (Kemble White). 2005A. GA from WPAP for Loop 1604 right of way, TCEQ files, 22 July 2005 (A).

SWCA Environmental Consultants (Kemble White). 2005B. GA from WPAP for Heritage Oaks Office Park, TCEQ files, 9 November 2005 (B).

Texas Department of Transportation (TxDOT). 2007. Administrative Record for 1604. Endangered Species Survey for TxDOT SAT Loop 1604 Improvements, SWCA (Kemble White), 1 May 2007.

_____. 2009. Karst Feature Assessment for Loop 1604 at US 281, Bexar County, Texas. Report dated 10 December 2009. 88 pp.

_____. 2015a. Final: Karst Invertebrate Technical Report for Loop 1604 from Interstate Highway 35 to State Highway 90, Bexar County, Texas. Technical Report prepared by Zara Environmental LLC, 27 March 2015. 271 pp. plus appendices A- K.

_____. 2015b. Geologic Assessment and Karst Feature Survey, I-10 Managed Lanes from FM 3351 (Ralph Fair Rd) to La Cantera Parkway, Bexar County, Texas. CSJ:

0072-07-041 and 0072-08-089. Prepared by Jackson Harper, P.G., 12 June 2015. 38 pp.

_____. 2017. Geologic Assessment. State Loop 1604 at Farm to Market (FM) 1535, Bexar County, CSJ 2452-02-118. September 25, 2017. 24 pp.

_____. 2018a. Geologic Assessment. State Loop 1604 at Bitters Road and Huebner Road, Bexar county, CSJ 2452-02-119. February 09, 2018. 126 pp.

_____. 2018b. Geologic Assessment. State Loop 1604 from Redland Road to Bulverde Road, Bexar county, CSJ 2452-03-118. February 28, 2018. 47 pp.

_____. 2019a. Final Karst Technical Report. Loop 1604 at Farm-to-Market Road 2696 (Blanco Road), Bexar County, Texas. CSJ: 2454-02-117. May 29, 2019. 46 pp.

_____. 2019b. Draft Biological Assessment (BA) for Consultation with the USFWS. Loop 1604 at Farm-to-Market Road (FM) 2696 (Blanco Road), Bexar County, Texas. CSJ: 2454-02-117. February 2019. 409 pp.

_____. 2019c. Interim Karst Technical Report. Construction Monitoring for US 281 from Loop 1604 to the Comal County Line, Bexar County, Texas. CSJ: 0253-04-138. July 26, 2019. 218 pp.

Texas Speleological Survey (TSS), 2009, Data request for caves in Bexar County.

Texas Speleological Survey (TSS). 2019. Data request for features in Bexar County.

Zara Environmental LLC. 2010a. Draft: Geologic Assessment for Loop 1604 from Interstate Highway 35 to State Highway 90, Bexar County, Texas. Draft report prepared for Michael Baker Jr., Inc. 7700 Chevy Chase Drive, Bldg. 1, Suite 210. Austin, Texas 78752. Dated 19 November 2010. 33pp.

_____. 2010b. Draft Karst Invertebrate Technical Report for Loop 1604 From Interstate Highway 35 to State Highway 90, Bexar County, Texas. Technical report prepared for Michael Baker Jr., Inc., Arlington, TX, 8 December 2010. 238 pp. plus appendices A – I.

_____. 2012a. Karst invertebrate technical report for voids discovered during construction at Loop 1604, Bexar County, Texas. Prepared for Hicks & Company, 12 January 2012. 54 pp.

_____. 2012b. Karst invertebrate technical report for Void HH3-30 at Loop 1604, Bexar County, Texas. Prepared for Hicks & Company, 30 March 2012. 16 pp.

_____. 2012c. Karst invertebrate technical report for north wall voids 31, 32, 33, & 34 at Loop 1604, Bexar County, Texas. Prepared for Hicks & Company, 9 April 2012. 23 pp.

_____. 2012d. Karst invertebrate technical report for Blanco wall voids 46, 47, & 48 at Loop 1604, Bexar County, Texas. Prepared for Hicks & Company, 15 August 2012. 23 pp.

_____. 2012e. Karst invertebrate technical report for Feature 50 at Loop 1604 near US 281, Bexar County, Texas. Prepared for Hicks & Company, 24 September 2012. 20 pp.

Appendix B. Results of all presence/absence surveys by feature and date

Provided as a separate attachment.

Appendix B. Results of all presence/absence surveys by feature and date.

Feature 1604-D07

Table B-1. Fauna observations and collections at feature 1604-D07 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
03/29/2019	Gnat	Diptera	Trap	1	N
	Mouse	*Mus* sp.	Trap	1	N
04/01/2019	Mite	Acari	Trap	1	N
	Springtail	Collembola	Trap	24	N
	Gnat	Diptera	Trap	4	N
04/03/2019	Fly	Diptera	Trap	3	N
04/05/2019	Fly	Diptera	Trap	3	N
04/08/2019	Springtail	Collembola	Trap	1	N
	Gnat	Diptera	Trap	5	N
	Mouse	*Mus* sp.	Trap	2	N
04/10/2019	Cockroach	Blattaria	Trap	2	N
	Frog	Anura	Entrance	1	N
04/12/2019	Centipede	Chilopoda (epigean)	Trap	1	N
	Mouse	*Mus* sp.	Trap	2	N
04/15/2019	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	2	N
04/17/2019	Cockroach	Blattaria	Trap	2	N
	Ant	Formicidae	Trap	1	N
04/19/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Gnat	Diptera	Trap	9	N
04/22/2019	Cockroach	Blattaria	Trap	2	N
04/24/2019	Cockroach	Blattaria	Trap	2	N
	Mouse	*Mus* sp.	Trap	1	N
04/26/2019	Mouse	*Mus* sp.	Trap	2	N
04/29/2019	Gnat	Diptera	Trap	14	N

Feature 1604-D19

Table B-2. Fauna observations and collections at Feature 1604-D19 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/12/2019	Woodlice	Armadillidae	Trap	4	N
	Centipede	Scolopendromorpha	Trap	1	N
	Earwig	Dermaptera	Trap	2	N
	Cockroach	Blattaria	Trap	2	N
08/14/2019	Wood lice	*Porcellio* sp.	Trap	15	N
	Spider	Araneae	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Cockroach	Blattaria	Trap	2	N
	Mediterranean gecko	*Hemidactylus turcicus*	Soil	1	N
08/16/2019	Earwig	Dermaptera	Trap	1	N
	Gnat	Diptera	Trap	1	N
08/19/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Springtail	Collembola	Trap	2	N
	Earwig	Dermaptera	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
08/21/2019	Insect larva	Insecta	Trap	1	N
	Woodlice	Armadillidae	Trap	1	N
	Cockroach	Blattaria	Trap	2	N
08/23/2019	Cricket nymph	Gryllidae	Trap	1	N
	Earwig	Dermaptera	Trap	3	N
	Cockroach	Blattaria	Trap	1	N
08/26/2019	Woodlice	Armadillidae	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
08/28/2019	Earwig	Dermaptera	Trap	1	N
09/30/2019	Earwig	Dermaptera	Trap	1	N
09/01/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Gnat	Diptera	Trap	1	N
09/03/2019	Cockroach	Blattaria	Trap	1	N
09/05/2019	No Fauna Observed				
09/07/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Ant	Formicidae	Trap	1	N

Table B-2 (Continued). Fauna observations and collections at Feature 1604-D19 by date

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
09/09/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Springtail	Collembola	Trap	2	N
	Earwig	Dermaptera	Trap	2	N
	Beetle	Coleoptera	Trap	1	N
	Mediterranean gecko	*Hemidactylus turcicus*	Trap	1	N

Feature 1604-E09 (Green Mountain Road Cave)

Table B-3. Fauna observations and collections at Feature 1604-E09 (Green Mountain Road Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/15/2019	Silverfish	*Texoreddellia* sp.	Soil	1	N
	Cricket nymph	Gryllidae	Ceiling	1	N
	Cricket	*Ceuthophilus secretus*	Ceiling	2	N
07/17/2019	Spider	Araneae (reduced eyes)	Trap	1	Y (1) ZARA 12513
	Silverfish	*Texoreddellia* sp.	Trap	14	N
	Cockroach	Blattaria	Trap	2	N
	Cricket	*Ceuthophilus secretus*	Trap	47	N
	Ant	Formicidae	Rock	10	N
	Gnat	Diptera	Trap	1	N
07/19/2019	Silverfish	*Texoreddellia* sp.	Trap	12	N
	Cockroach	Blattaria	Trap	4	N
	Cricket nymph	Gryllidae	Trap	2	N
	Cricket	*Ceuthophilus secretus*	Trap	30	N
	Gnat	Diptera	Trap	2	N
07/22/2019	Silverfish	*Texoreddellia* sp.	Trap	17	N
	Cricket nymph	Gryllidae	Trap	38	N
	Cricket	*Ceuthophilus secretus*	Trap	9	N
	Cricket	Gryllidae	Trap	1	N
	Grasshopper	Orthoptera	Soil	1	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	2	N
07/24/2019	Harvestman	*Chinquepellobunus* sp.	Soil	1	N
	Silverfish	*Texoreddellia* sp.	Trap	3	N
	Cricket nymph	Gryllidae	Trap	24	N
	Grasshopper	Orthoptera	Soil	1	N
	Cricket	*Ceuthophilus secretus*	Trap	7	N
	Cockroach	Blattaria	Soil	1	N

Table B-3 (Continued). Fauna observations and collections at Feature 1604-E09 (Green Mountain Road Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/26/2019	Spider	Araneae (reduced eyes)	Trap	1	Y (1) ZARA 12516
	Cricket nymph	Gryllidae	Trap	18	N
	Cricket	*Ceuthophilus secretus*	Trap	4	N
	Grasshopper	Orthoptera	Trap	1	N
7/29/2019	Spider	Araneae (reduced eyes)	Trap	1	Y (1) ZARA 12518
	Schizomid	*Agastoschizomus* sp.	Trap	1	Y (1) ZARA 12519
	Silverfish	*Texoreddellia sp.*	Trap	1	N
	Cricket nymph	Gryllidae	Trap	20	N
	Cricket nymph	Gryllidae	Soil	8	N
	Cricket	*Ceuthophilus secretus*	Trap	6	N
07/31/2019	Harvestman	*Chinquepellobunus* sp.	Soil	1	N
	Silverfish	*Texoreddellia sp.*	Trap	3	N
	Cricket	*Ceuthophilus secretus*	Trap	5	N
	Cricket nymph	Gryllidae	Trap	27	N
	Cockroach	Blattaria	Trap	1	N
08/02/2019	Silverfish	*Texoreddellia sp.*	Trap	3	N
	Cricket	*Ceuthophilus secretus*	Trap	2	N
	Cricket nymph	Gryllidae	Trap	16	N
	Cricket nymph	Gryllidae	Soil	9	N
	Cockroach	Blattaria	Trap	5	N

Table B-3 (Continued). Fauna observations and collections at Feature 1604-E09 (Green Mountain Road Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/07/2019	Harvestman	*Chinquepellobunus* sp.	Ceiling	1	Y (1) ZARA 12600
	Silverfish	*Texoreddellia* sp.	Trap	5	Y (1) ZARA 12602
	Cricket nymph	Gryllidae	Trap	35	N
	Cricket	*Ceuthophilus cunicularis*	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Cockroach	Blattaria	Trap	5	N
08/12/2019	Harvestman	*Chinquepellobunus* sp.	Trap	1	Y (1) ZARA 12603
	Cricket nymph	Gryllidae	Trap	10	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Grasshopper	Orthoptera	Soil	1	N
	Cockroach	Blattaria	Trap	2	N
	Ant	Formicidae	Trap	1	N
08/14/2019	Harvestman	*Chinquepellobunus* sp.	Trap	1	Y (1) ZARA 12624
	Cricket nymph	Gryllidae	Trap	5	N
	Cricket nymph	Gryllidae	Soil	3	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Grasshopper	Orthoptera	Trap	1	N
	Silverfish	*Texoreddellia* sp.	Trap	5	N
	Cockroach	Blattaria	Soil	1	N
	Cockroach	Blattaria	Trap	1	N

Table B-3 (Continued). Fauna observations and collections at Feature 1604-E09 (Green Mountain Road Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/16/2019	Woodlice	*Brackenridgia* sp.	Trap	1	N
	Slug	Gastropoda	Soil	1	N
	Harvestman	*Chinquepellobunus* sp.	Soil	1	N
	Springtail	Collembola	Trap	2	N
	Silverfish	*Texoreddellia* sp.	Trap	3	N
	Cricket nymph	*Ceuthophilus* sp.	Trap	9	N
	Cockroach	Blattaria	Trap	4	N
08/19/2019	Harvestman	*Chinquepellobunus* sp.	Soil Rock	1 1	N N
	Springtail	Collembola	Trap	2	N
	Silverfish	*Texoreddellia* sp.	Trap	2	N
	Cricket nymph	*Ceuthophilus* sp.	Trap Soil	7 3	N N
	Cockroach	Blattaria	Trap	6	N
	Beetle	Coleoptera	Trap	1	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
08/21/2019	Spider	Araneae	Ceiling	1	N
	Mite	Acarina	Trap	1	N
	Millipede	*Cambala* sp.	Rock	1	N
	Cricket nymph	*Ceuthophilus* sp.	Trap	6	N
	Cricket	Gryllidae	Trap	1	N
	Cockroach	Blattaria	Trap	5	N
	Ant	Formicidae	Trap	1	N

Feature 1604-F061 (Scottish Beard Cave)

Table B-4. Fauna observations and collections at Feature 1604-F061 (Scottish Beard Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
06/27/2019	Harvestman	*Chinquepellobunus* sp.	Rock	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Rock	4	N
07/01/2019	Harvestman	*Chinquepellobunus* sp.	Ceiling	1	N
	Gnat	Diptera	Trap	5	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Ceiling	1	N
07/03/2019	Gnat	Diptera	Trap	17	N
07/05/2019	Gnat	Diptera	Trap	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	2	N
07/08/2019	Earwig	Dermaptera	Trap	1	N
	Gnat	Diptera	Trap	9	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	5	N
07/10/2019	Harvestman	*Chinquepellobunus* sp.	Soil	1	N
	Silverfish	*Texoreddellia* sp.	Trap	5	N
	Gnat	Diptera	Trap	4	N
07/12/2019	Millipede	*Cambala* sp.	Trap	2	N
	Moth	Lepidoptera	Trap	2	N
	Gnat	Diptera	Trap	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Rock	8	N
07/15/2019	Millipede	*Cambala* sp.	Trap	1	N
	Moth	Lepidoptera	Trap	2	N
	Gnat	Diptera	Trap	3	N
	Mosquito	Culicidae	Trap	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	8	N
07/17/2019	Millipede	*Cambala* sp.	Trap	3	N
	Moth	Lepidoptera	Trap	1	N
	Gnat	Diptera	Trap	42	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	7	N

Table B-4 (Continued). Fauna observations and collections at Feature 1604-F061 (Scottish Beard Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/19/2019	Woodlice	*Brackenridgia* sp.	Trap	1	N
	Earwig	Dermaptera	Trap	2	N
	Gnat	Diptera	Trap	18	N
	Maggot	Diptera	Trap	70	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	9	N
	Gulf Coast toad	*Incilius nebulifer*	Soil	1	N
07/22/2019	Millipede	*Cambala* sp.	Trap	3	N
	Earwig	Dermaptera	Trap	3	N
	Gnat	Diptera	Trap	3	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	6	N
	Gulf Coast toad	*Incilius nebulifer*	Soil	1	N
07/24/2019	Woodlice	*Brackenridgia* sp.	Soil	3	N
	Harvestman	*Chinquepellobunus* sp.	Soil	1	N
	Millipede	*Cambala* sp.	Soil	1	N
	Cricket nymph	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	12	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	1	N
	Mouse	*Mus* sp.	Trap	1	N
07/26/2019	Woodlice	*Brackenridgia* sp.	Soil	4	N
	Millipede	*Cambala* sp.	Soil	1	N
	Millipede	*Cambala* sp.	Trap	2	N
	Cricket nymph	Gryllidae	Trap	1	N
	Earwig	Dermaptera	Trap	5	N
	Ant	Formicidae	Trap	3	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	5	N
	Gulf Coast toad	*Incilius nebulifer*	Soil	1	N

Table B-4 (Continued). Fauna observations and collections at Feature 1604-F061 (Scottish Beard Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/29/2019	Woodlice	*Brackenridgia* sp.	Soil	2	N
	Millipede	*Cambala* sp.	Trap	3	N
	Silverfish	*Texoreddellia* sp.	Trap	1	N
	Cricket nymph	Gryllidae	Trap	3	N
	Cricket	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	7	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Trap	1	N
07/31/2019	Woodlice	*Brackenridgia* sp.	Soil	2	N
	Millipede	*Cambala* sp.	Trap	4	N
	Silverfish	*Texoreddellia* sp.	Trap	1	N
	Earwig	Dermaptera	Trap	7	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	3	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Soil	3	N

Feature 1604-F073 (Leopard Cave)

Table B-5. Fauna observations and collections at feature 1604-F073 (Leopard Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
03/22/2019	No Fauna Observed				
03/25/2019	Snail (epigean)	Gastropoda	Floor/Rock	3	N
	Woodlice (epigean)	*Porcellio* sp.	Floor	1	N
	Gnat	Diptera	Trap	2	N
03/27/2019	No Fauna Observed				
03/29/2019	Cave cricket	*Ceuthophilus cunicularis*	Trap	2	N
	Gnat	Diptera	Trap	2	N
	Moth	Lepidoptera	Trap	1	N
04/01/2019	Gnat	Diptera	Trap	1	N
04/03/2019	Fly	Diptera	Trap	1	N
04/05/2019	Cave cricket	*Ceuthophilus cunicularis*	Trap	1	N
	Fly	Diptera	Trap	4	N
04/08/2019	Cave cricket	*Ceuthophilus* sp.	Trap	1	N
	Gnat	Diptera	Trap	2	N
04/10/2019	Field cricket	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	3	N
04/12/2019	Gnat	Diptera	Trap	13	N
	Mosquito	Culicidae	Trap	1	N
	Moth	Lepidoptera	Trap	1	N
04/15/2019	Fly larvae	Diptera	Trap	1	N
	Gnat	Diptera	Trap	2	N
04/17/2019	Fly	Diptera	Trap	1	N
04/19/2019	Cave cricket	*Ceuthophilus cunicularis*	Trap	1	N
	Gnat	Diptera	Trap	8	N
04/22/2019	Flea	Siphonaptera	Trap	2	N
	Cricket	Gryllidae	Trap	1	N
	Fly	Diptera	Trap	2	N
	Gnat	Diptera	Trap	4	N

Feature 1604-F074

Table B-6. Fauna observations and collections at Feature 1604-F074 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/28/2019	Springtail	Collembola	Trap	12	N
	Cockroach	Blattaria	Trap	1	N
08/30/2019	Springtail	Collembola	Trap	6	N
	Cockroach	Blattaria	Trap	1	N
09/01/2019	Springtail	Collembola	Trap	6	N
	Cricket	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
09/03/2019	Springtail	Collembola	Trap	7	N
	Cricket	Gryllidae	Trap	7	N
	Moth	Lepidoptera	Trap	1	N
09/05/2019	Springtail	Collembola	Trap	8	N
	Ant	Formicidae	Trap	1	N
09/07/2019	Springtail	Collembola	Trap	3	N
	Ant	Formicidae	Trap	2	N
09/09/2019	Springtail	Collembola	Trap	11	N
09/11/2019	Springtail	Collembola	Trap	4	N
	Ant	Formicidae	Trap	3	N
09/13/2019	Cricket nymph	Gryllidae	Trap	1	N
	Ant	Formicidae	Trap	2	N
	Moth	Lepidoptera	Trap	1	N
09/15/2019	Mediterranean gecko	*Hemidactylus turcicus*	Trap	1	N
09/17/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Ant	Formicidae	Trap	1	N
09/19/2019	Springtail	Collembola	Trap	6	N
	Woodlice	*Porcellio* sp.	Trap	1	N
	Ant	Formicidae	Trap	1	N
09/21/2019	Cricket	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
	Mediterranean gecko	*Hemidactylus turcicus*	Trap	1	N
09/23/2019	Springtail	Collembola	Trap	11	N
	Earwig	Dermaptera	Trap	1	N
	Gnat	Diptera	Trap	1	N

Feature 1604-F077 (Hubcap Cave)

Table B-7. Fauna observations and collections at feature 1604-F077 Hubcap Cave by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
03/22/2019	Spider web	Araneae	Floor/Rock	1	N
03/25/2019	Woodlice	*Porcellio* sp.	Floor Trap	2 1	N
	Cellar spider	Pholcidae	Floor	7	N
	Gnat	Diptera	Trap	1	N
03/27/2019	Cellar spider	Pholcidae	Floor	2	N
	Cockroach	Blattaria	Floor	1	N
03/29/2019	Woodlice	*Porcellio* sp.	Trap	2	N
	Woodlice	*Brackenridgia* sp.	Floor	1	N
	Cellar spider	Pholcidae	Webs Trap	3 1	N
	Booklice	Psocoptera	Rock	1	N
	Gnat	Diptera	Trap	1	N
04/01/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Spider	Araneae (eyed)	Rock	1	N
	Cellar spider	Pholcidae	Rock	10	N
	Flea	Siphonaptera	Trap	1	N
	Fly	Diptera	Trap	2	N
04/03/2019	Woodlice	*Porcellio* sp.	Floor	7	N
	Woodlice	*Brackenridgia* sp.	Floor	1	N
	Flea	Siphonaptera	Floor	1	N
	Springtail	Collembola	Floor	20	N
	Gnat	Diptera	Trap	2	N
	Mammal hair	Mammalia	Trap	1	N
04/05/2019	Woodlice	*Porcellio* sp.	Trap	2	N
	Spider	Araneae	Trap Wall	1 3	N
	Fly	Diptera	Trap	2	N
04/08/2019	Woodlice	*Porcellio* sp.	Trap	3	N
	Cellar spider	Pholcidae	Trap	2	N
	Springtail	Collembola	Trap Floor	3 10	N
	Field cricket	Gryllidae	Trap	1	N
	Fly	Diptera	Trap Floor	7 3	N

Table B-6 cont. Fauna observations and collections at feature 1604-F077 Hubcap Cave by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
04/10/2019	Woodlice	Armadillidae	Trap	2	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	3	N
	Flying insect (epigean)	Insecta	Trap	1	N
04/12/2019	Spider	Araneae (eyed)	Rock	2	N
	Cockroach	Blattaria	Trap Rock	2 3	N
	Mouse	*Mus* sp.	Trap	1	N
04/15/2019	Cockroach	Blattaria	Trap	2	N
	Gnat	Diptera	Trap	1	N
04/17/2019	Woodlice	Armadillidae	Floor	1	N
	Spider	Araneae (epigean)	Floor	1	N
	Cellar spider	Pholcidae	Floor	2	N
	Flea	Siphonaptera	Floor	2	N
	Cockroach	Blattaria	Trap	1	N
04/19/2019	Cellar spider	Pholcidae	Trap Floor	2 3	N
	Spider	Araneae (epigean)	Rock	1	N
	Field cricket	Gryllidae	Trap	1	N
	Cockroach	Blattaria	Trap	2	N
	Beetle	Coleoptera	Trap	1	N
	Moth	Lepidoptera	Flying	1	N
04/22/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Flea	Siphonaptera	Trap	2	N
	Booklice	Psocoptera	Trap	4	Y
	Cockroach	Blattaria	Trap	1	N
	Fly	Diptera	Trap	4	N
04/24/2019	Woodlice	*Brackenridgia* sp.	Floor	1	N
	Spider	Araneae	Floor	1	N
	Cellar spider	Pholcidae	Floor	2	N
	Cockroach	Blattaria	Floor	1	N

Feature 1604-F084

Table B-8. Fauna observations and collections at feature 1604-F084 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
03/25/2019	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	2	N
	Mouse	*Mus* sp.	Trap	1	N
03/27/2019	Fly	Diptera	Trap	3	N
03/29/2019	Frog	Anura	Floor	1	N
04/01/2019	Gnat	Diptera	Trap	1	N
	Mouse	*Mus* sp.	Trap	2	N
04/03/2019	No Fauna Observed				
04/05/2019	Gnat	Diptera	Trap	3	N
	Rat snake	*Pantherophis* sp.	Trap	1	N
04/08/2019	Gnat	Diptera	Trap	1	N
04/10/2019	Gnat	Diptera	Trap	1	N
04/12/2019	Gnat	Diptera	Trap	1	N
04/15/2019	Beetle	Coleoptera (epigean)	Trap	1	N
04/17/2019	No Fauna Observed				
04/19/2019	No Fauna Observed				
04/22/2019	Cockroach	Blattaria	Trap	2	N
04/24/2019	No Fauna Observed				

Feature 1604-FZ3

Table B-9. Fauna observations and collections at feature 1604-FZ3 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
03/25/2019	Woodlice	*Porcellio* sp.	Trap	3	N
03/27/2019	True bug	Hemiptera	Trap	2	N
03/29/2019	Woodlice	Armadillidae	Trap	1	N
04/01/2019	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
04/03/2019	No Fauna Observed				
04/05/2019	Woodlice	Armadillidae	Wall	2	N
	Woodlice	*Porcellio* sp.	Trap	5	N
	Fly	Diptera	Trap	2	N
04/08/2019	Woodlice	*Porcellio* sp.	Trap	16	N
	Gnat	Diptera	Trap	1	N
04/10/2019	Woodlice	Armadillidae	Trap	3	N
	Gnat	Diptera	Trap	2	N
04/12/2019	No Fauna Observed				
04/15/2019	Woodlice	Armadillidae	Trap	3	N
04/17/2019	Woodlice	*Porcellio* sp.	Trap	4	N
	Spider	Araneae (epigean)	Trap	1	N
04/19/2019	Woodlice	*Porcellio* sp.	Trap	7	N
04/22/2019	Woodlice	*Porcellio* sp.	Trap	2	N
	Gnat	Diptera	Trap	2	N
04/24/2019	Gnat	Diptera	Trap	3	N

Feature 1604-FZ4

Table B-10. Fauna observations and collections at Feature 1604-FZ4 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/26/2019	No Fauna Observed				
08/28/2019	Springtail	Collembola	Trap	2	N
	Cockroach	Blattaria	Trap	2	N
	Wasp	Apocrita	Trap	2	N
	Gnat	Diptera	Trap	1	N
08/30/2019	Cockroach	Blattaria	Trap	3	N
	Ant	Formicidae	Trap	9	N
09/01/2019	Springtail	Collembola	Trap	5	N
09/03/2019	Insect larva	Insecta	Trap	1	N
	Springtail	Collembola	Trap	3	N
	Cockroach	Blattaria	Trap	1	N
09/05/2019	Springtail	Collembola	Trap	8	N
	Ant	Formicidae	Trap	1	N
09/07/2019	Springtail	Collembola	Trap	7	N
	Ant	Formicidae	Trap	11	N
09/09/2019	Springtail	Collembola	Trap	1	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
09/11/2019	Springtail	Collembola	Trap	1	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
09/13/2019	Springtail	Collembola	Trap	2	N
	Cockroach	Blattaria	Trap	1	N
	Ant	Formicidae	Trap	2	N
09/15/2019	Ant	Formicidae	Trap	4	N
	Mouse	*Mus* sp.	Trap	1	N
09/17/2019	Springtail	Collembola	Trap	1	N
	Gnat	Diptera	Trap	1	N
	Rodent	*Mus* sp.	Trap	2	N
09/19/2019	Springtail	Collembola	Trap	4	N
	Ant	Formicidae	Trap	4	N
	Moth	Lepidoptera	Trap	1	N
	Gnat	Diptera	Trap	1	N

Table B-10 (Continued). Fauna observations and collections at Feature 1604-FZ4 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
09/21/2019	Springtail	Collembola	Trap	2	N
	Cockroach	Blattaria	Trap	1	N
	Moth	Lepidoptera	Trap	2	N
	Ant	Formicidae	Trap	12	N

Feature 1604-FZ7

Table B-11. Fauna observations and collections at Feature 1604-FZ7 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
06/27/2019	Harvestman	*Leiobunum townsendi*	Rock	1	N
	Earwig	Dermaptera	Soil	1	N
07/01/2019	Cockroach	Blattaria	Trap	1	N
	Spider	Araneae (surface)	Trap	1	N
	Gnat	Diptera	Trap	2	N
07/03/2019	Cricket	Gryllidae	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Gnat	Diptera	Trap	1	N
07/05/2019	Ant	Formicidae	Trap	2	N
07/08/2019	Woodlice	Armadillidae	Trap	8	N
	Harvestman	*Leiobunum townsendi*	Trap	1	N
	Cricket	Gryllidae	Trap	1	N
	Ant	Formicidae	Trap	2	N
	Gnat	Diptera	Trap	3	N
07/10/2019	Woodlice	*Brackenridgia* sp.	Trap	1	N
	Millipede	*Cambala* sp.	Trap	2	N
	Cricket	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	2	N
07/12/2019	Cricket	Gryllidae	Trap	2	N
	Cricket nymph	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
07/15/2019	Woodlice	Armadillidae	Trap	1	N
	Spider	Araneae	Trap	1	N
	Cricket	Gryllidae	Trap	2	N
	Beetle	Coleoptera	Soil	1	N
	Gnat	Diptera	Trap	8	N
07/17/2019	Millipede	*Cambala* sp.	Trap	1	N
	Cricket nymph	Gryllidae	Trap	18	N
	Earwig	Dermaptera	Trap	2	N
	Gnat	Diptera	Trap	4	N
	Mosquito	Culicidae	Trap	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Trap	1	N

Table B-11 (Continued). Fauna observations and collections at Feature 1604-FZ7 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/19/2019	Cricket nymph	Gryllidae	Trap	6	N
	Earwig	Dermaptera	Trap	6	N
	Gnat	Diptera	Trap	3	N
07/22/2019	Woodlice	*Brackenridgia* sp.	Trap	1	N
	Spider	Araneae	Trap	2	N
	Millipede	Diplopoda	Trap	2	N
	Millipede	*Cambala* sp.	Trap	39	N
	Cricket nymph	Gryllidae	Trap	2	N
	Earwig	Dermaptera	Trap	13	N
07/24/2019	Woodlice	*Brackenridgia* sp.	Trap	1	N
	Spider	Araneae	Soil	1	N
	Harvestman	*Leiobunum townsendi*	Soil	1	N
	Millipede	*Cambala* sp.	Trap	1	N
	Cricket nymph	Gryllidae	Trap	4	N
	Earwig	Dermaptera	Trap	11	N
	Gnat	Diptera	Trap	10	N
07/26/2019	Woodlice	Armadillidae	Trap	3	N
	Spider	Araneae	Trap	1	Y
	Spider	*Cicurina platypus/bullis*	Trap	1	Y (1) ZARA 12517
07/29/2019	Woodlice	Armadillidae	Trap	2	N
	Spider	Araneae	Trap	1	N
	Millipede	*Cambala* sp.	Trap	1	N
	Springtail	Collembola	Trap	6	N
	Cricket	Gryllidae	Trap	2	N
	Cricket nymph	Gryllidae	Trap	6	N
	Earwig	Dermaptera	Trap	4	N
	Gnat	Diptera	Trap	3	N
07/31/2019	Millipede	*Cambala* sp.	Trap	1	N
	Cricket	Gryllidae	Trap	1	N
	Cricket nymph	Gryllidae	Trap	1	N
	Earwig	Dermaptera	Trap	6	N

Feature 1604-L12

Table B-12. Fauna observations and collections at Feature 1604-L12 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/09/2019	No Fauna Observed				
08/12/2019	Cricket nymph	Gryllidae	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Assassin bug	Reduviidae	Trap	1	N
08/14/2019	Springtail	Collembola	Trap	2	N
	Gnat	Diptera	Trap	1	N
08/16/2019	Springtail	Collembola	Trap	12	N
08/19/2019	Cricket nymph	Gryllidae	Trap	1	N
	Ant	Formicidae	Trap	4	N
08/21/2019	Cricket	Gryllidae	Trap	1	N
	Mosquito	Culicidae	Trap	1	N
	Mediterranean gecko	*Hemidactylus turcicus*	Trap	1	N
08/23/2019	Springtail	Collembola	Trap	4	N
	Moth	Lepidoptera	Trap	1	N
08/26/2019	No Fauna Observed				
08/28/2019	Springtail	Collembola	Trap	2	N
08/30/2019	No Fauna Observed				
09/01/2019	Spider	Araneae	Trap	2	N
	Cricket	Gryllidae	Trap	1	N
	Weevil	Curculionoidea	Trap	1	N
	Mediterranean gecko	*Hemidactylus turcicus*	Trap	1	N
09/03/2019	No Fauna Observed				
09/05/2019	No Fauna Observed				
09/07/2019	Spider	Araneae	Trap	1	N
	Springtail	Collembola	Trap	2	N
	Beetle	Coleoptera	Trap	1	N
	Moth	Lepidoptera	Trap	1	N

Feature 1604-L13

Table B-13. Fauna observations and collections at Feature 1604-L13 by date

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/09/2019	No Fauna Observed				
08/12/2019	Spider	Araneae	Trap	1	N
	Assassin bug	Reduviidae	Trap	1	N
08/14/2019	Ant	Formicidae	Trap	2	N
08/16/2019	Gnat	Diptera	Trap	1	N
08/19/2019	Weevil	Curculionidae	Trap	1	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	2	N
08/21/2019	Weevil	Curculionoidea	Trap	1	N
	Ant	Formicidae	Trap	1	N
08/23/2019	No Fauna Observed				
08/26/2019	No Fauna Observed				
08/28/2019	No Fauna Observed				
08/30/2019	Ant	Formicidae	Trap	1	N
09/01/2019	Gulf Coast toad	*Incilius nebulifer*	Trap	1	N
09/03/2019	No Fauna Observed				
09/05/2019	No Fauna Observed				
09/07/2019	Gnat	Diptera	Trap	2	N

Feature 1604-L16 (12A Cave)

Table B-14. Fauna observations and collections at Feature 1604-L16 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/09/2019	Spider	Araneae	Ceiling	3	N
	Gnat	Diptera	Ceiling	2	N
08/12/2019	Spider	Araneae	Trap	1	N
	Cricket nymph	Gryllidae	Trap	1	N
	Ant	Formicidae	Trap	17	N
08/14/2019	Spider	Araneae	Soil	2	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Earwig	Dermaptera	Trap	2	N
	Ant	Formicidae	Trap	10	N
08/16/2019	Woodlice	Armadillidae	Trap	3	N
	Woodlice	*Porcellio* sp.	Trap	1	N
	Spider	Araneae	Soil	1	N
	Cellar spider	Pholcidae	Trap	1	N
	Cricket	Gryllidae	Trap	2	N
	Earwig	Dermaptera	Trap	1	N
	Ant	Formicidae	Trap	2	N
	Gnat	Diptera	Trap	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Trap	2	N
08/19/2019	Spider	Araneae	Web	2	N
	Earwig	Dermaptera	Trap	2	N
	Mediterranean gecko	*Hemidactylus turcicus*	Trap	1	N
08/21/2019	Woodlice	Armadillidae	Trap	1	N
	Spider	Araneae	Web	2	N
	Earwig	Dermaptera	Trap	1	N
	Wasp	Apocrita	Trap	1	N
	Ant	Formicidae	Trap	2	N
	Gnat	Diptera	Trap	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Rock	2	N

Table B-14 (Continued). Fauna observations and collections at Feature 1604-L16 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/23/2019	Spider	Araneae	Trap	1	N
	Ant	Formicidae	Trap	6	N
	Gnat	Diptera	Trap	1	N
08/26/2019	Ant	Formicidae	Trap	1	N
08/28/2019	Cricket	Gryllidae	Trap	1	N
	Earwig	Dermaptera	Trap	3	N
	Ant	Formicidae	Trap	3	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Trap	1	N
08/30/2019	Spider	Araneae	Trap	1	N
	Millipede	*Cambala* sp.	Trap	1	N
	Ant	Formicidae	Trap	3	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Trap	1	N
09/01/2019	Snake	Colubridae	Trap	1	N
09/03/2019	Earwig	Dermaptera	Trap	1	N
	Ant	Formicidae	Trap	19	N
09/09/2019	Spider	Araneae	Web	2	N
	Springtail	Collembola	Trap	2	N
	Cricket	Gryllidae	Trap	1	N
	Ant	Formicidae	Trap	30	N
	Toad	*Incilius nebulifer*	Trap	1	N
09/11/2019	Spider	Araneae	Trap	1	N
			Web	3	N
	Springtail	Collembola	Trap	7	N
	Beetle	Tenebrionidae	Trap	2	N
	Ant	Formicidae	Trap	1	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Trap	1	N
			Rock	5	N

Feature 1604-R03

Table B-15. Fauna observations and collections at Feature 1604-R03 by date

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/12/2019	Millipede	Diplopoda	Trap	3	N
	Cricket nymph	Gryllidae	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Beetle	Coleoptera	Trap	1	N
08/14/2019	Soft tick	Argasidae	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	7	N
08/16/2019	Soft tick	Argasidae	Trap	1	N
	Millipede	Diplopoda	Trap	2	N
	Gnat	Diptera	Trap	1	N
08/19/2019	Soft tick	Argasidae	Trap	2	N
	Millipede	Diplopoda	Trap	2	N
	Mosquito	Culicidae	Trap	1	N
	Gnat	Diptera	Trap	14	N
08/21/2019	Millipede	Diplopoda	Trap	2	N
	Cricket nymph	*Ceuthophilus* sp.	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Weevil	Curculionidae	Trap	1	N
	Gnat	Diptera	Trap	4	N
08/23/2019	Cricket	*Ceuthophilus secretus*	Trap	2	N
	Cockroach	Blattaria	Trap	2	N
	Moth	Lepidoptera	Trap	2	N
	Gnat	Diptera	Trap	4	N

Table B-15 (Continued). Fauna observations and collections at Feature 1604-R03 by date

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/26/2019	Woodlice	Armadillidae	Trap	1	N
	Woodlice	*Porcellio* sp.	Trap	1	N
	Millipede	Diplopoda	Trap	2	N
	Cricket nymph	*Ceuthophilus* sp.	Trap	4	N
	Cockroach	Blattaria	Trap	3	N
	Ant	Formicidae	Trap	1	N
	Moth	Lepidoptera	Trap	1	N
	Gnat	Diptera	Trap	5	N
	Gulf Coast toad	*Incilius nebulifer*	Trap	2	N
08/28/2019	Millipede	Diplopoda	Trap	3	N
	Gnat	Diptera	Trap	9	N
08/30/2019	Soft tick	Argasidae	Trap	1	N
	Millipede	Diplopoda	Trap	2	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	6	N
09/01/2019	Soft tick	Argasidae	Trap	2	N
	Gnat	Diptera	Trap	5	N
09/03/2019	Earwig	Dermaptera	Trap	1	N
	Wasp	Apocrita	Trap	1	N
	Gnat	Diptera	Trap	8	N
09/05/2019	Soft tick	Argasidae	Trap	1	N
	Gnat	Diptera	Trap	6	N
09/07/2019	Soft tick	Argasidae	Trap	5	N
	Mosquito	Culicidae	Trap	2	N
09/09/2019	Soft tick	Argasidae	Trap	6	N
	Millipede	Diplopoda	Trap	1	N
	Gnat	Diptera	Trap	2	N
	Gulf Coast toad	*Incilius nebulifer*	Trap	1	N

Feature 1604-R04

Table B-16. Fauna observations and collections at Feature 1604-R04 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/30/2019	Ant	Formicidae	Trap	2	N
	Wasp	Apocrita	Trap	1	N
	Mosquito	Culicidae	Trap	1	N
09/01/2019	Gnat	Diptera	Trap	3	N
09/03/2019	No Fauna Observed				
09/05/2019	Gnat	Diptera	Trap	1	N
09/07/2019	Gnat	Diptera	Trap	1	N
09/09/2019	No Fauna Observed				
09/11/2019	No Fauna Observed				
09/13/2019	Gnat	Diptera	Trap	1	N
09/15/2019	Ant	Formicidae	Trap	2	N
09/17/2019	No Fauna Observed				
09/19/2019	Ant	Formicidae	Trap	4	N
09/21/2019	No Fauna Observed				
09/23/2019	No Fauna Observed				
09/25/2019	No Fauna Observed				

Feature 1604-R05

Table B-17. Fauna observations and collections at Feature 1604-R05 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/30/2019	Spider	Araneae	Trap	1	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
09/01/2019	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
09/03/2019	Spider	Araneae	Trap	1	N
09/05/2019	Gnat	Diptera	Trap	5	N
09/07/2019	Ant	Formicidae	Trap	100	N
09/09/2019	Gnat	Diptera	Trap	1	N
09/11/2019	No Fauna Observed				
09/13/2019	Ant	Formicidae	Trap	1	N
09/15/2019	Ant	Formicidae	Trap	3	N
09/17/2019	No Fauna Observed				
09/19/2019	Moth	Lepidoptera	Trap	1	N
09/21/2019	Mosquito	Culicidae	Trap	1	N
09/23/2019	Soft tick	Argasidae	Trap	2	N
	Ant	Formicidae	Trap	1	N
09/25/2019	Soft tick	Argasidae	Trap	5	N
	Ant	Formicidae	Trap	1	N

Feature 1604-R06

Table B-18. Fauna observations and collections at Feature 1604-R06 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/14/2019	Spider	Araneae	Trap	2	N
	Cockroach	Blattaria	Trap	1	N
	Ant	Formicidae	Trap	1	N
08/16/2019	No Fauna Observed				
08/19/2019	Spider	Araneae	Trap	1	N
08/21/2019	Garter snake	*Thamnophis* sp.	Rock	1	N
08/23/2019	No Fauna Observed				
08/26/2019	No Fauna Observed				
08/28/2019	Ant	Formicidae	Trap	1	N
08/30/2019	Cockroach	Blattaria	Trap	1	N
09/01/2019	No Fauna Observed				
09/03/2019	No Fauna Observed				
09/05/2019	Cockroach	Blattaria	Trap	1	N
09/07/2019	Moth	Lepidoptera	Trap	1	N
09/09/2019	Gnat	Diptera	Trap	1	N
09/11/2019	Spider	Araneae	Trap	1	N

Feature LOOP-009

Table B-19. Fauna observations and collections at Feature LOOP-009 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/01/2019	Cricket	Gryllidae	Trap	1	N
07/03/2019	Ant	Formicidae	Trap	4	N
07/05/2019	Ant	Formicidae	Trap	2	N
07/08/2019	Cricket	Gryllidae	Trap	1	N
	Ant	Formicidae	Trap	7	N
	Gnat	Diptera	Trap	7	N
07/10/2019	Ant	Formicidae	Trap	1	N
	Moth	Lepidoptera	Trap	1	N
	Gnat	Diptera	Trap	1	N
07/12/2019	Ant	Formicidae	Trap	3	N
	Gnat	Diptera	Trap	2	N
7/15/2019	Ant	Formicidae	Trap	3	N
	Gnat	Diptera	Trap	2	N
07/17/2019	Woodlice	*Brackenridgia sp.*	Trap	5	N
	Gnat	Diptera	Trap	2	N
07/19/2019	Ant	Formicidae	Trap	1	N
07/22/2019	Earwig	Dermaptera	Trap	1	N
07/24/2019	No Fauna Observed				
07/26/2019	Gnat	Diptera	Trap	1	N
07/29/2019	Earwig	Dermaptera	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	3	N
07/31/2019	Earwig	Dermaptera	Trap	2	N
	Ant	Formicidae	Trap	4	N

Feature LOOP-102 (Fiesta Cave)

Table B-20. Fauna observations and collections at Feature LOOP-102 (Fiesta Cave) by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
06/27/2019	Harvestman	*Leiobunum townsendi*	Ceiling	250	N
	Gnat	Diptera	Soil	2	N
	Mosquito	Culicidae	Flying	20	N
	Canyon wren	*Catherpes mexicanus*	Dirt	3	N
	North American porcupine	*Erethizon dorsatum*	Dirt	1	N
07/01/2019	Woodlice	Armadillidae	Trap	20	N
	Harvestman	*Leiobunum townsendi*	Trap	200	N
	Cricket	*Ceuthophilus secretus*	Ceiling	3	N
	Cockroach	Blattaria	Trap	2	N
	Gnat	Diptera	Trap	3	N
07/03/2019	Soft tick	Argasidae	Trap	10	N
	Harvestman	*Leiobunum townsendi*	Trap	3	N
	Crickets	*Ceuthophilus secretus*	Trap	16	N
	Gnat	Diptera	Trap	15	N
07/08/2019	Soft tick	Argasidae	Trap	5	N
	Centipede	Scolopendromorpha	Trap	2	N
	Cricket	*Ceuthophilus secretus*	Trap	8	N
	Gnat	Diptera	Trap	46	N
	Fly	Diptera	Trap	1	N
07/10/2019	Soft tick	Argasidae	Trap	3	N
	Gnat	Diptera	Trap	31	N
	Gulf Coast toad	*Incilius nebulifer*	Trap	1	N
07/12/2019	Soft tick	Argasidae	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Gnat	Diptera	Trap	55	N
07/15/2019	Soft tick	Argasidae	Trap	2	N
	Beetle	Coleoptera	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	4	N
	Gnat	Diptera	Trap	46	N
07/17/2019	Harvestman	*Leiobunum townsendi*	Trap	5	N
	Gnat	Diptera	Trap	8	N

Table B-20 (Continued). Fauna observations and collections at Feature LOOP-102 by date

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/19/2019	Soft tick	Argasidae	Trap	4	N
	Cricket	*Ceuthophilus secretus*	Trap	7	N
	Gnat	Diptera	Trap	7	N
07/22/2019	Soft tick	Argasidae	Trap	1	N
	Gnat	Diptera	Trap	17	N
07/24/2019	Cockroach	Blattaria	Trap	1	N
	Bee	Apocrita	Trap	1	N
	Gnat	Diptera	Trap	12	N
	Gulf Coast toad	*Incilius nebulifer*	Trap	1	N
07/26/2019	Soft tick	Argasidae	Trap	1	N
	Harvestman	*Leiobunum townsendi*	Trap	13	N
	Gnat	Diptera	Trap	5	N
07/29/2019	Cricket	*Ceuthophilus cunicularis*	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	25	N
	Gnat	Diptera	Trap	12	N
07/31/2019	Soft tick	Argasidae	Trap	7	N
	Cricket	*Ceuthophilus secretus*	Trap	3	N
	Gnat	Diptera	Trap	9	N
	Mouse	*Mus sp.*	Trap	1	N
08/02/2019	Soft tick	Argasidae	Trap	3	N
	Cricket nymph	Gryllidae	Trap	1	N
	Gnat	Diptera	Trap	5	N
	Mosquito	Culicidae	Trap	2	N

Feature LOOP-103

Table B-21. Fauna observations and collections at Feature LOOP-103 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/30/2019	Millipede	Diplopoda	Trap	8	N
	Centipede	Scutigeromorpha	Trap	1	N
	Cricket	Gryllidae	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	8	N
09/01/2019	Woodlice	Armadillidae	Trap	1	N
	Harvestman	*Leiobunum townsendi*	Trap	1	N
	Soft tick	Argasidae	Trap	1	N
	Millipede	Diplopoda	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Beetle	Coleoptera	Trap	1	N
	Ant	Formicidae	Trap	2	N
	Mouse	*Mus* sp.	Trap	1	N
09/03/2019	Woodlice	Armadillidae	Trap	3	N
	Millipede	Diplopoda	Trap	26	N
	Centipede	Scutigeromorpha	Trap	1	N
09/05/2019	Spider	Araneae	Trap	1	N
	Millipede	Diplopoda	Trap	9	N
	Cricket	*Ceuthophilus secretus*	Trap	2	N
	Earwig	Dermaptera	Trap	2	N
	Beetle	Coleoptera	Trap	2	N
	Gnat	Diptera	Trap	1	N
	Mosquito	Culicidae	Trap	1	N
09/07/2019	Cockroach	Blattaria	Trap	1	N
09/09/2019	Harvestman	Opiliones	Trap	2	N
	Millipede	Diplopoda	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	6	N
	Earwig	Dermaptera	Trap	1	N
	Beetle	Coleoptera	Trap	2	N
	Ant	Formicidae	Trap	20	N
	Gnat	Diptera	Trap	2	N

Table B-21 (Continued). Fauna observations and collections at Feature LOOP-103 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
09/11/2019	Woodlice	Armadillidae	Trap	1	N
	Harvestman	*Leiobunum townsendi*	Trap	2	N
	Millipede	Diplopoda	Trap	5	N
	Moth	Lepidoptera	Trap	1	N
	Gnat	Diptera	Trap	2	N
09/13/2019	Woodlice	*Porcellio* sp.	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Beetle	Coleoptera	Trap	1	N
	Moth	Lepidoptera	Trap	3	N
	Gnat	Diptera	Trap	5	N
09/15/2019	Beetle	Coleoptera	Trap	1	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	2	N
	Snake	Thamnophis	Trap	1	N
09/17/2019	Woodlice	Armadillidae	Trap	1	N
	Mite	Acarina	Trap	1	N
	Soft tick	Argasidae	Trap	1	N
	Harvestman	*Leiobunum townsendi*	Trap	2	N
	Earwig	Dermaptera	Trap	2	N
	Moth	Lepidoptera	Trap	1	N
	Gnat	Diptera	Trap	2	N
	Snake	*Thamnophis* sp.	Trap	2	N
09/19/2019	Harvestman	*Leiobunum townsendi*	Trap	1	N
	Centipede	Scutigeromorpha	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Beetle	Coleoptera	Trap	1	N
	Ant	Formicidae	Trap	3	N
	Gnat	Diptera	Trap	6	N
	Mosquito	Culicidae	Trap	1	N
	Mediterranean gecko	*Hemidactylus turcicus*	Trap	1	N
09/21/2019	Earwig	Dermaptera	Trap	2	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N

Table B-21 (Continued). Fauna observations and collections at Feature LOOP-103 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
09/21/2019	Mosquito	Culicidae	Trap	1	N
09/23/2019	Harvestman	*Leiobunum townsendi*	Trap	2	N
	Millipede	Diplopoda	Trap	3	N
	Earwig	Dermaptera	Trap	2	N
	Ant	Formicidae	Trap	1	N
	Gnat	Diptera	Trap	1	N
	Mosquito	Culicidae	Trap	1	N
09/25/2019	Millipede	Diplopoda	Trap	1	N
	Earwig	Dermaptera	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	4	N
	Snake	Colubridae	Trap	1	N

Feature LOOP-207

Table B-22. Fauna observations and collections at Feature LOOP-207 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
07/29/2019	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Gulf Coast toad	*Incilius nebulifer*	Trap	1	N
	Snake	Colubridae	Trap	1	N
07/31/2019	Woodlice	Armadillidae	Trap	3	N
	Millipede	Diplopoda	Trap	3	N
	Cricket	*Ceuthophilus cunicularis*	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Snake	Colubridae	Trap	1	N
08/02/2019	Woodlice	Armadillidae	Trap	2	N
	Millipede	Diplopoda	Trap	2	N
	Cricket	*Ceuthophilus secretus*	Trap	3	N
	Cockroach	Blattaria	Trap	1	N
	Beetle	Coleoptera	Trap	1	N
	Ant	Formicidae	Trap	1	N
	Ant	Formicidae	Trap	26	N
08/09/2019	Woodlice	Armadillidae	Trap	2	N
	Spider	Araneae	Trap	1	N
	Millipede	Diplopoda	Trap	22	N
	Cricket	*Ceuthophilus secretus*	Trap	2	N
	Ant	Formicidae	Trap	9	N
	Gnat	Diptera	Trap	13	N
08/12/2019	Isopod	Armadillidae	Trap	6	N
	Millipede	Diplopoda	Trap	23	N
	Cricket	*Ceuthophilus secretus*	Trap	2	N
	Beetle	Coleoptera	Trap	2	N
	Ant	Formicidae	Trap	14	N
	Gnat	Diptera	Trap	8	N

Table B-22 (Continued). Fauna observations and collections at Feature LOOP-207 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/14/2019	Woodlice	Armadillidae	Trap	14	N
	Soft tick	Argasidae	Trap	1	N
	Spider	Araneae	Trap	4	N
	Millipede	Diplopoda	Trap	6	N
	Cockroach	Blattaria	Trap	3	N
	Ant	Formicidae	Trap	3	N
08/16/2019	Woodlice	Armadillidae	Trap	4	N
	Millipede	Diplopoda	Trap	15	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Beetle	Coleoptera	Trap	3	N
	Ant	*Formicidae*	Trap	27	N
08/19/2019	Woodlice	Armadillidae	Trap	10	N
	Soft tick	Argasidae	Trap	1	N
	Millipede	Diplopoda	Trap	11	N
	Ant	Formicidae	Trap	13	N
08/21/2019	Woodlice	Armadillidae	Trap	3	N
	Millipede	Diplopoda	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Ant	Formicidae	Trap	12	N
08/23/2019	Woodlice	Armadillidae	Trap	3	N
	Harvestman	Opiliones	Trap	1	N
	Millipede	Diplopoda	Trap	5	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	39	N
08/26/2019	Centipede	Scutigeromorpha	Trap	1	N
	Millipede	Diplopoda	Trap	6	N
	Mosquito	Culicidae	Trap	1	N
	Gnat	Diptera	Trap	43	N
	Cliff chirping frog	*Eleutherodactylus marnockii*	Trap	2	N

Table B-22 (Continued). Fauna observations and collections at Feature LOOP-207 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/28/2019	Woodlice	Armadillidae	Trap	3	N
	Millipede	Diplopoda	Trap	6	N
	Cricket	*Ceuthophilus secretus*	Trap	2	N
	Moth	Lepidoptera	Trap	2	N
	Gnat	Diptera	Trap	14	N
08/30/19	Woodlice	Armadillidae	Trap	1	N
	Harvestman	*Leiobunum townsendi*	Trap	17	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Ant	Formicidae	Trap	11	N
09/01/19	Woodlice	Armadillidae	Trap	1	N
	Harvestman	*Leiobunum townsendi*	Trap	63	N
	Millipede	Diplopoda	Trap	3	N
	Earwig	Dermaptera	Trap	2	N
	Cockroach	Blattaria	Trap	1	N
	Gnat	Diptera	Trap	10	N

Feature LOOP-215

Table B-23. Fauna observations and collections at Feature LOOP-215 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/09/2019	Spider	Araneae	Web	2	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Ant	Formicidae	Trap	40	N
08/12/2019	Woodlice	Armadillidae	Trap	7	N
	Cockroach	Blattaria	Trap	15	N
	Ant	Formicidae	Trap	5	N
	Canyon wren	*Catherpes mexicanus*	Trap	1	N
	Rodent	*Mus* sp.	Trap	1	N
08/14/2019	Millipede	Diplopoda	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	4	N
	Ant	Formicidae	Trap	40	N
08/16/2019	Woodlice	Armadillidae	Trap	5	N
			Soil	3	N
	Spider	Araneae	Web	1	N
	Millipede	Diplopoda	Trap	2	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Ant	Formicidae	Trap	10	N
08/19/2019	Woodlice	Armadillidae	Trap	6	N
	Millipede	Diplopoda	Trap	2	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Cockroach	Blattaria	Trap	2	N
	Ant	Formicidae	Trap	7	N
08/21/2019	Woodlice	Armadillidae	Trap	1	N
	Spider	Araneae	Soil	1	N
	Millipede	Diplopoda	Soil	4	N
			Trap	4	N
	Cricket	*Ceuthophilus secretus*	Trap	2	N
08/23/2019	Cricket	*Ceuthophilus secretus*	Trap	2	N
	Millipede	Diplopoda	Trap	7	N
	Gnat	Diptera	Trap	1	N
08/26/2019	Woodlice	Armadillidae	Trap	1	N
	Millipede	Diplopoda	Trap	8	N

Table B-23 (Continued). Fauna observations and collections at Feature LOOP-215 by date.

Date	Common Name	Lowest Taxonomic Identification	Location/ Substrate	# Observed	Collected Y/N? (#)
08/28/2019	Woodlice	Armadillidae	Trap	1	N
	Millipede	Diplopoda	Trap	9	N
	Ant	Formicidae	Trap	25	N
	Canyon wren	*Catherpes mexicanus*	Trap	1	N
08/30/2019	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Millipede	Diplopoda	Trap	3	N
	Millipede	Diplopoda	Rock	12	N
	Moth	Lepidoptera	Trap	1	N
09/01/2019	Woodlice	Armadillidae	Trap	2	N
	Millipede	Diplopoda	Trap	2	N
	Cricket	*Ceuthophilus secretus*	Trap	5	N
	Ant	Formicidae	Trap	40	N
09/03/2019	Millipede	Diplopoda	Trap	9	N
	Ant	Formicidae	Trap	6	N
09/05/2019	Woodlice	Armadillidae	Trap	1	N
	Millipede	Diplopoda	Trap	13	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Cockroach	Blattaria	Trap	1	N
	Ant	Formicidae	Trap	11	N
09/07/2019	Millipede	Diplopoda	Trap	1	N
	Cricket	*Ceuthophilus secretus*	Trap	1	N
	Gnat	Diptera	Trap	2	N

Appendix C. Genetic determination report

Provided as a separate attachment.

Cicurina Species Identification Report to Zara and TxDOT

Caleb D. Phillips, caleb.phillips@ttu.edu, phone: 806-834-8181

January 21, 2020

This is a report of molecular species identifcation of one *Cicurina* specimen provided to Caleb D. Phillips.

Specimens examined

TK 188518; Zara 6789; Feature JCT-26-NB (5): USA: TX: Bexar Co; -98.48860; 29.60897; 18 November 2011; Jeanette Larsen; Hicks 1604/281 interchange project

Methods

A portion of the mitochondria Cytochrome C Oxidase Subunit I gene was amplified and sequenced using primers developed in-house by Caleb Philips based on the mitochondrial genome sequence provided by Parlos et al (in prep). All reaction conditions were similar to those in Parlos et al. (in prep). Digitial sequence data was compared to a database of *Cicurina* COI sequences available at GenBank through accession numbers KU552214-KU552333. Pairwise genetic distance of each specimen was compared to each database specimen. Analysis employed the Kimura 2-parameter model of molecular evolution and uniform rates of mutation among sites. Resulting pairwise genetic distance matrix was parsed and visualized using custom R code.

Results

Total Number of Base Pairs Compared: 1083

Number of variable sites: 353

Number of Parsimony Informative Sites: 289

Number of Singleton Sites: 64

Based on the results of analysis the following species idenfications are provided.

Zara6789: *Cicurina puentecilla*

Figures

Figure(s) provided below illustrate genetic divergence of specimens examined in this report relative to database entries. Each comparison is colored according to the species identification of each database entry. Instances in which a county name rather than a species name is provided reflect specimens examined by Parlos et al. (in prep), for which species status is currently unknown.

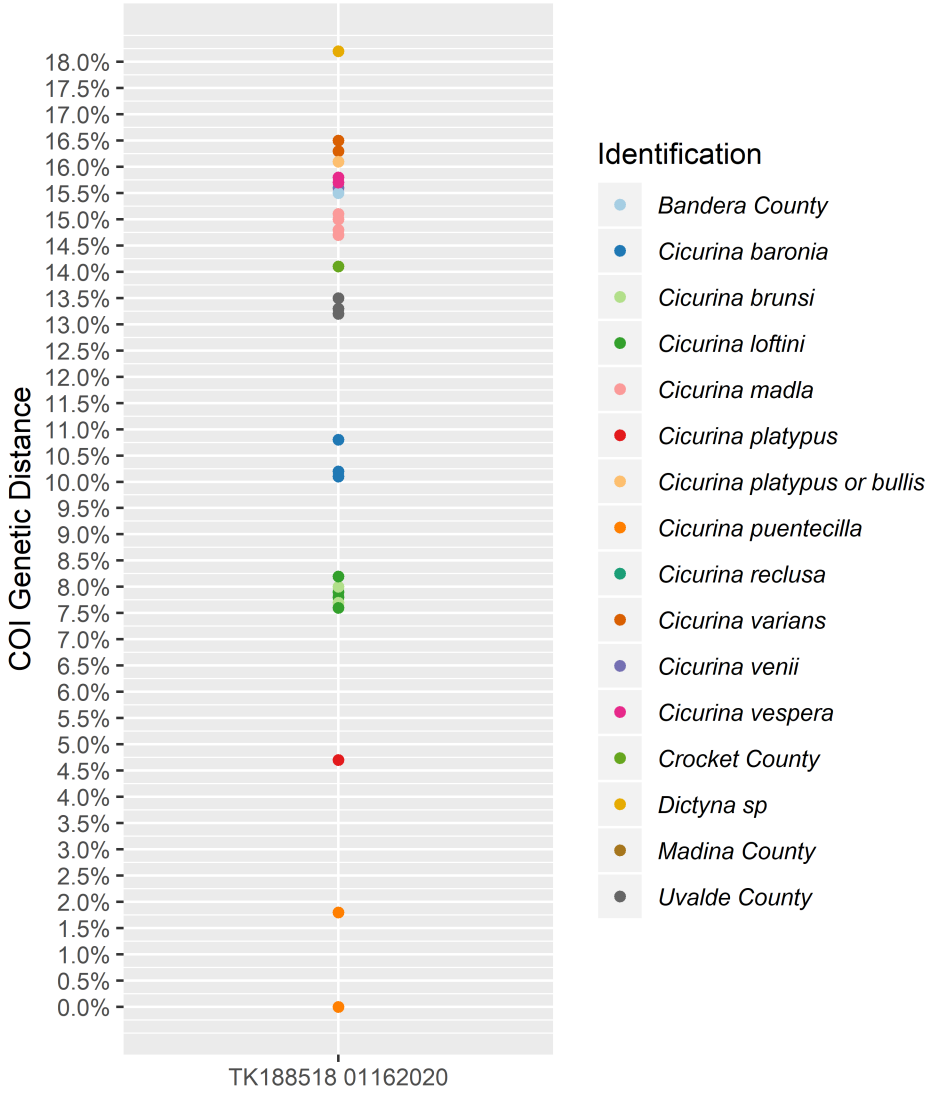


Figure 1: Comparison of specimen TK188518/Zara6789 to all database entries.

Cicurina Species Identification Report to Zara and TxDOT

Caleb D. Phillips, caleb.phillips@ttu.edu, phone: 806-834-8181

September 19, 2019

This is a report of molecular species identification of one *Cicurina* specimen provided to Caleb D. Phillips.

Specimens examined

Zara12517 from location 1604-FZ7 (Coordinates: 29.608061, -98.525249)

Methods

A portion of the mitochondria Cytochrome C Oxidase Subunit I gene was amplified and sequenced using primers developed in-house by Caleb Philips based on the mitochondrial genome sequence provided by Parlos et al (in prep). All reaction conditions were similar to those in Parlos et al. (in prep). Digitial sequence data was compared to a database of *Cicurina* COI sequences available at GenBank through accession numbers KU552214-KU552333. Pairwise genetic distance of each specimen was compared to each database specimen. Analysis employed the Kimura 2-parameter model of molecular evolution and uniform rates of mutation among sites. Resulting pairwise genetic distance matrix was parsed and visualized using custom R code.

Results

Total Number of Base Pairs Compared: 1083

Number of variable sites: 353

Number of Parsimony Informative Sites: 299

Number of Singleton Sites: 54

Based on the results of analysis the following species idenfications are provided.

Zara12517: *Cicurina platypus/bullis*

Figures

Figure(s) provided below illustrate genetic divergence of specimens examined in this report relative to database entries. Each comparison is colored according to the species identification of each database entry. Instances in which a county name rather than a species name is provided reflect specimens examined by Parlos et al. (in prep), for which species status is currently unknown.

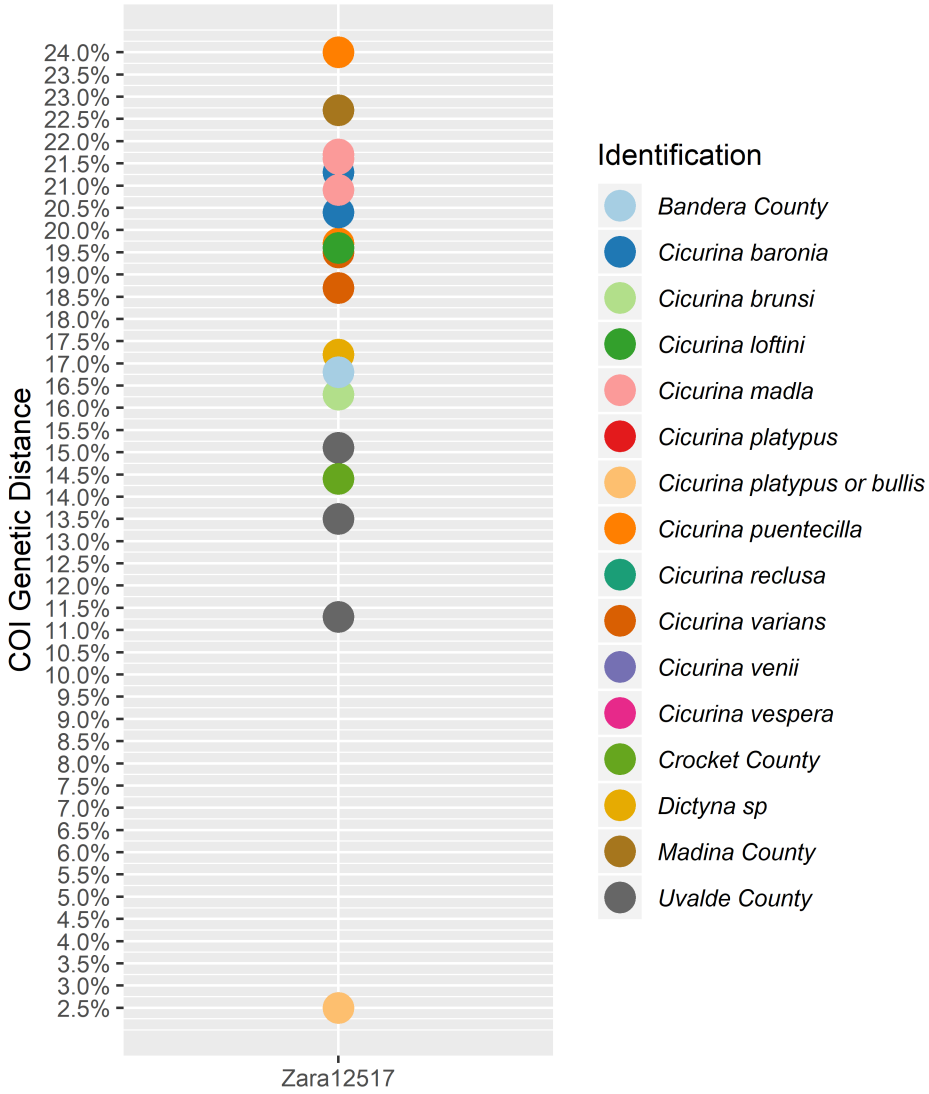


Figure 1: Comparison of specimen Zara12517 to all database entries.

On Tuesday, October 8, 2019, 3:01:32 PM CDT, Oscar Federico Francke B <offb@ib.unam.mx> wrote:

Howdy Peter:

Rodrigo had a chance to check the shizos you sent in the last package.

The protoschizomid from Texas is a new Agastoschizomus without a doubt. Rodrigo has to try to dissect the spermatheca to determine if it is an adult female or not. However, the flagellum is missing and without it he is very hesitant to describe it. Perhaps the flagellum broke when then removed the specimen from the sticky trap. If they are going to sample that cave again, with sticky traps again, please tell them to be very carefull not to leave the flagellum behind! Even if it breaks off, putting it in the vial with a note to that effect would be of great help!

The two specimens from QR are a new species of Troglostenochrus! Before we only had females and it was thought to be perhaps a Mayazomus, but this time you guys caught an adult male (finally!) and there is no doubt about its identity. The only two known species in that genus are from caves in Chiapas and in Guerrero!! What a biogeographic puzzle!

Cheers,

Oscar

--

Dr. Oscar F. Francke B.

Curador, Colección Nacional de Arácnidos

Instituto de Biologia, UNAM

Coyoacan, Ciudad de México

(55) 56 22 91 45

Appendix D. Climate data

Climate data for each feature provided as Excel (.xls) files upon request.

Appendix E. CONFIDENTIAL Mapped feature locations.

Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

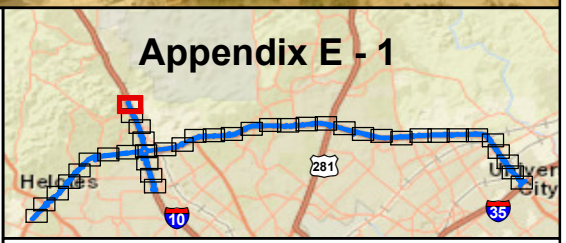
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 1



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

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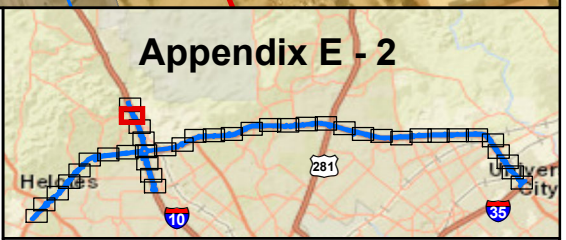
- Project Area
- Action Area
- Critical Habitat Unit
- Streams

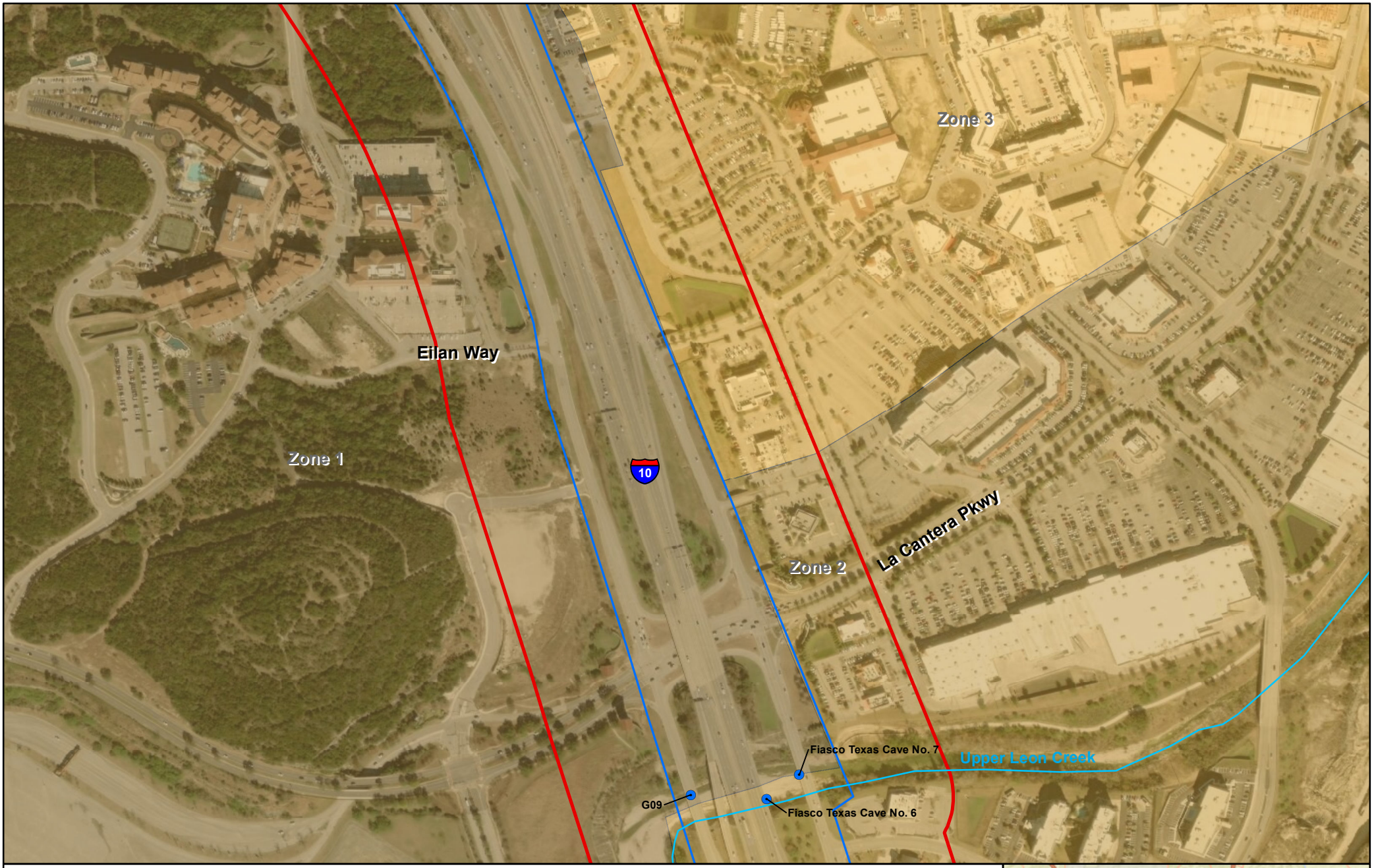
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 2



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

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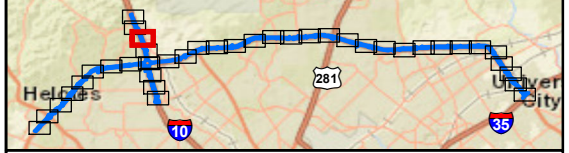
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

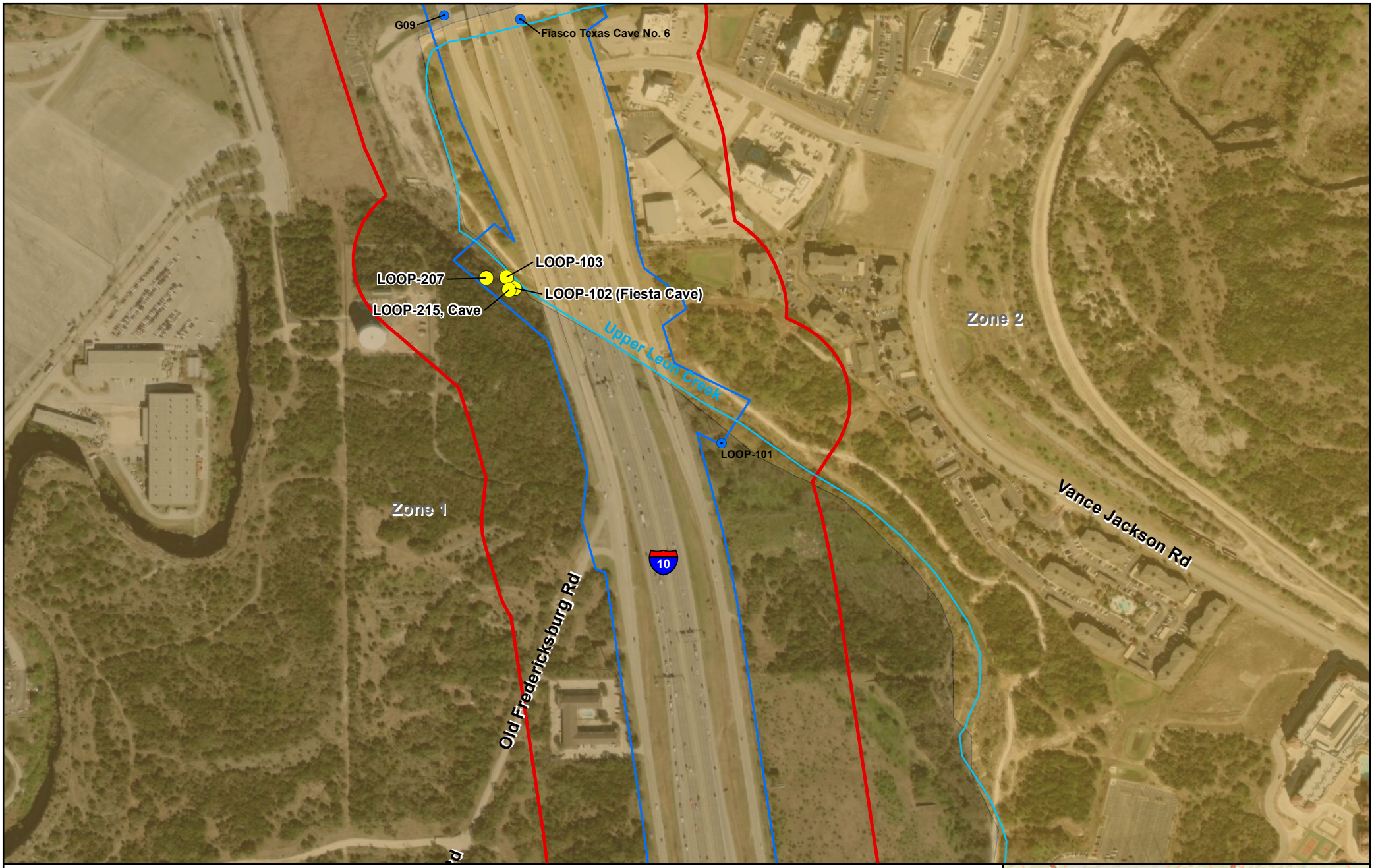
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 3



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

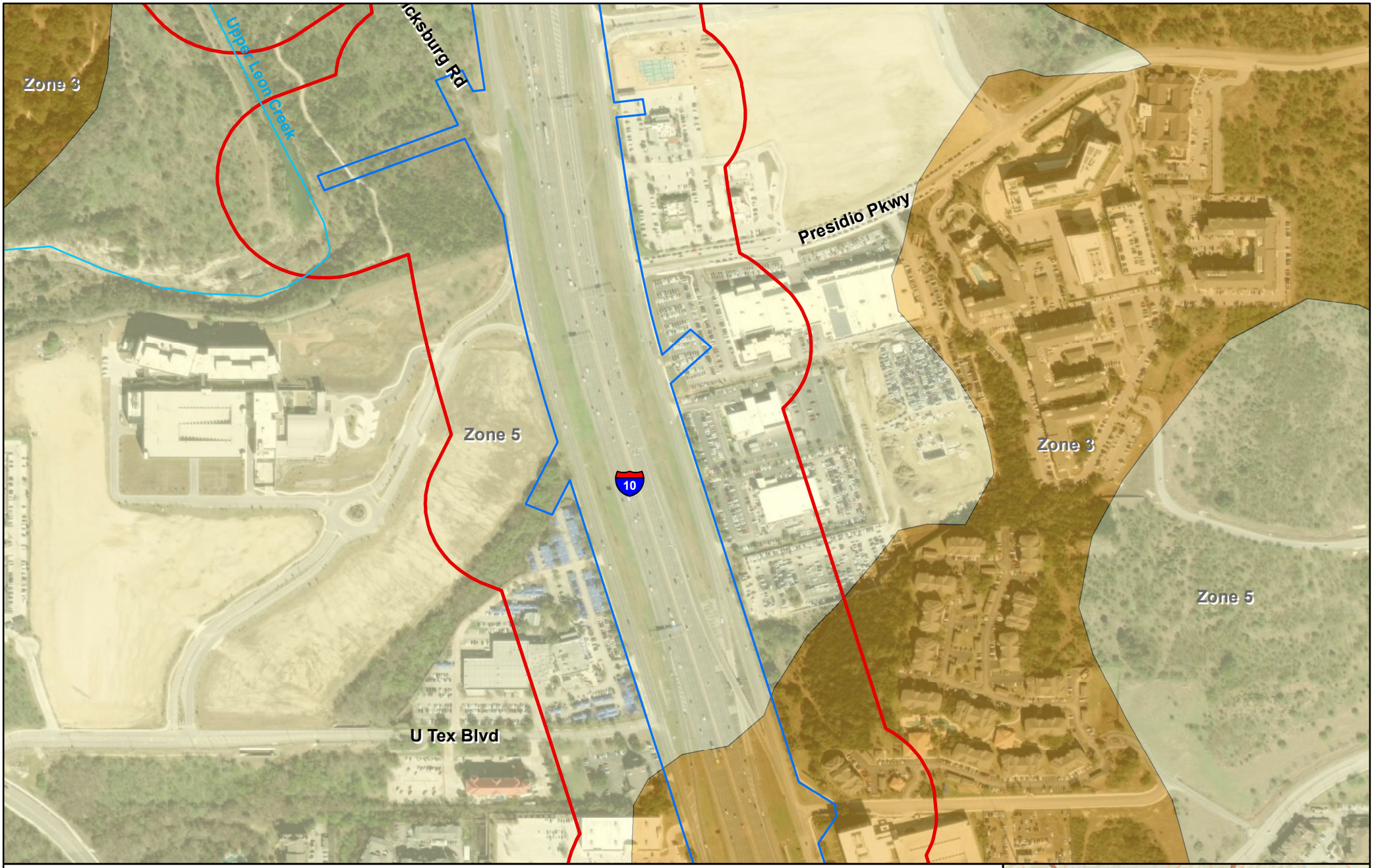
- Project Area
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 4

Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

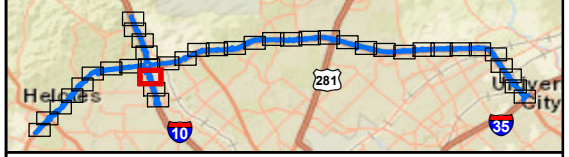
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

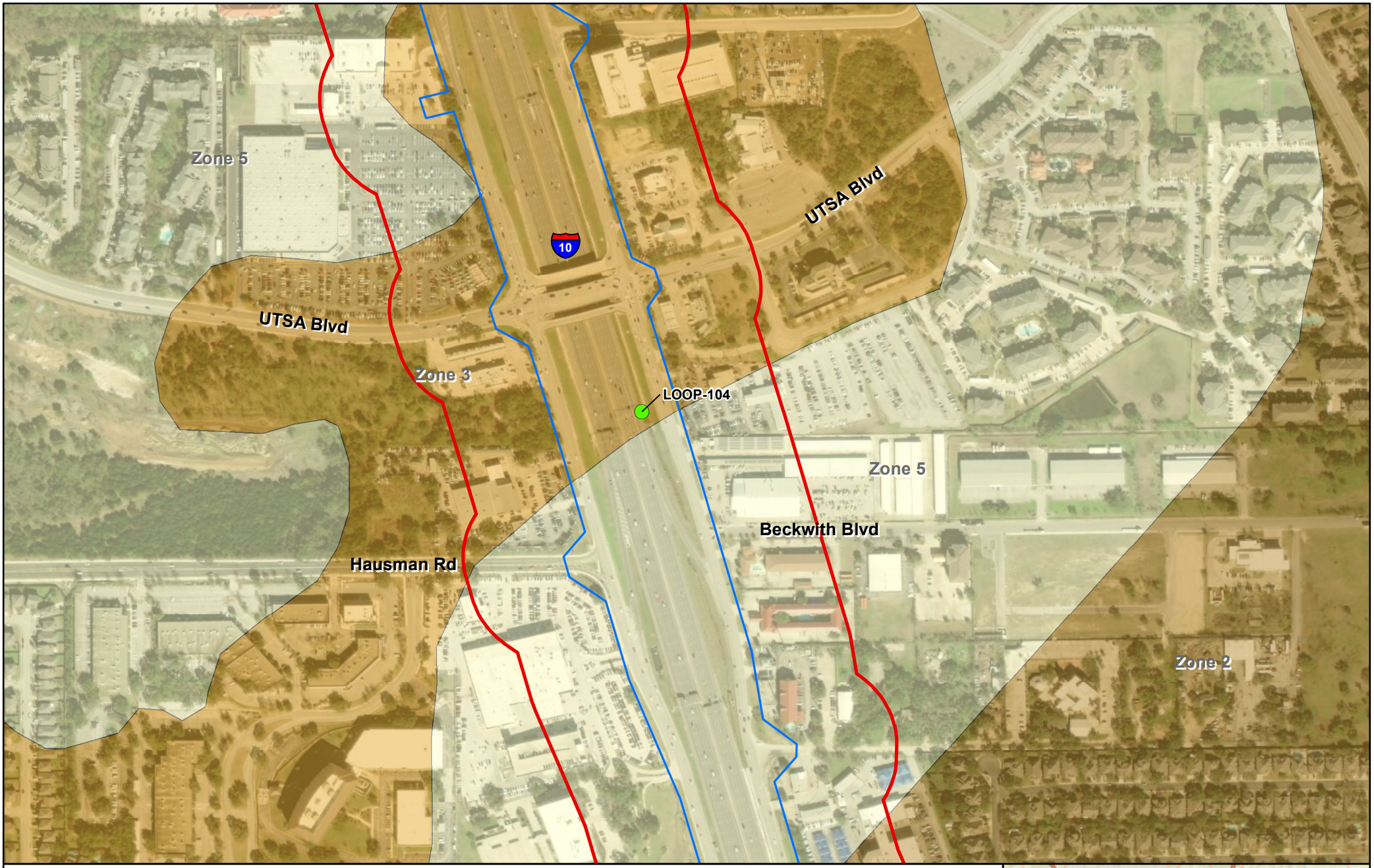
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 5



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

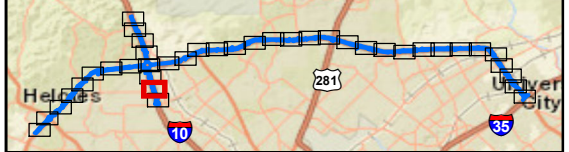
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 6



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

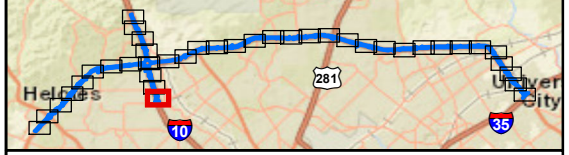
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

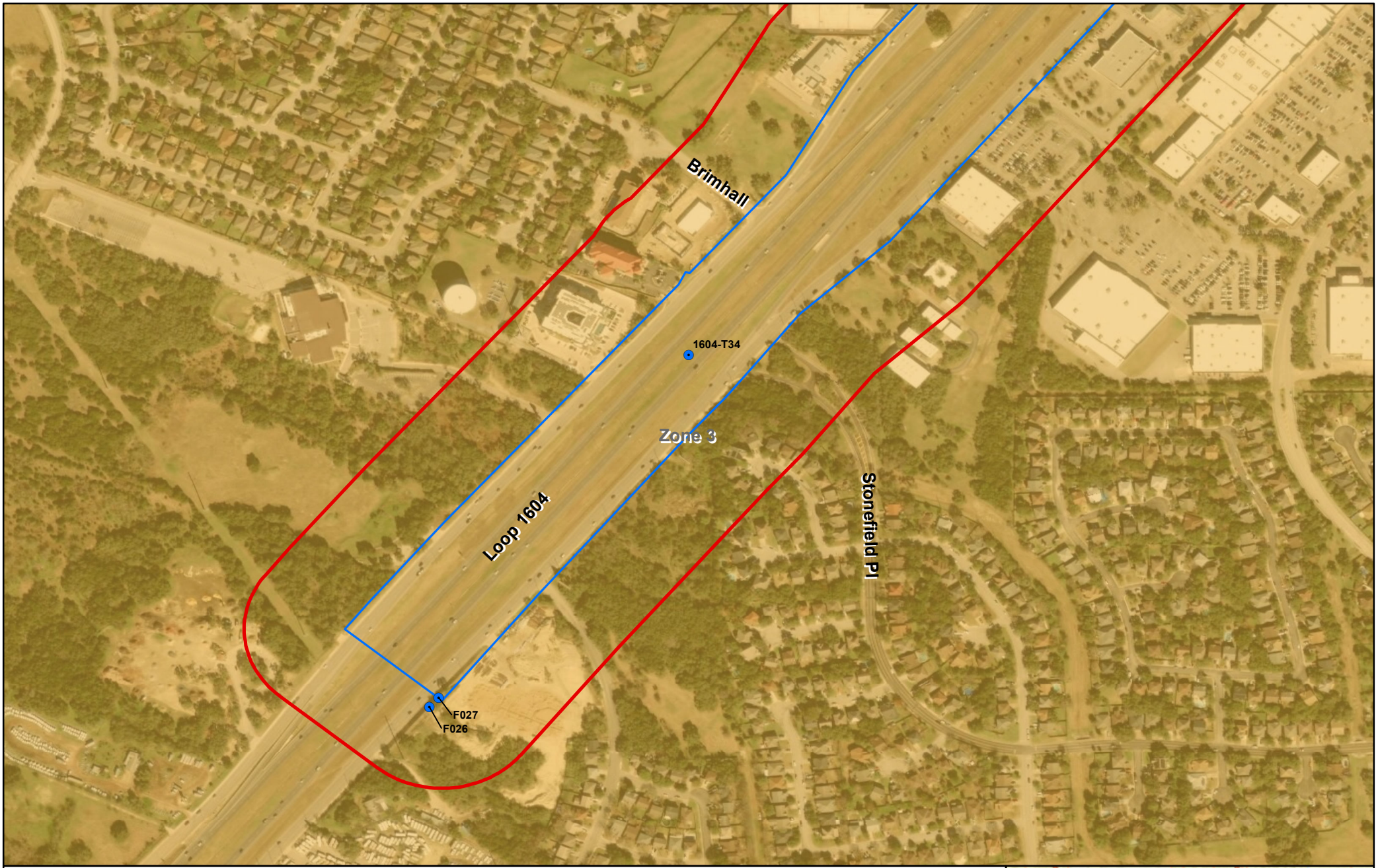
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 7



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

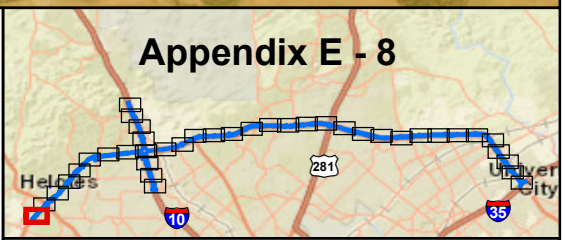
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

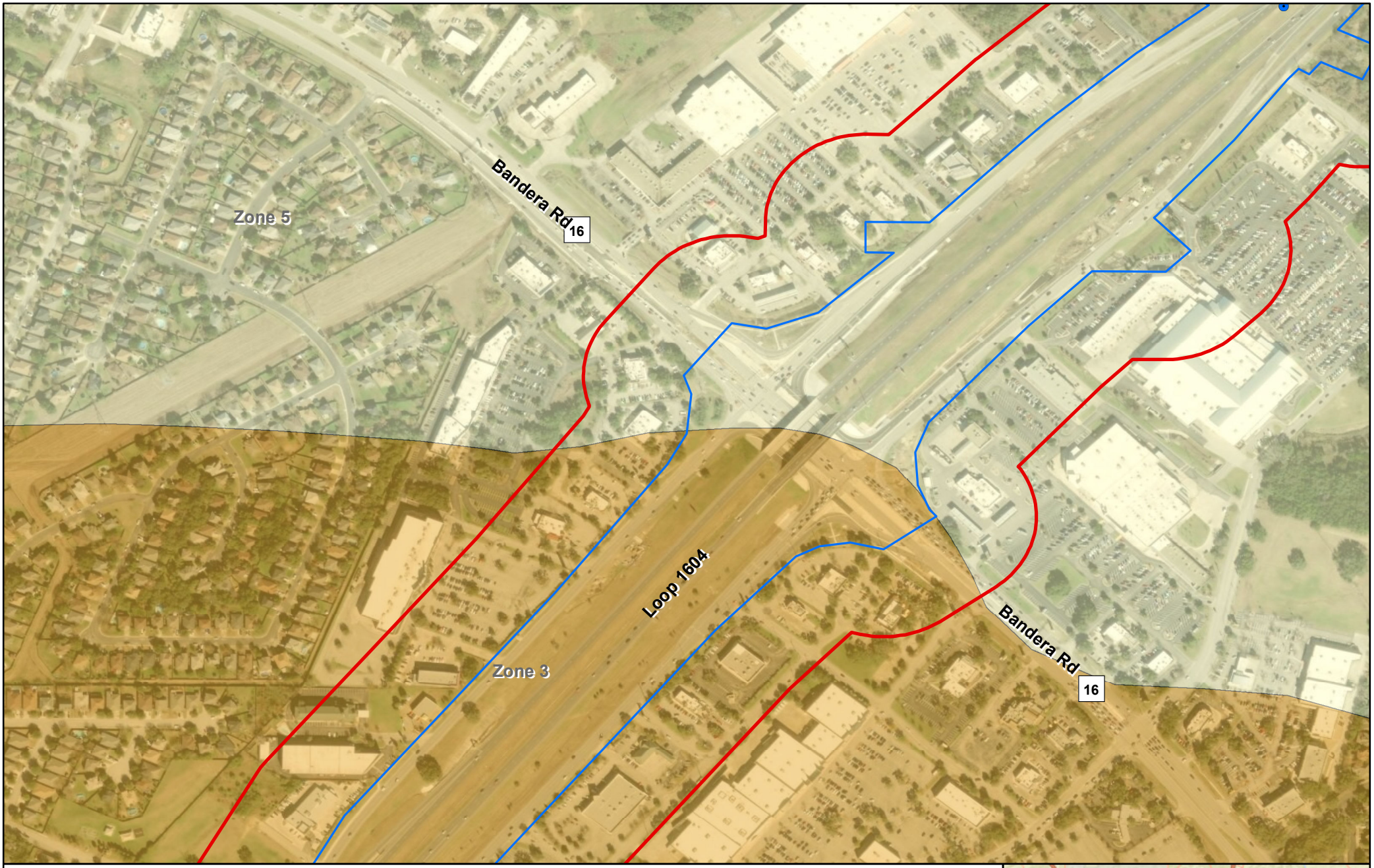
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 8



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

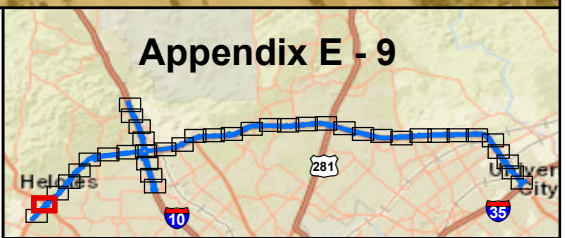
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

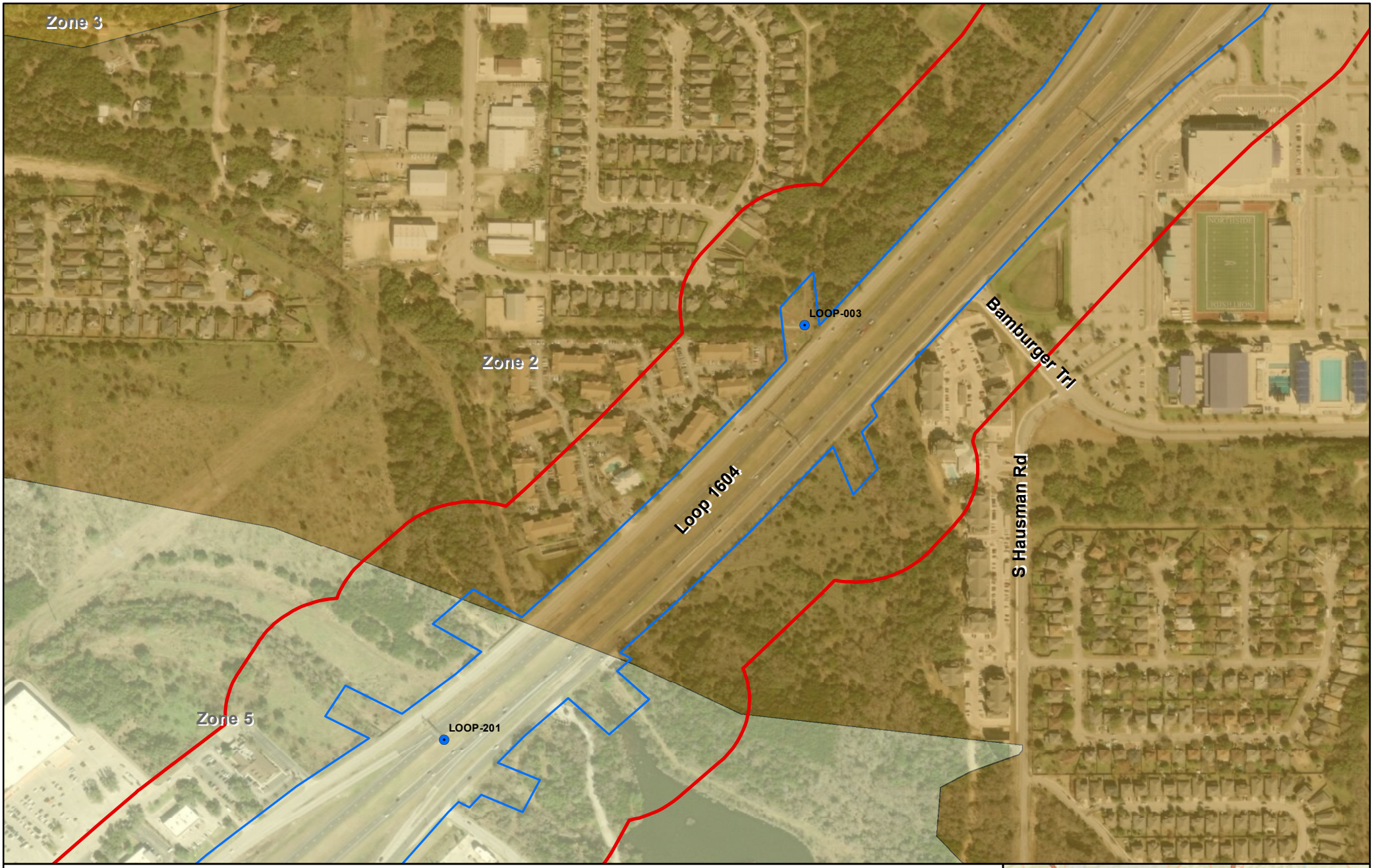
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 9



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

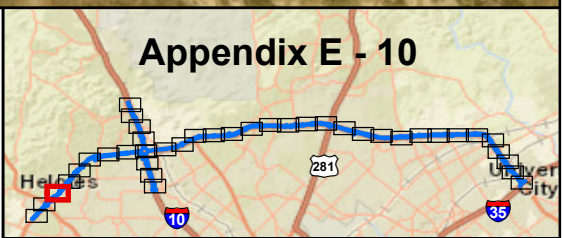
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

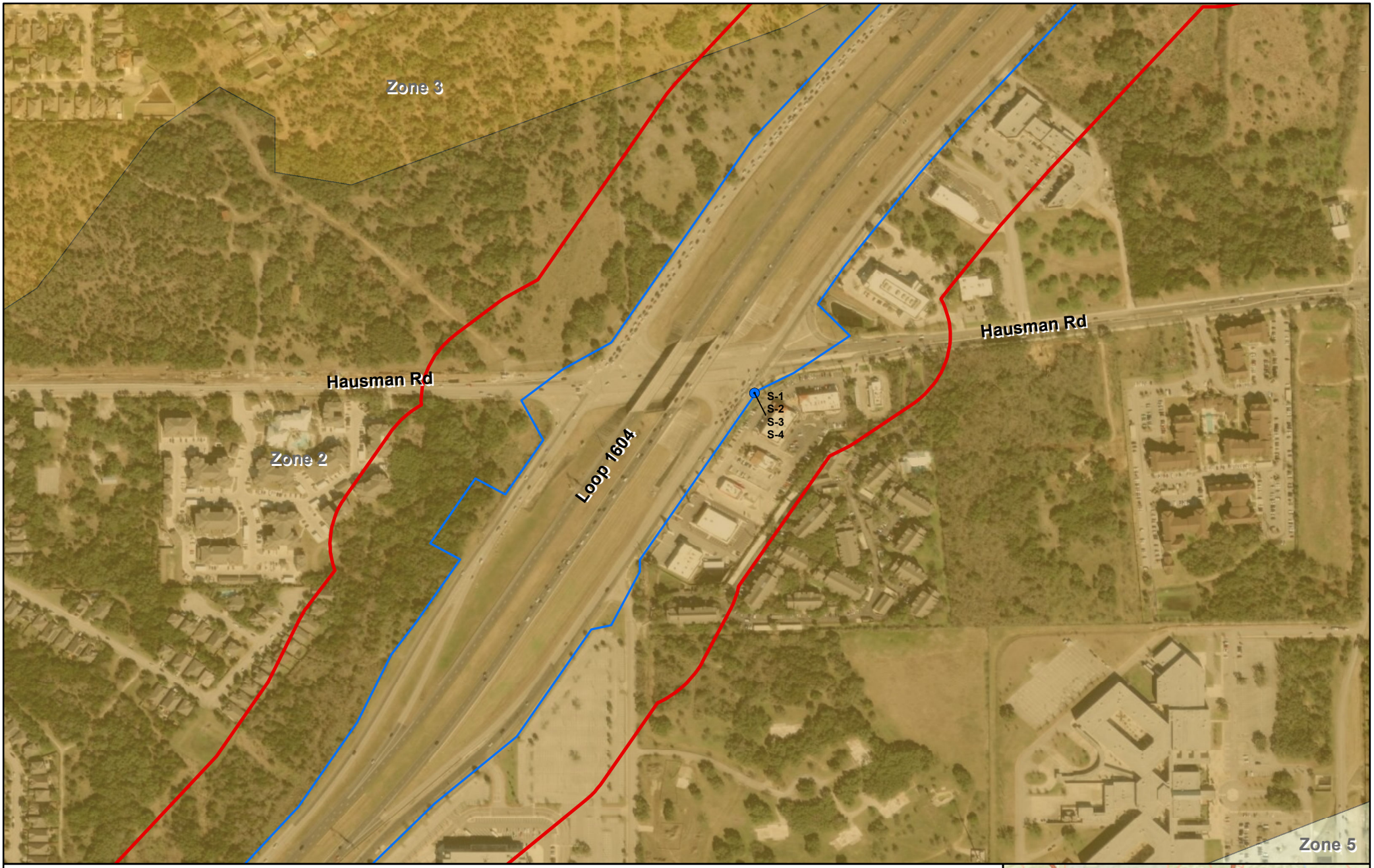
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 10



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

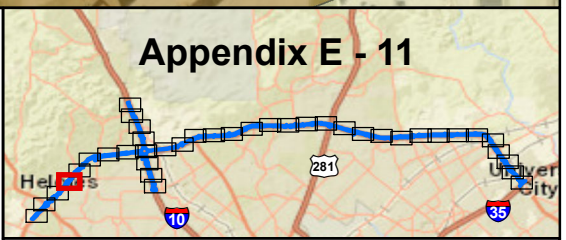
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

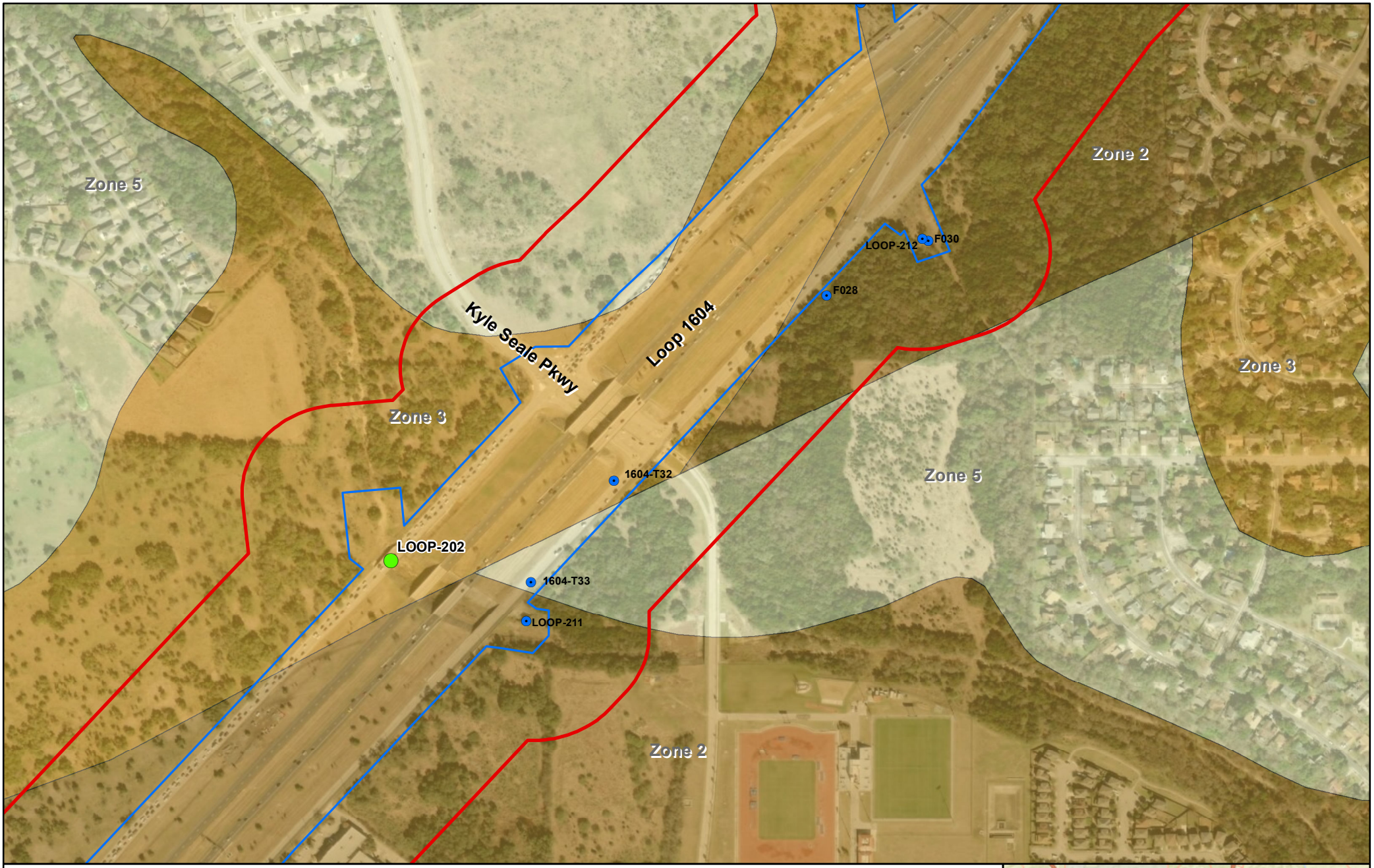
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 11



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

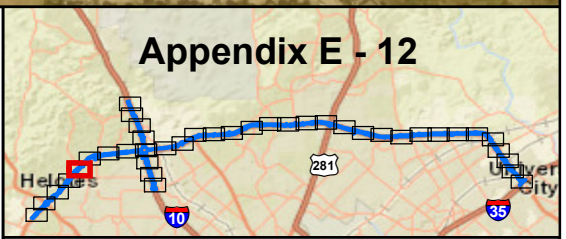
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

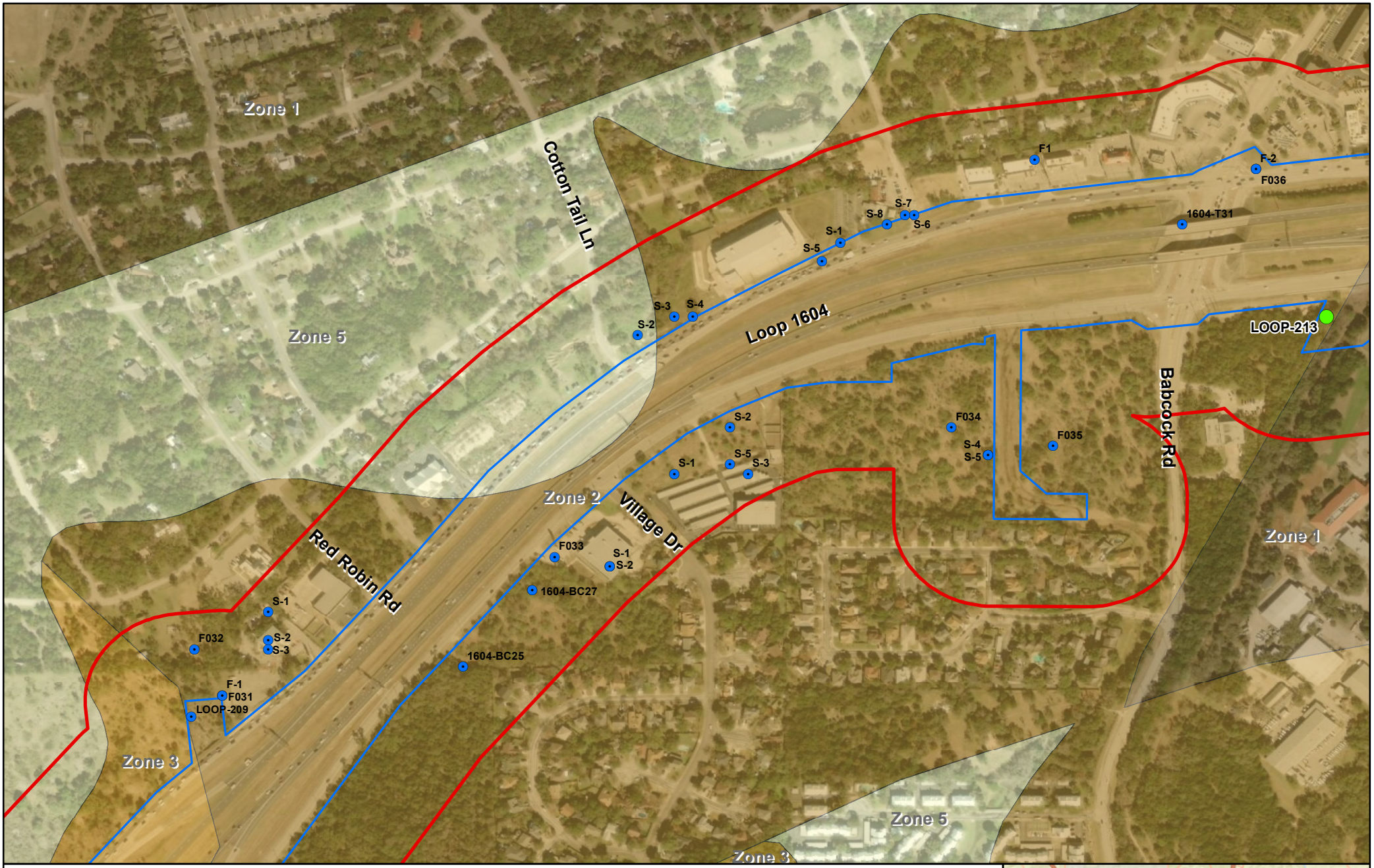
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 12



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

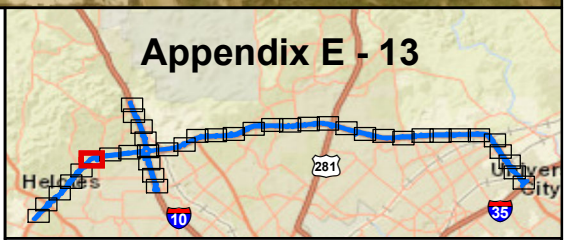
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

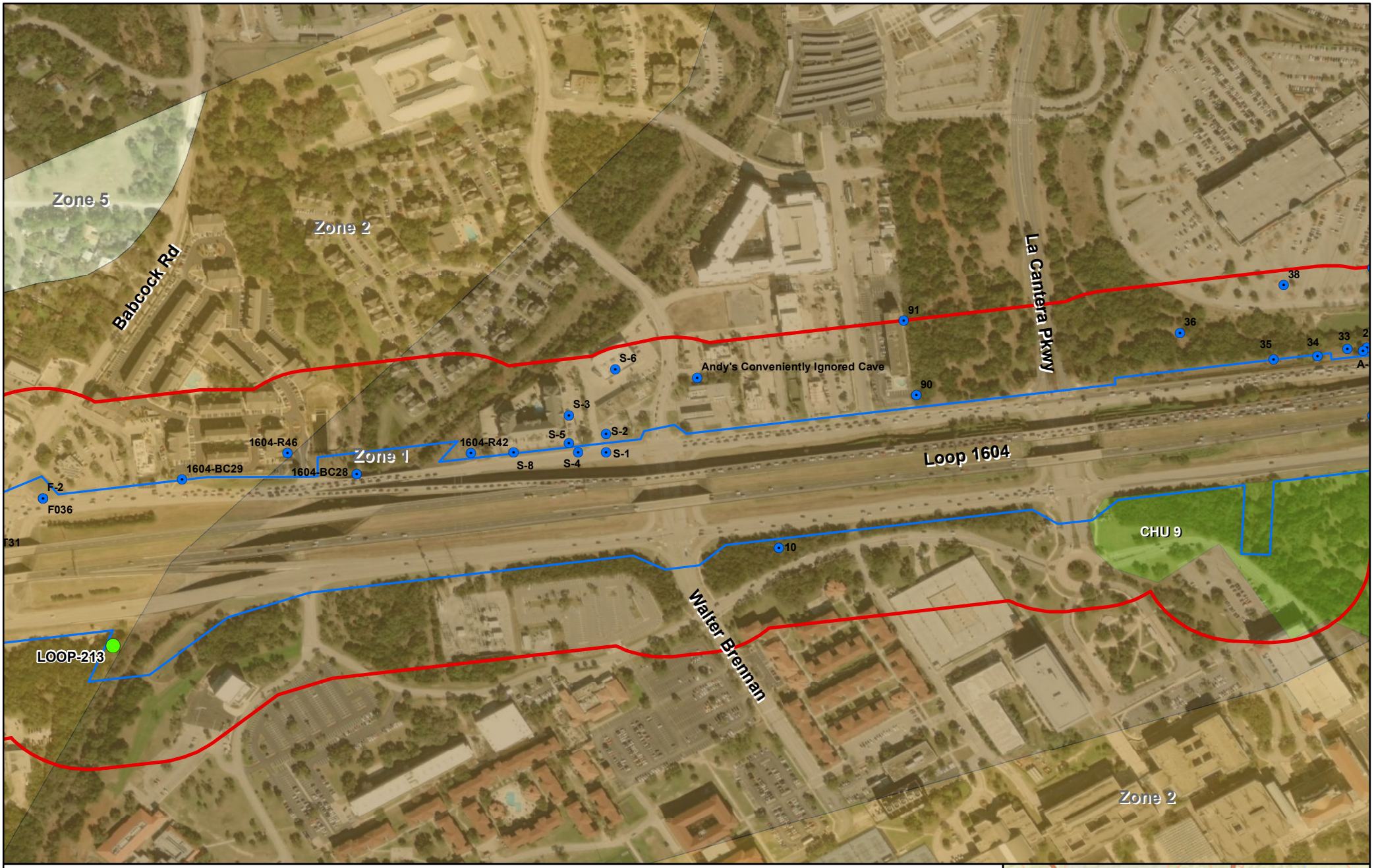
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 13



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

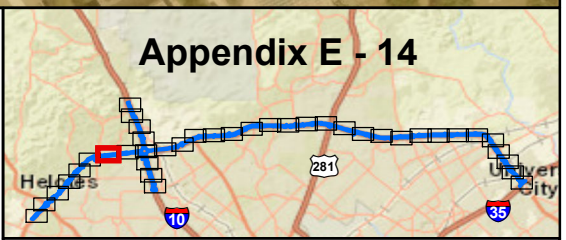
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

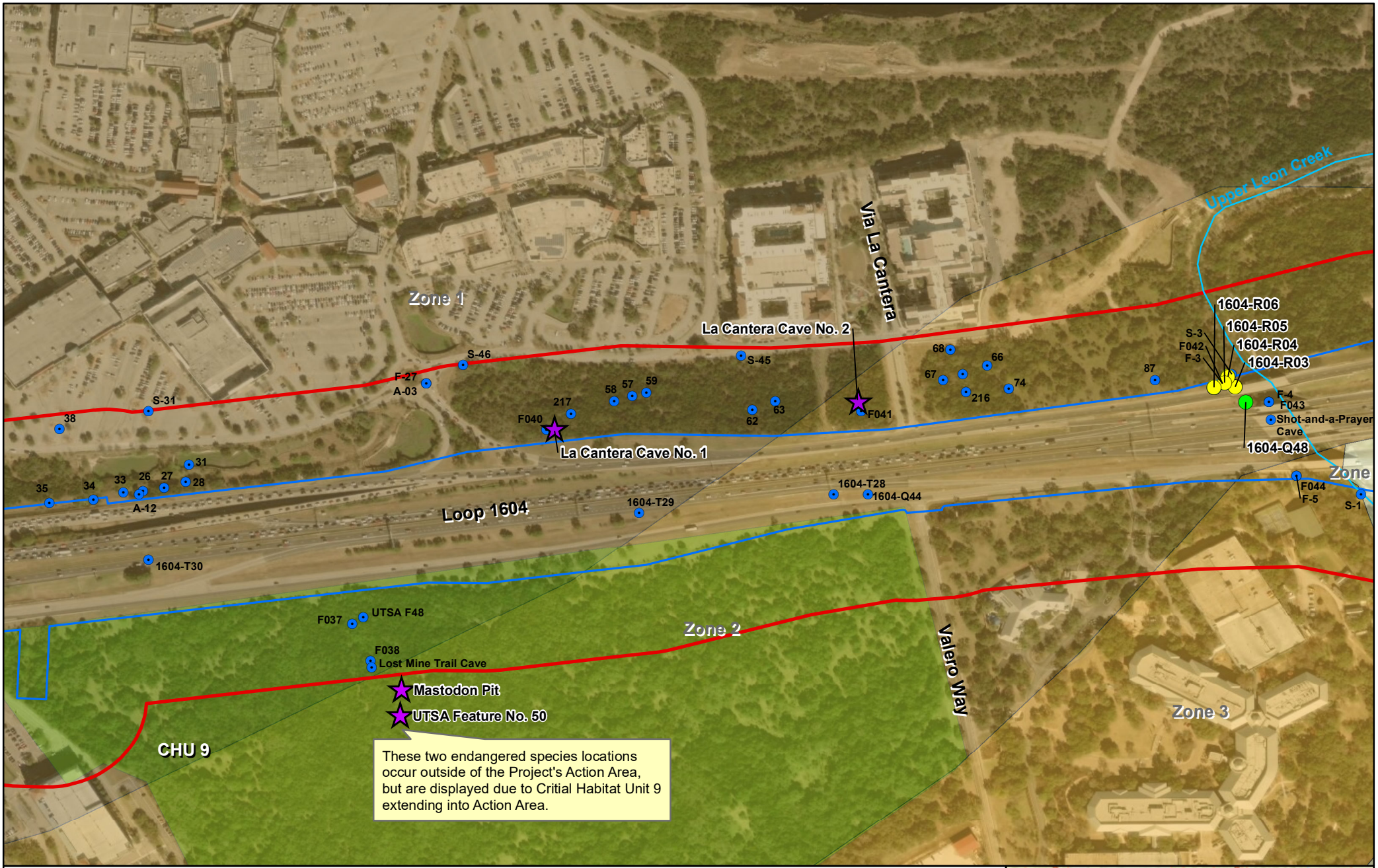
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 14



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

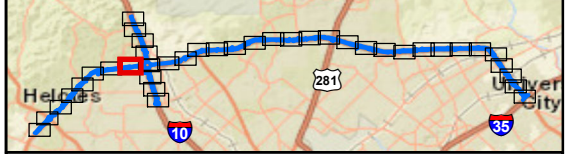
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 15



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

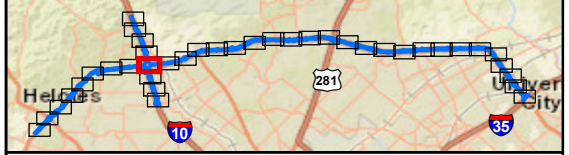
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

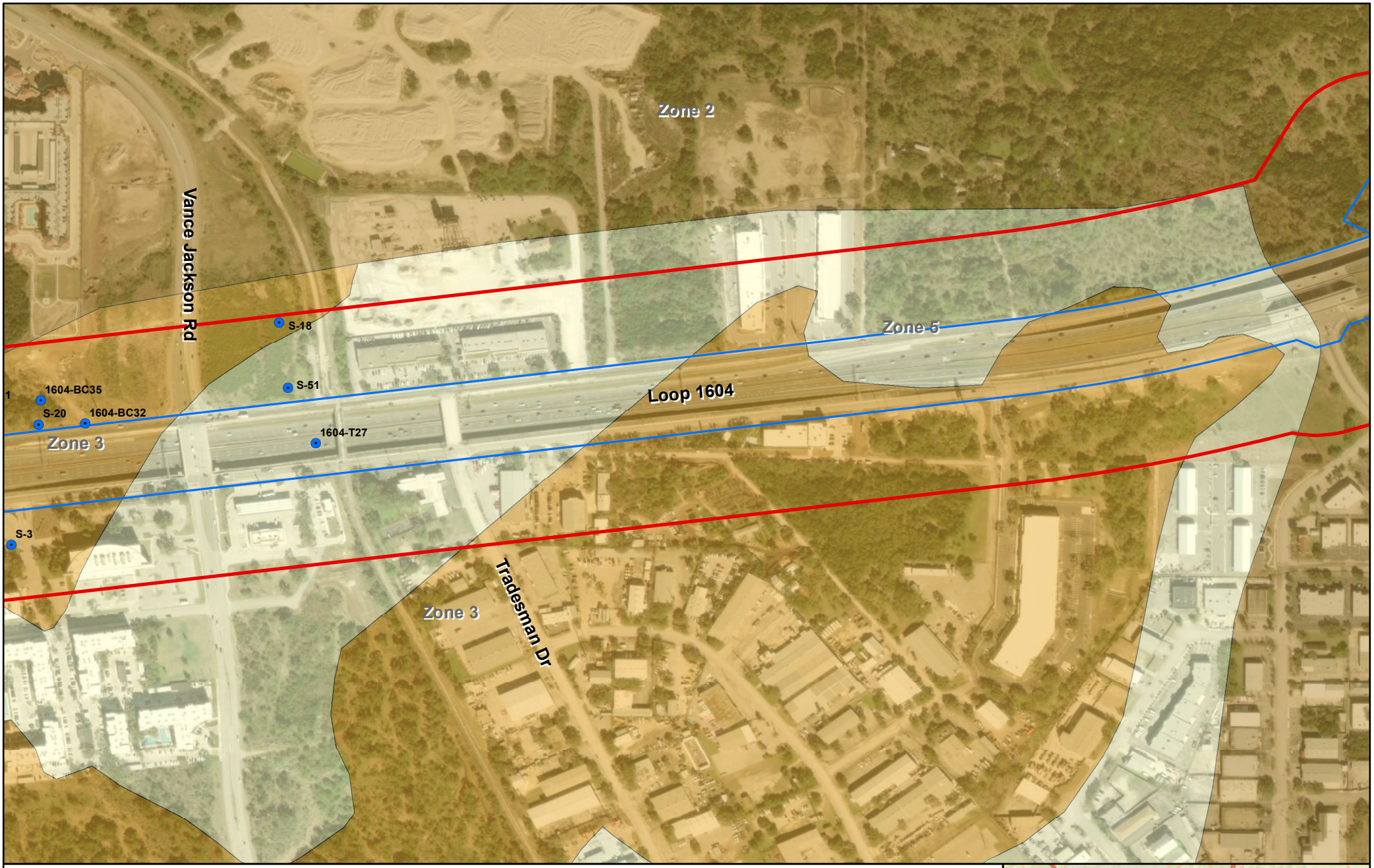
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 16



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

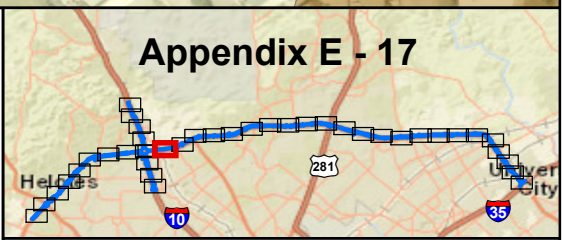
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

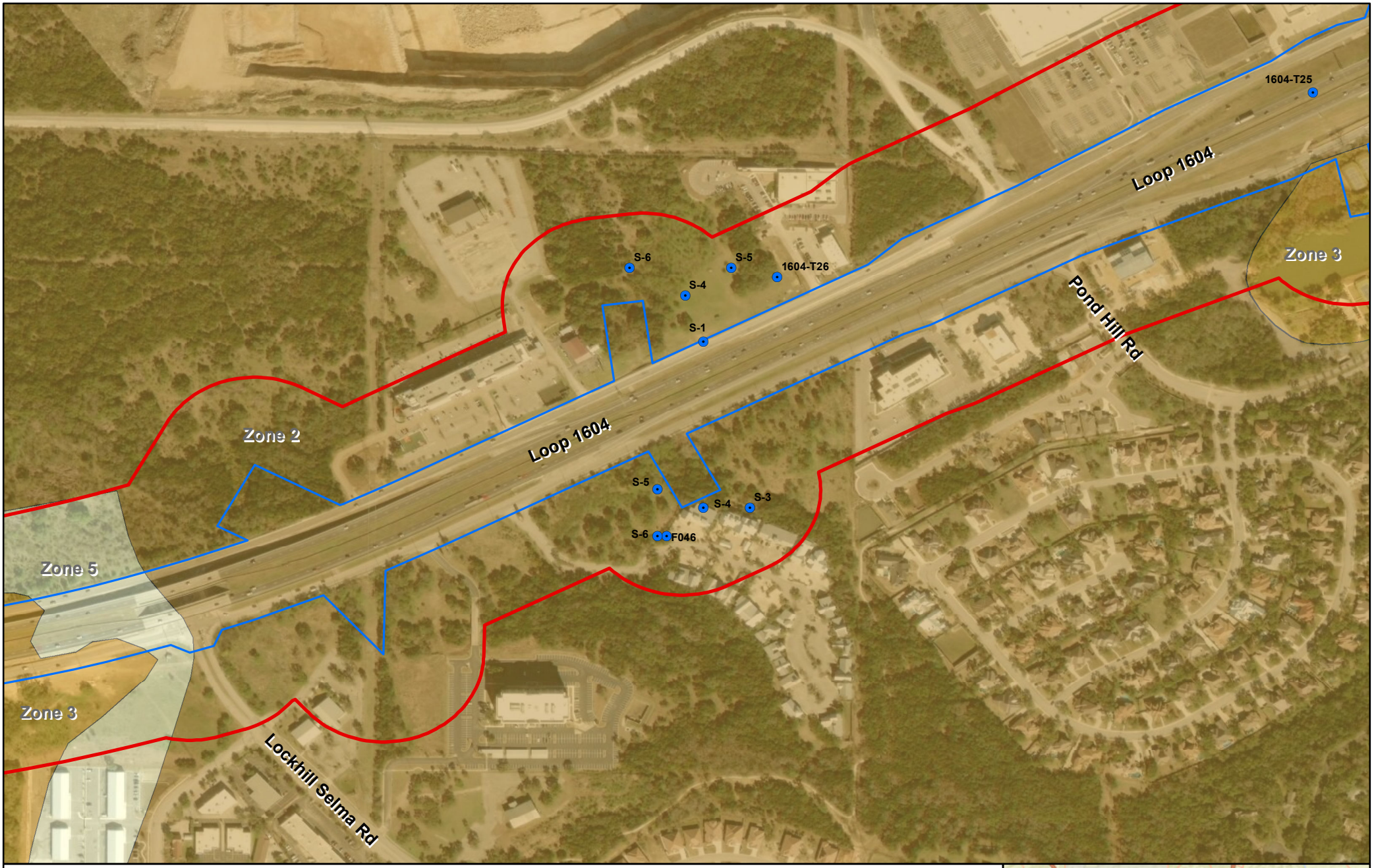
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 17



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

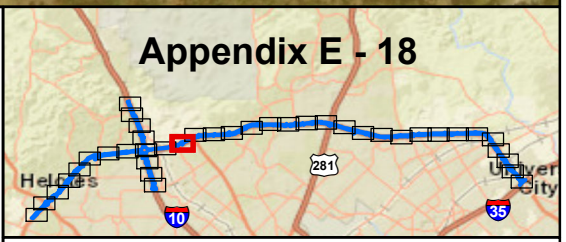
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 18



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

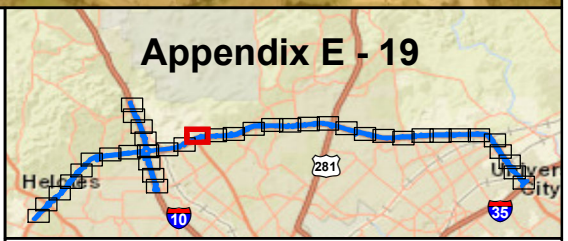
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

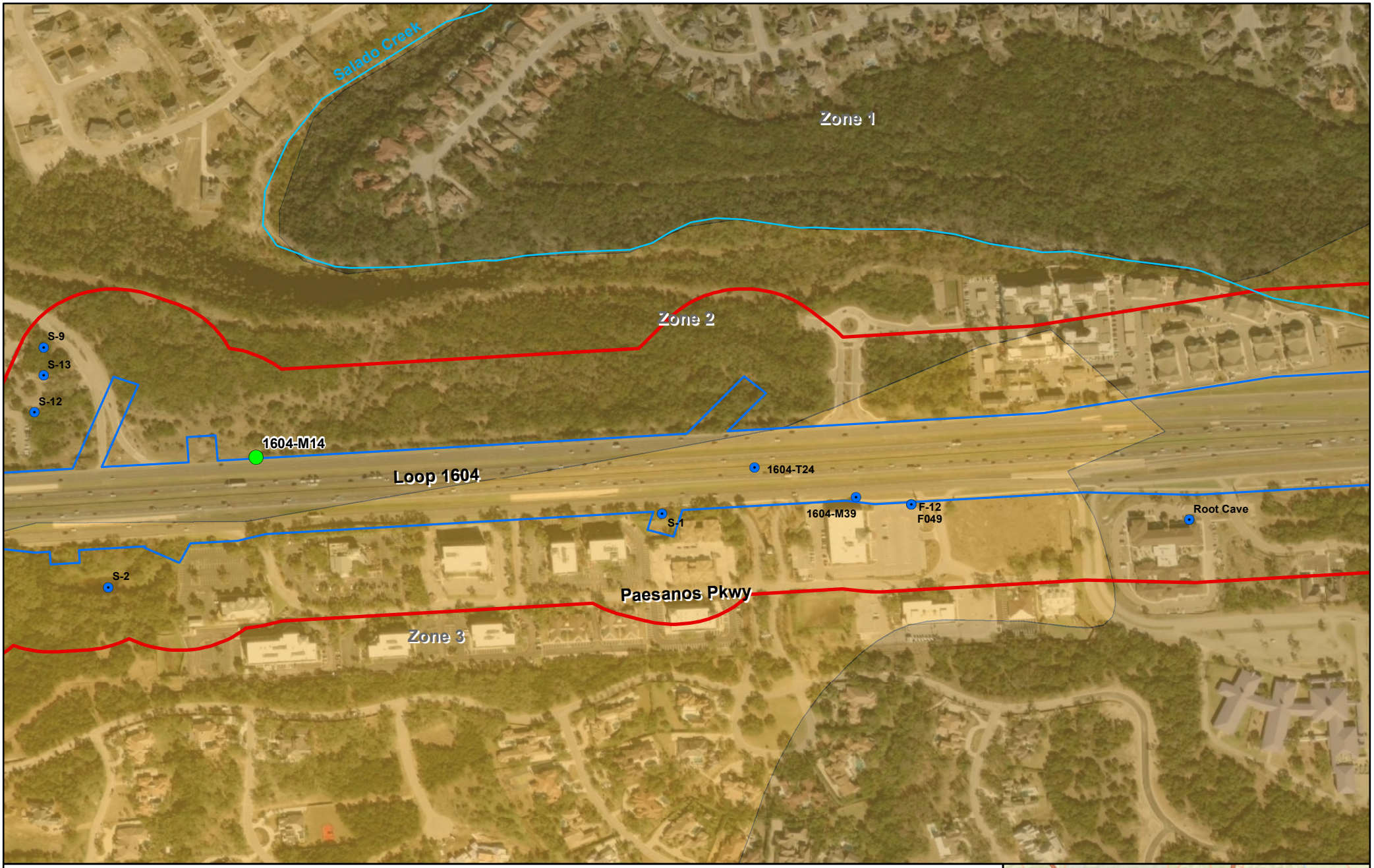
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 19



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

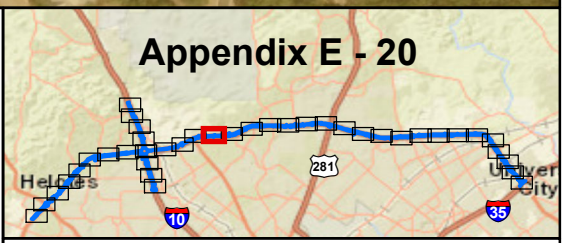
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

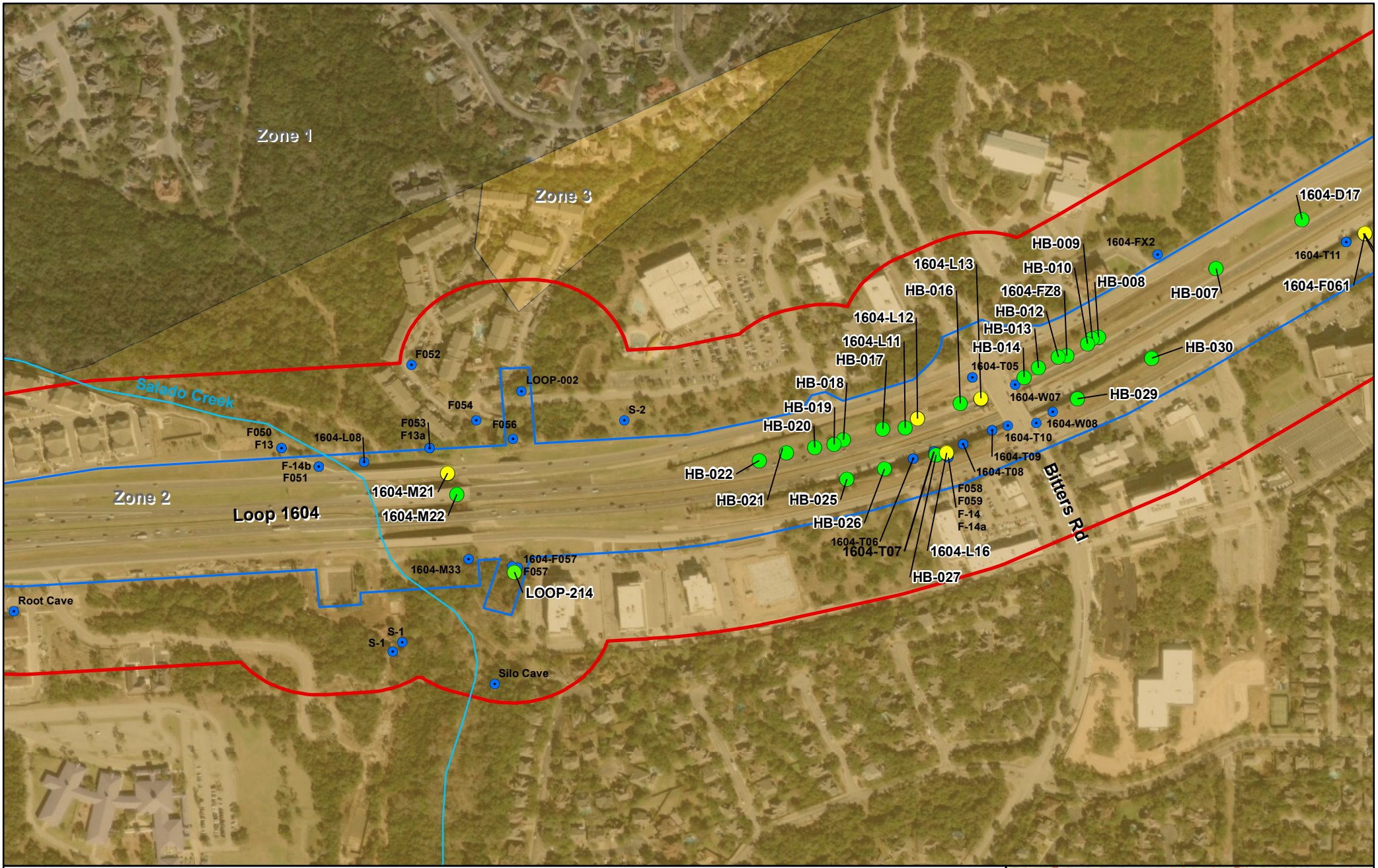
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 20



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

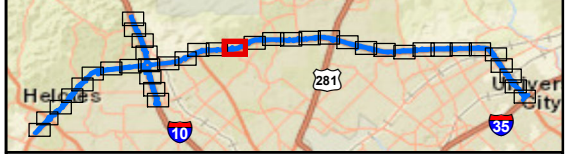
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

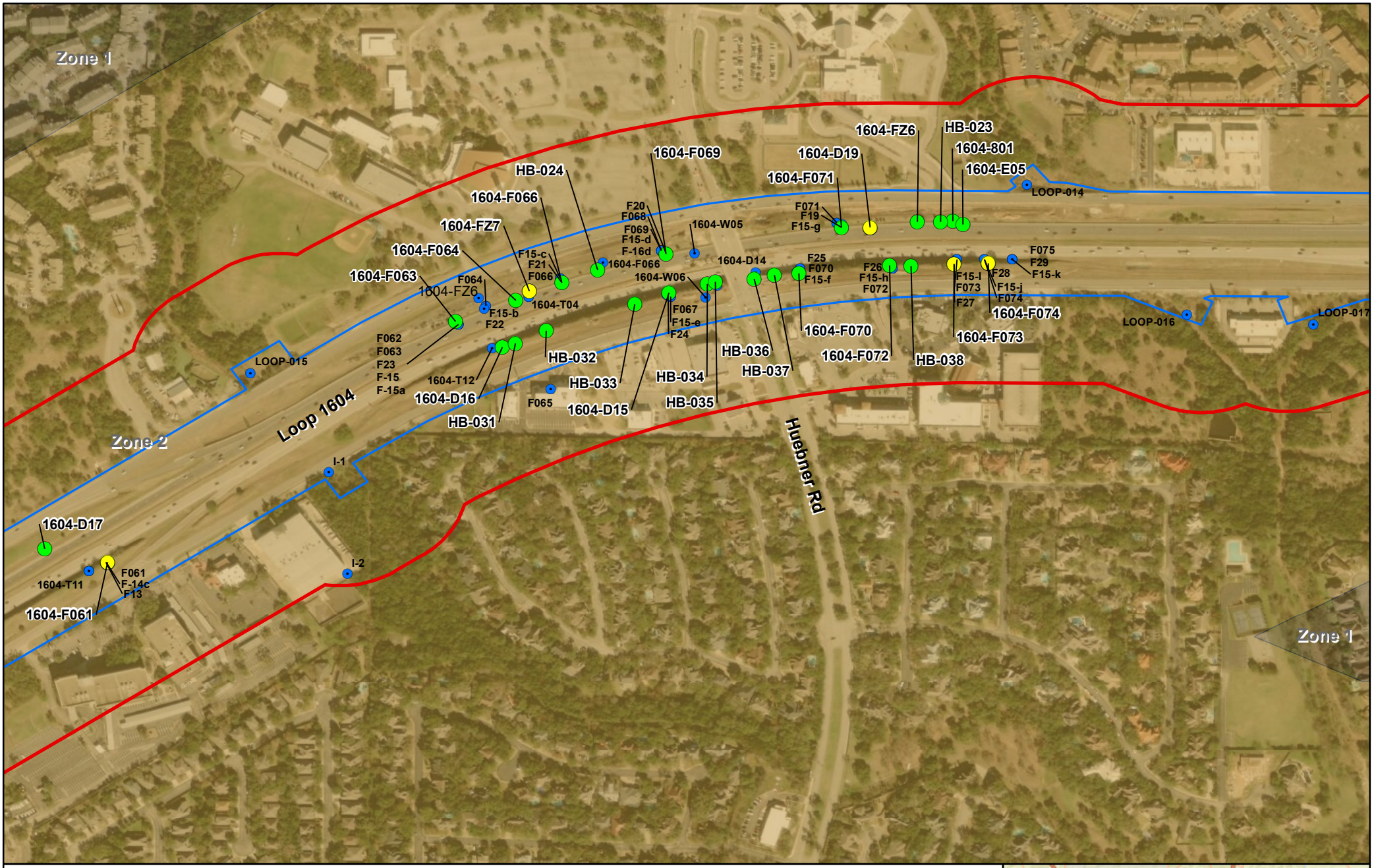
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 21



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

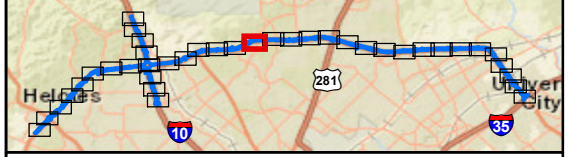
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

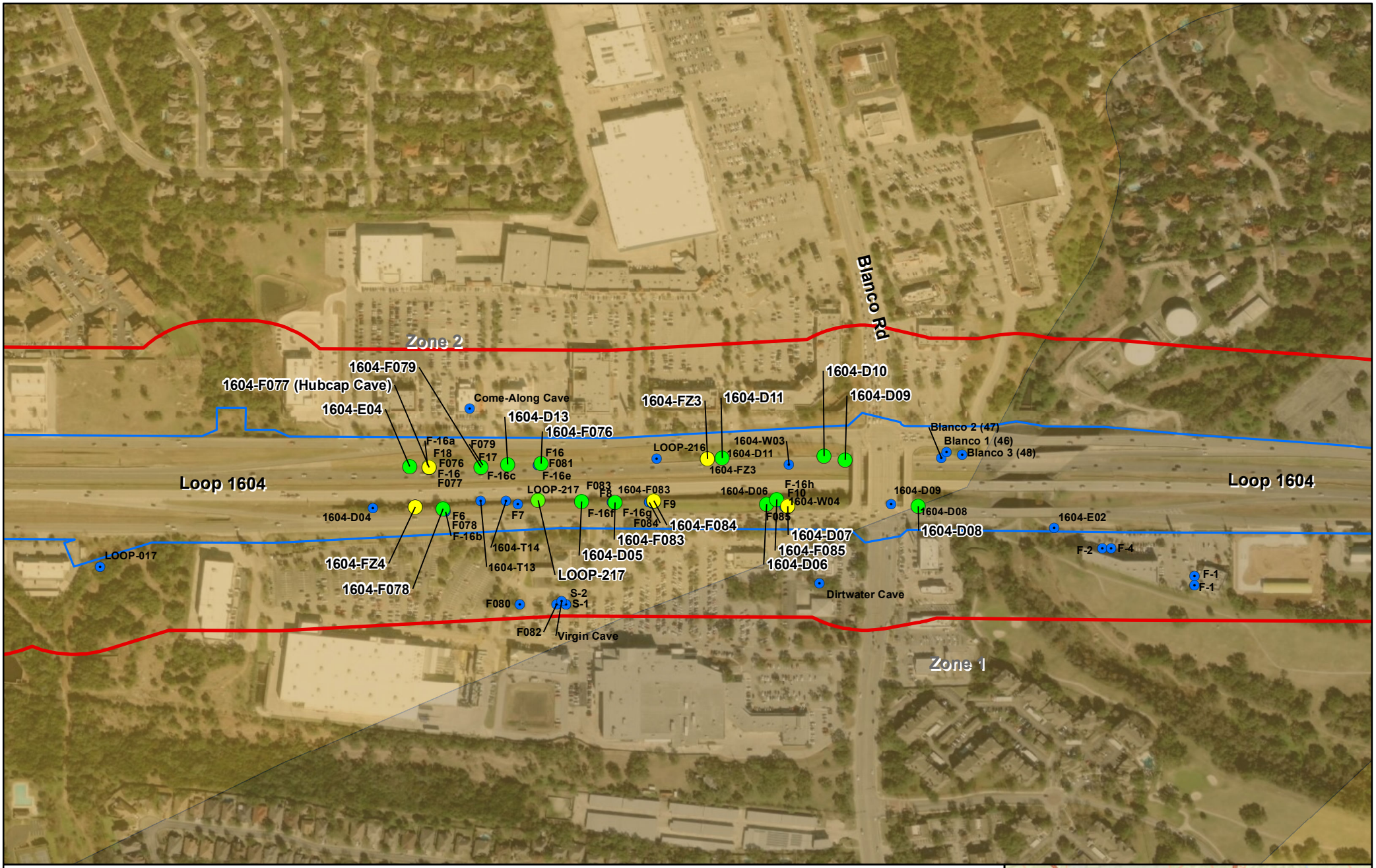
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 22



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

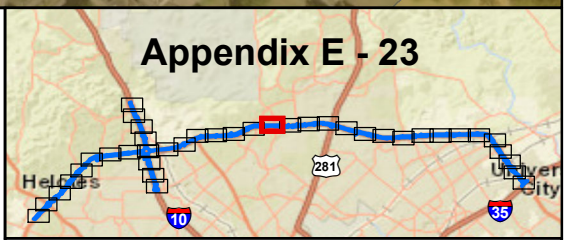
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 23



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

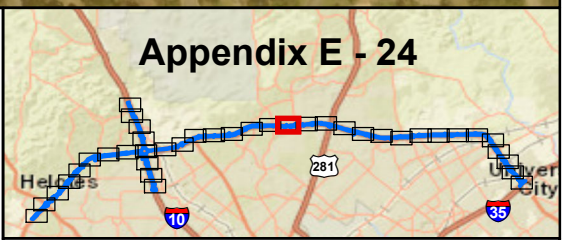
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

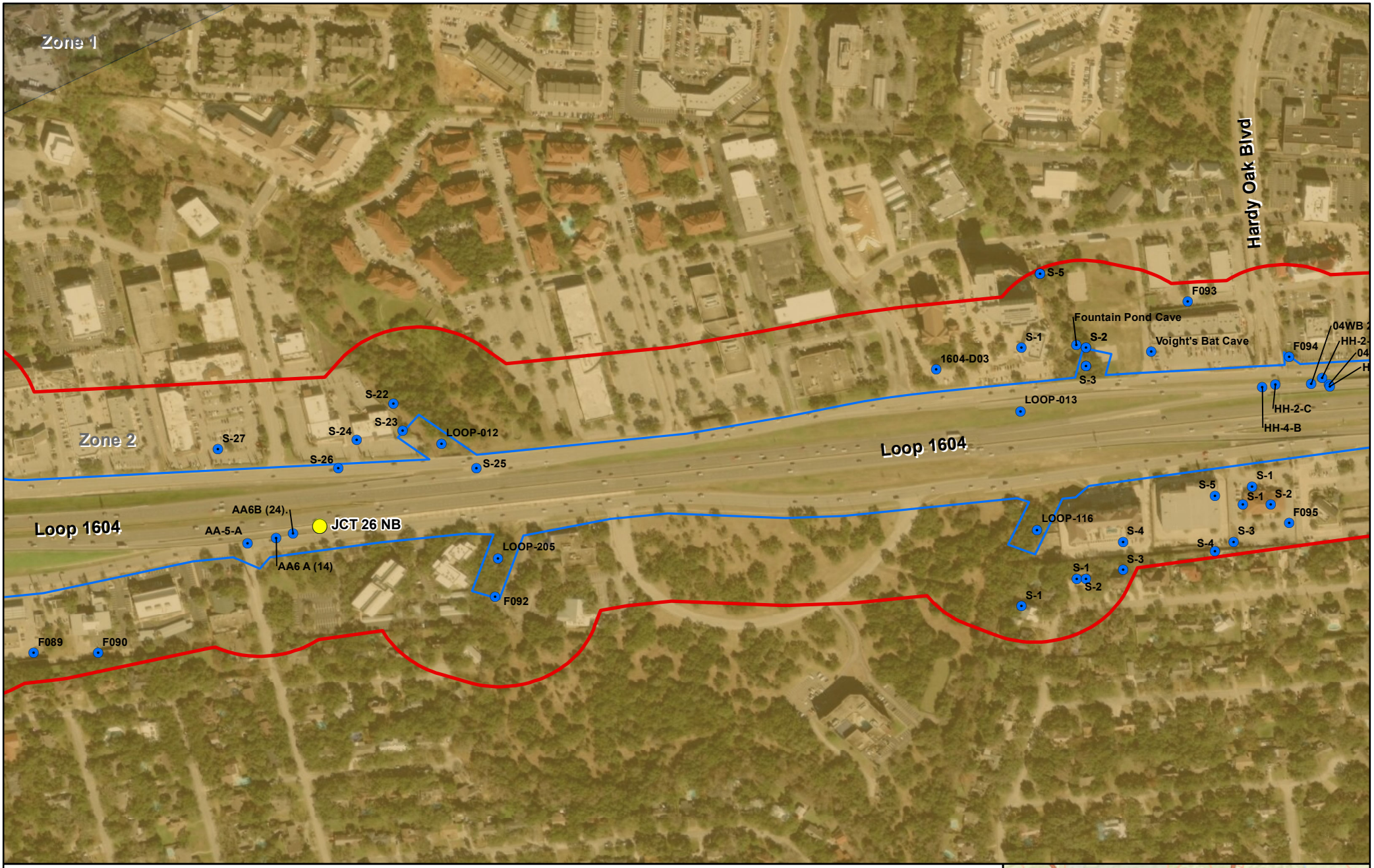
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 24



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

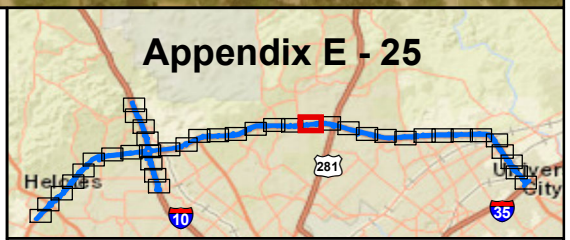
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

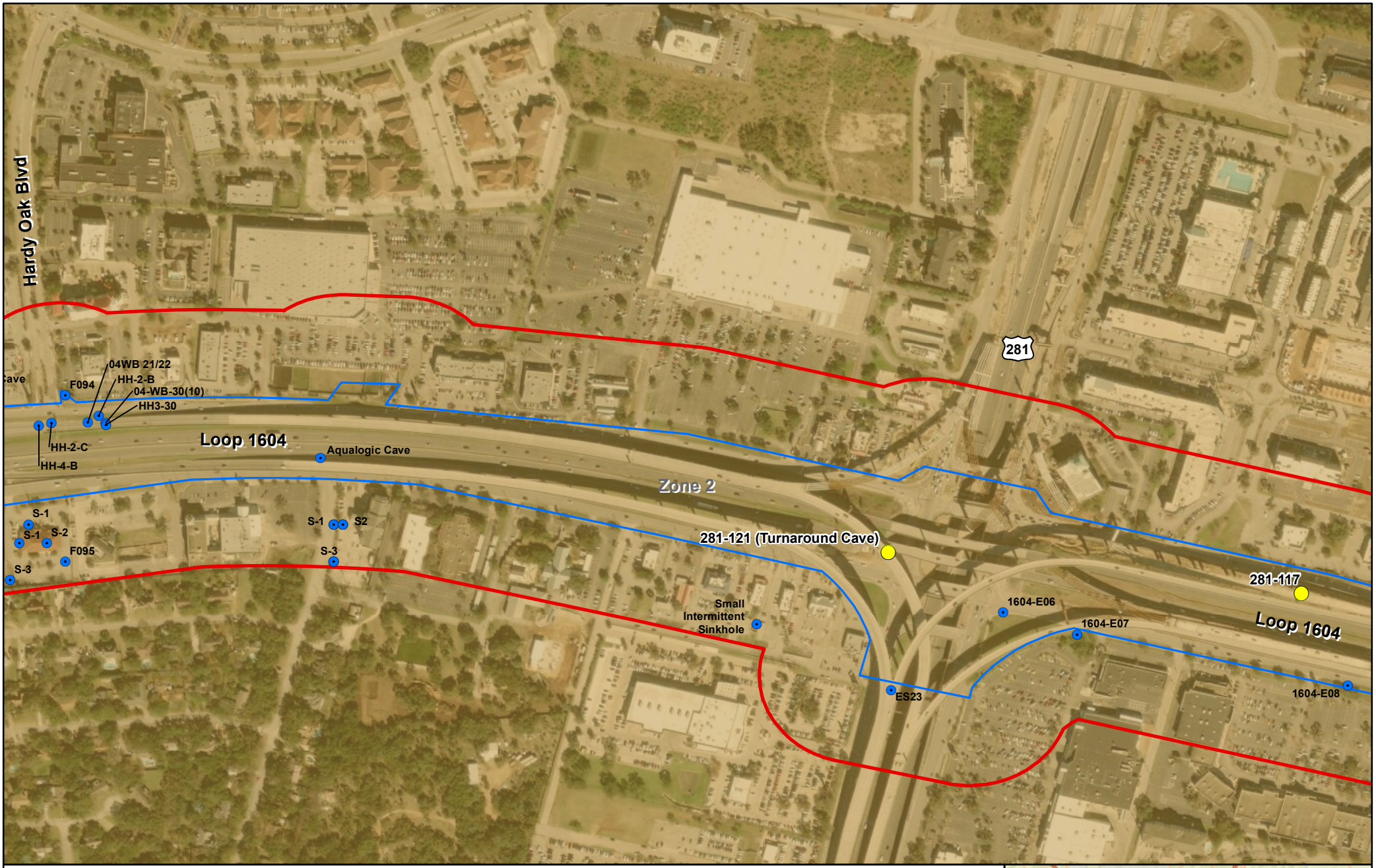
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 25



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

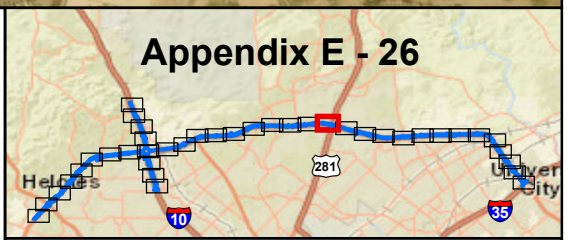
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

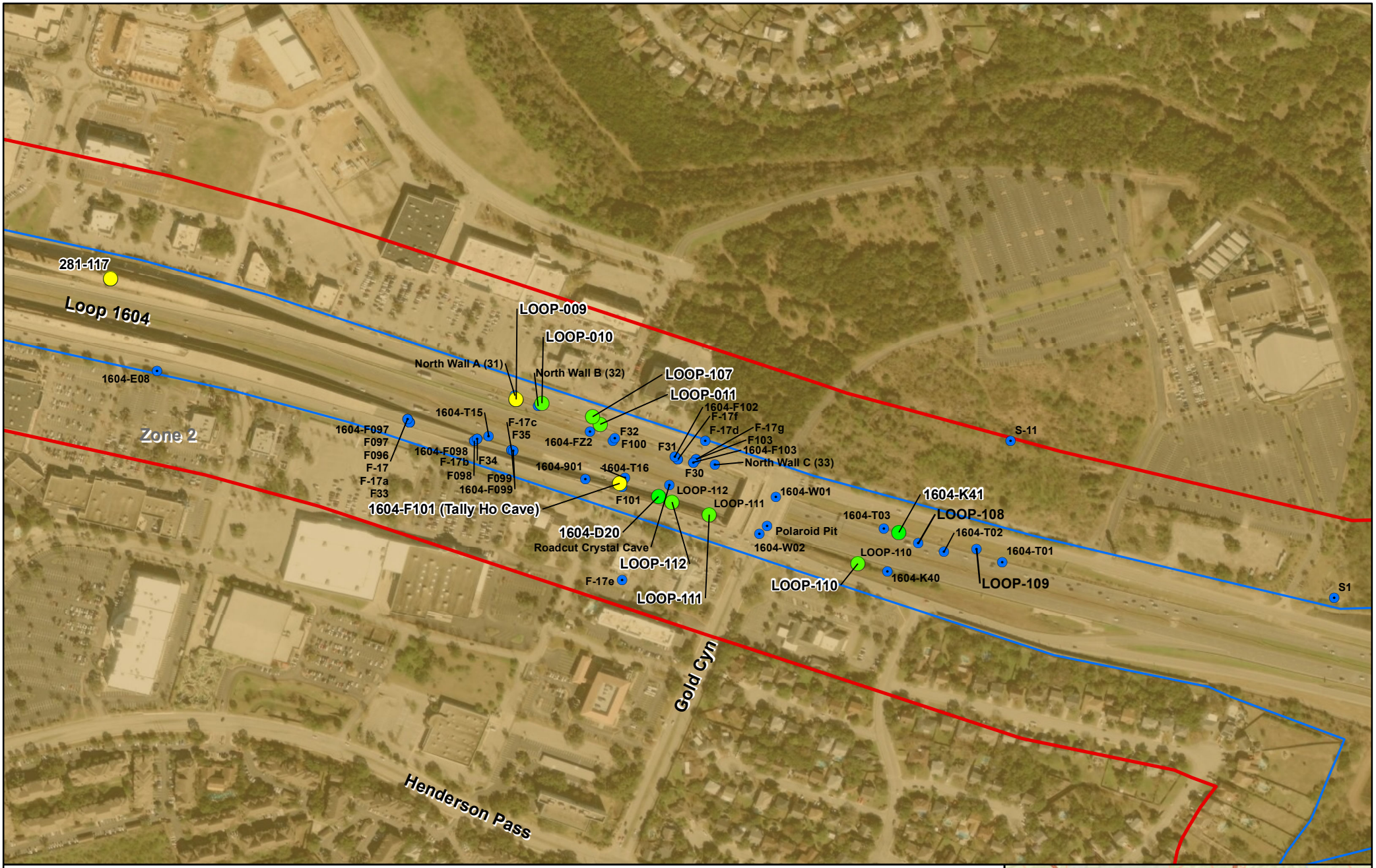
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 26



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

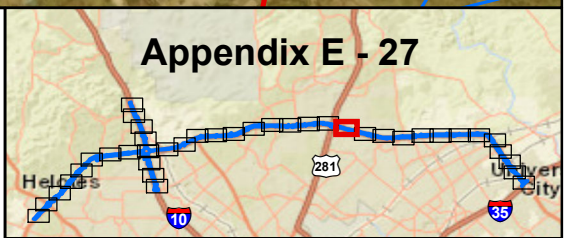
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

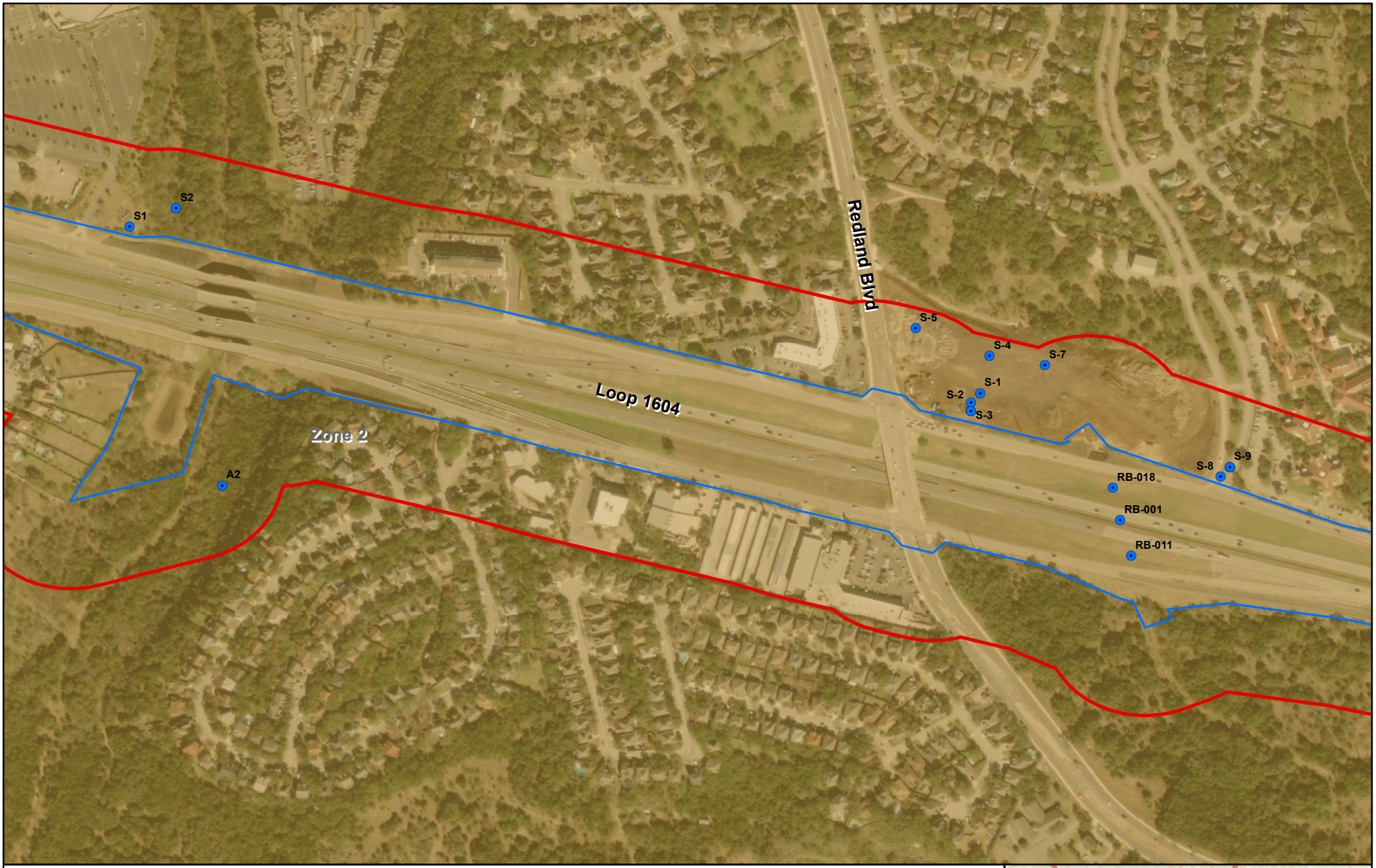
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 27



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

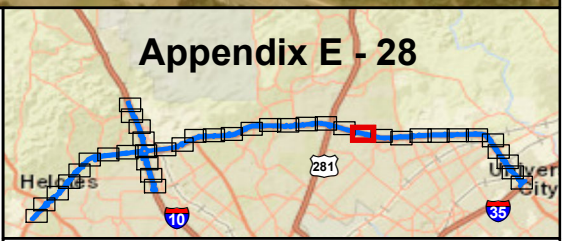
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

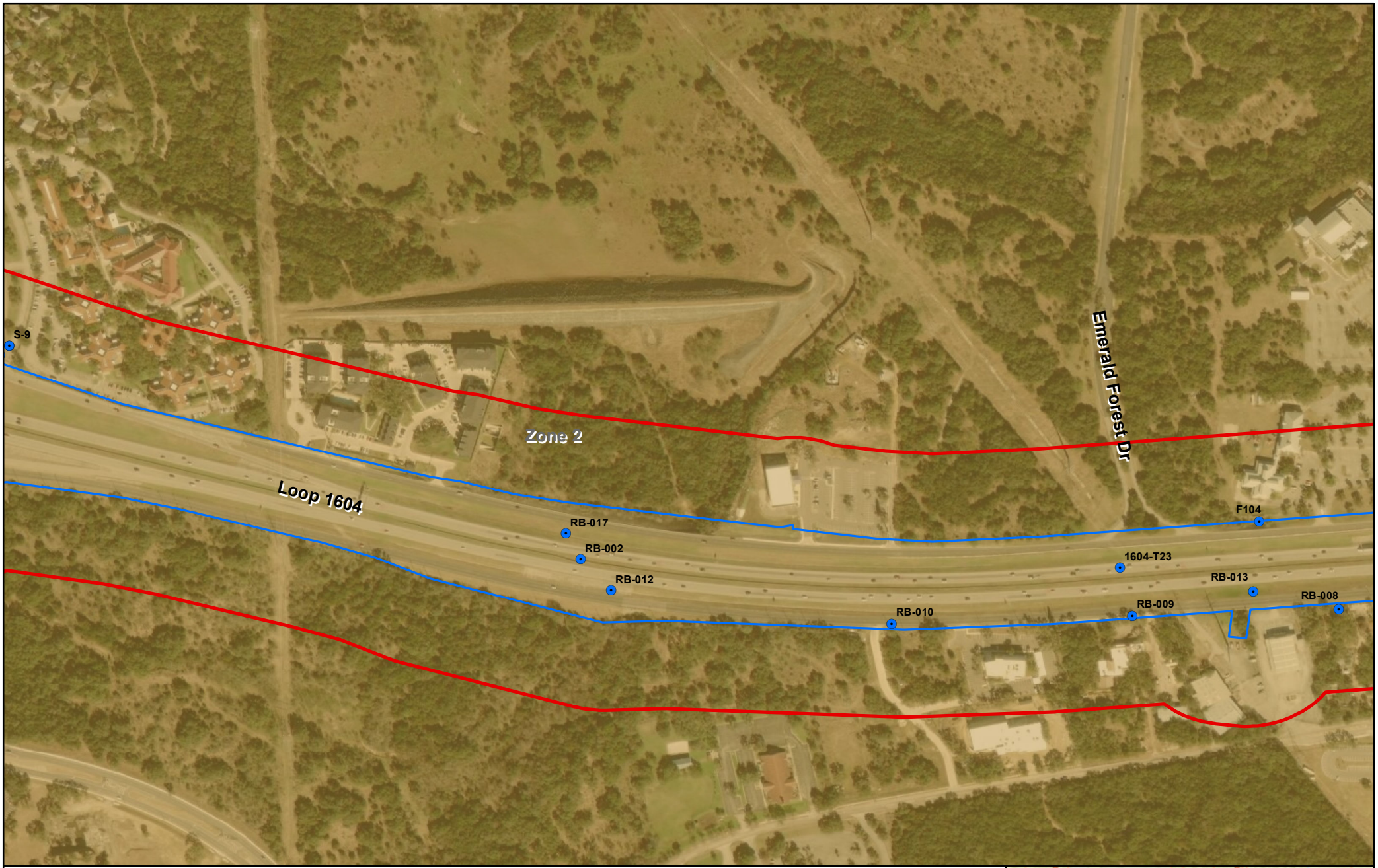
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 28



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

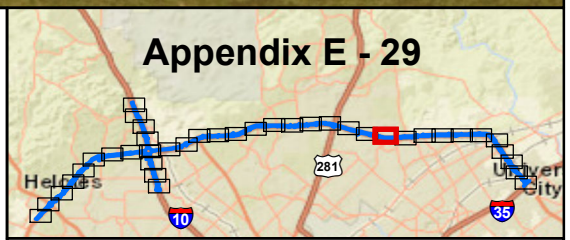
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

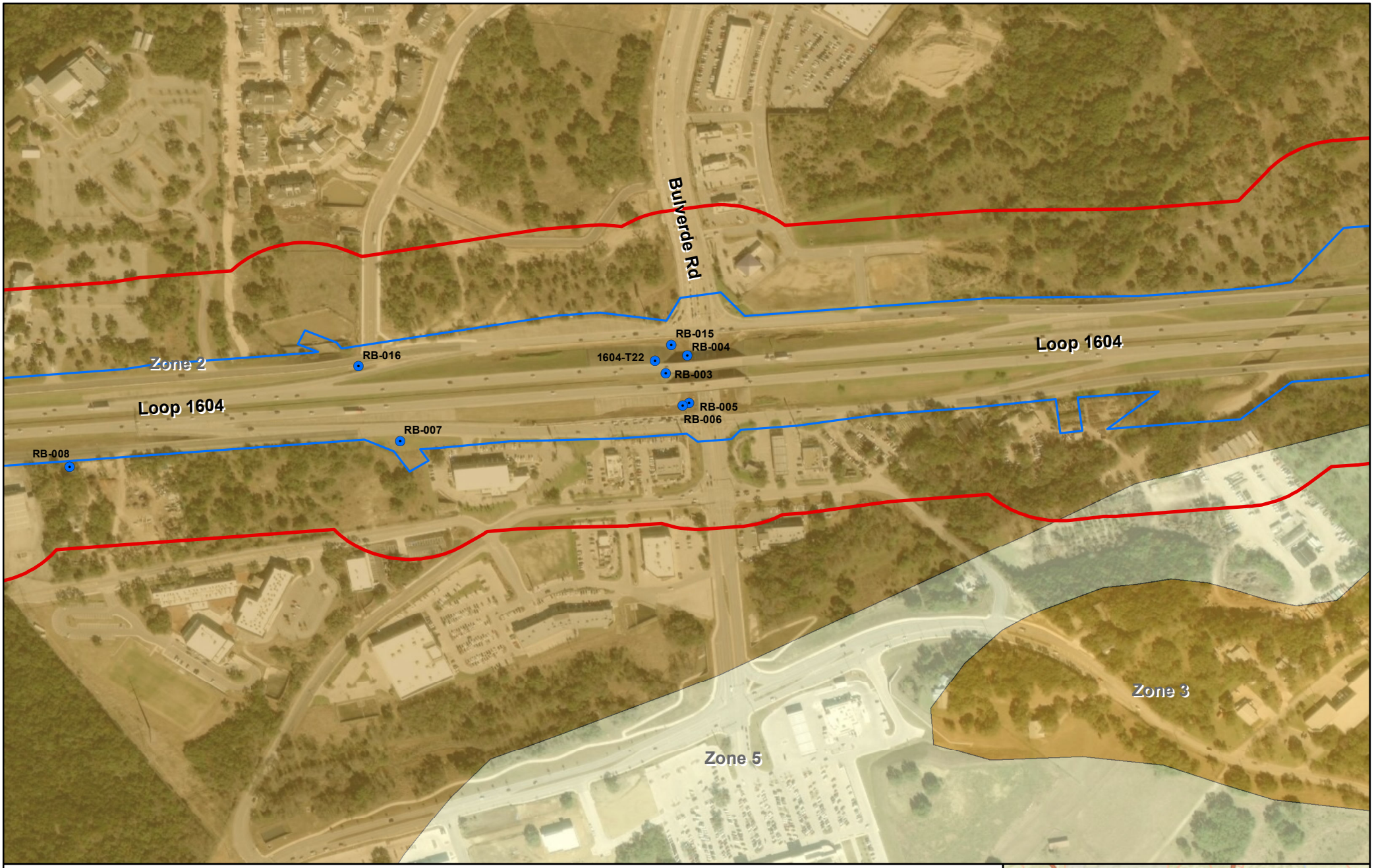
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 29



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

- Endangered species present
- Presence/absence survey conducted; No endangered species detected
- Not karst invertebrate habitat
- Historic, destroyed, not found, not evaluated, GA-only

Karst Zones

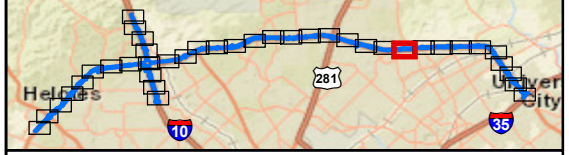
- 1: Known to contain endangered species
- 2: High probability for endangered species
- 3: Probably do not contain endangered species
- 4: Requires further research
- 5: Does not contain endangered species

- Project Area
- Action Area
- Critical Habitat Unit
- Streams

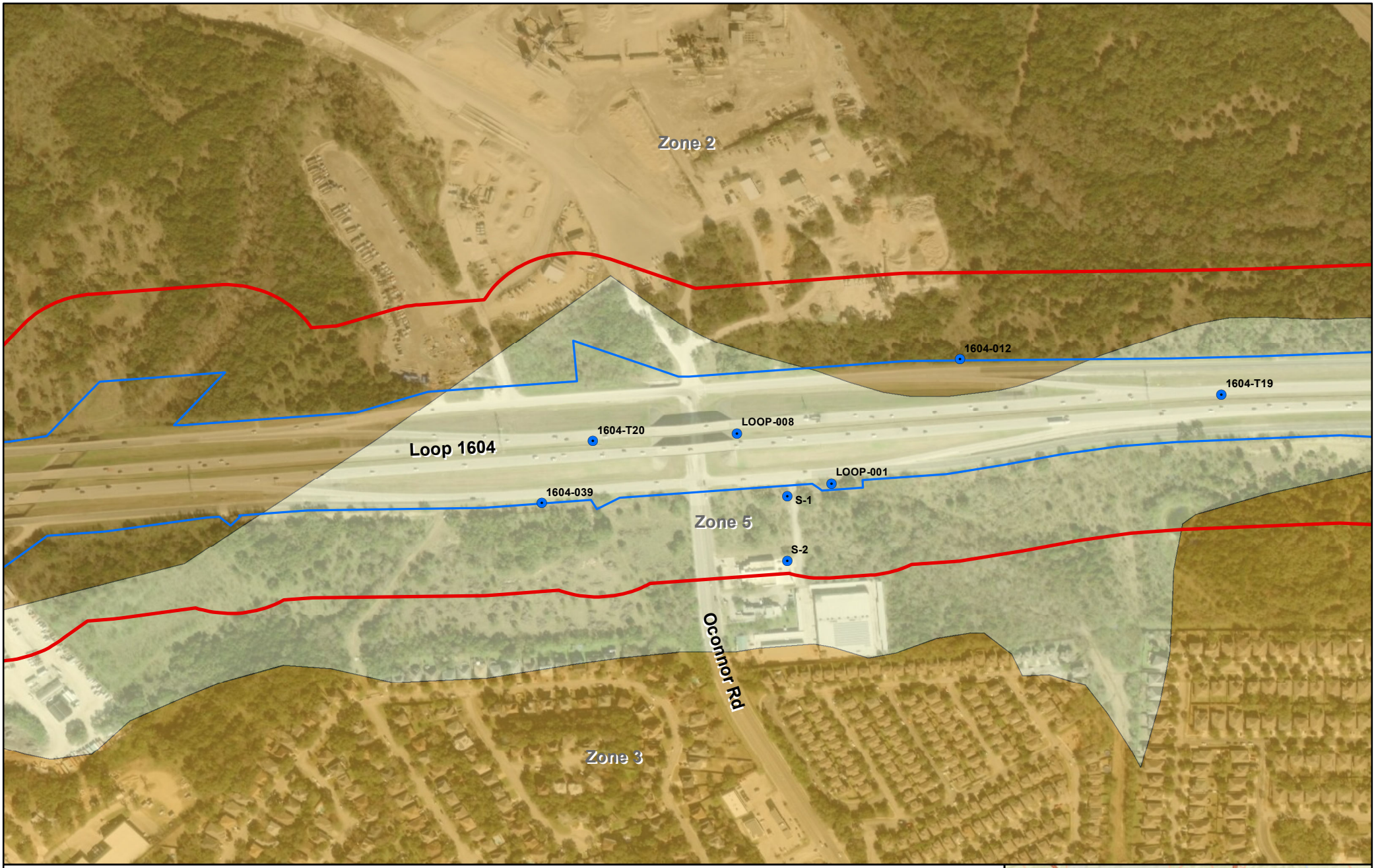
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 30



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



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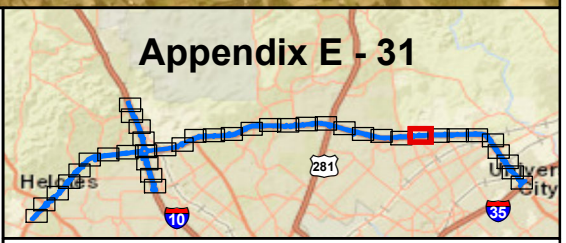
- Project Area
- Action Area
- Critical Habitat Unit
- Streams

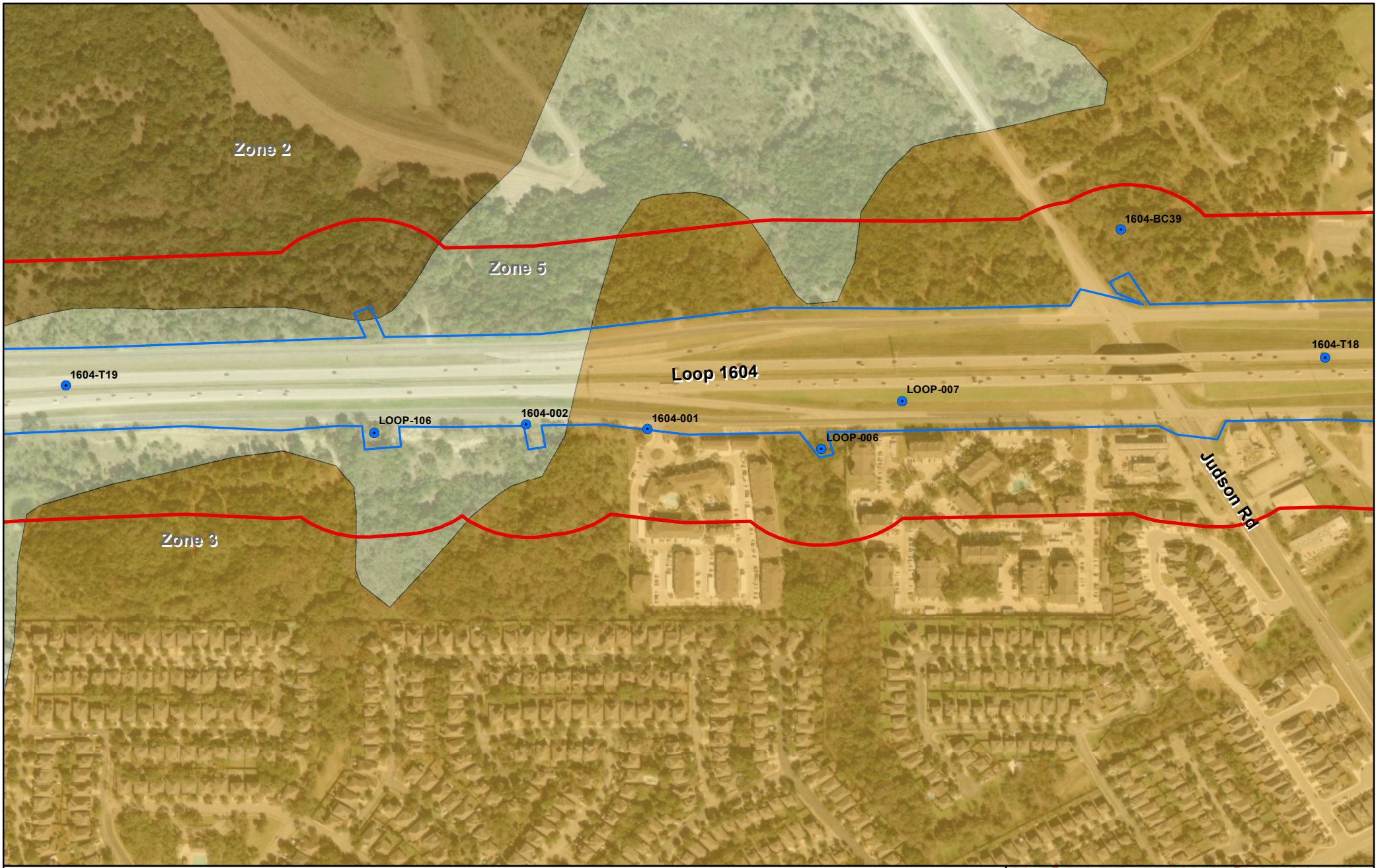
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 31



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

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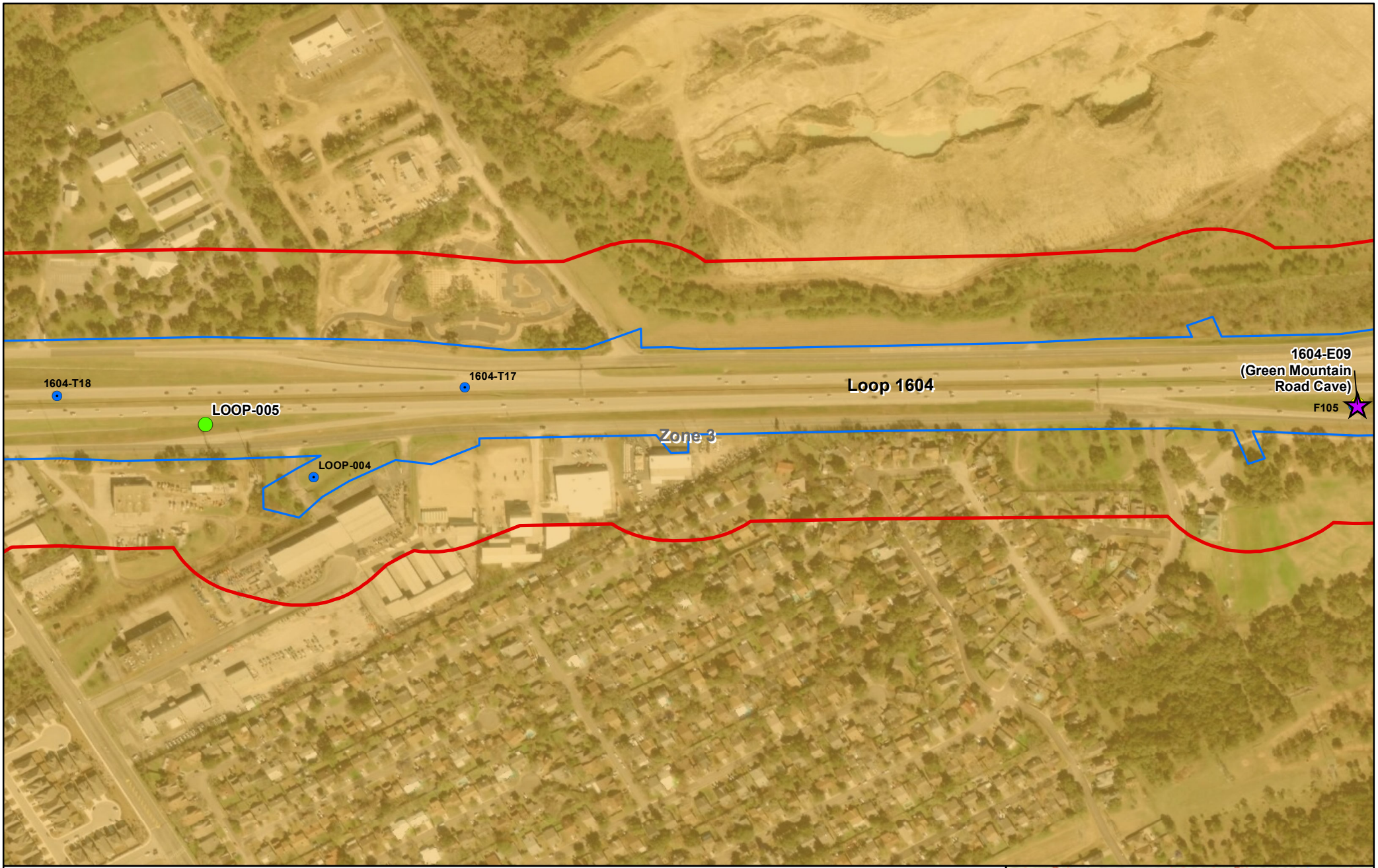
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 32

Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



Features

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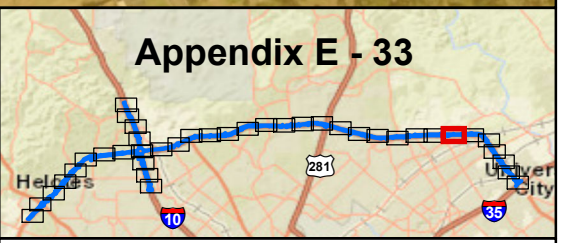
- Project Area
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 33



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

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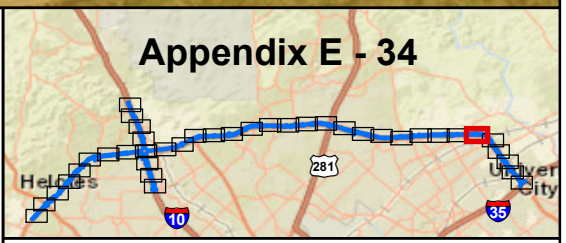
- Project Area
- Action Area
- Critical Habitat Unit
- Streams

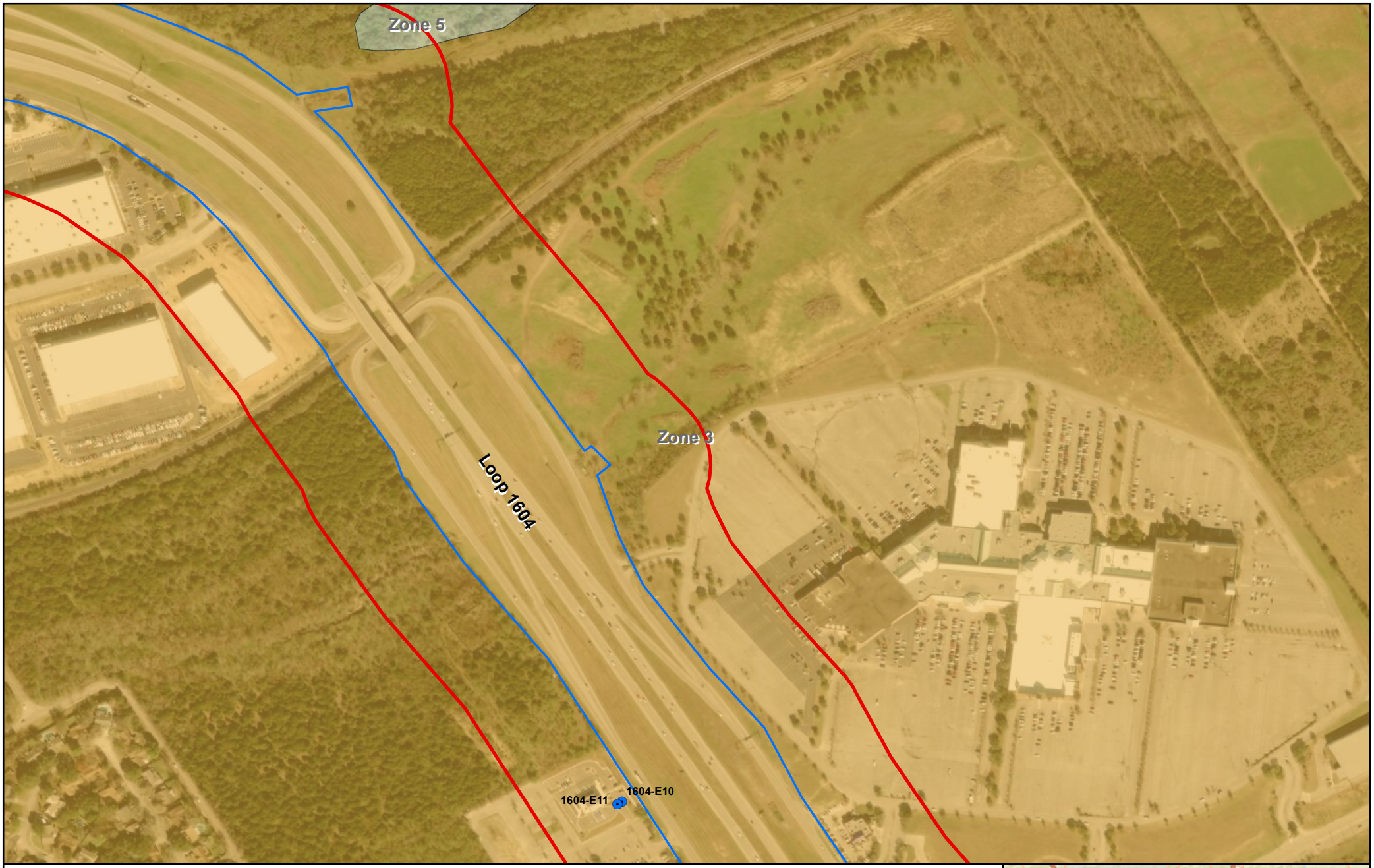
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 34



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



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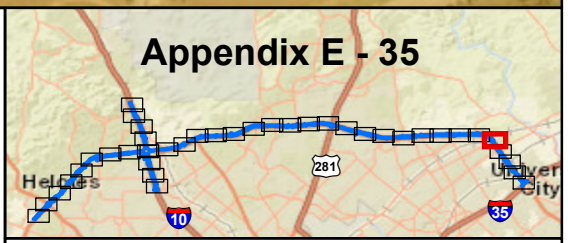
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 35



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

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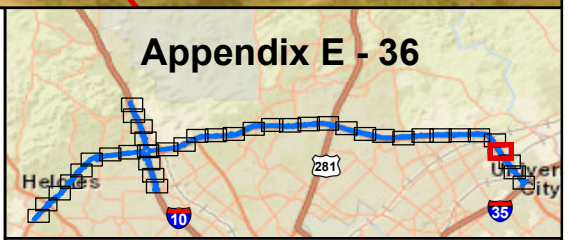
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 36



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

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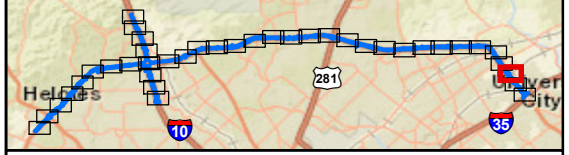
- Action Area
- Critical Habitat Unit
- Streams

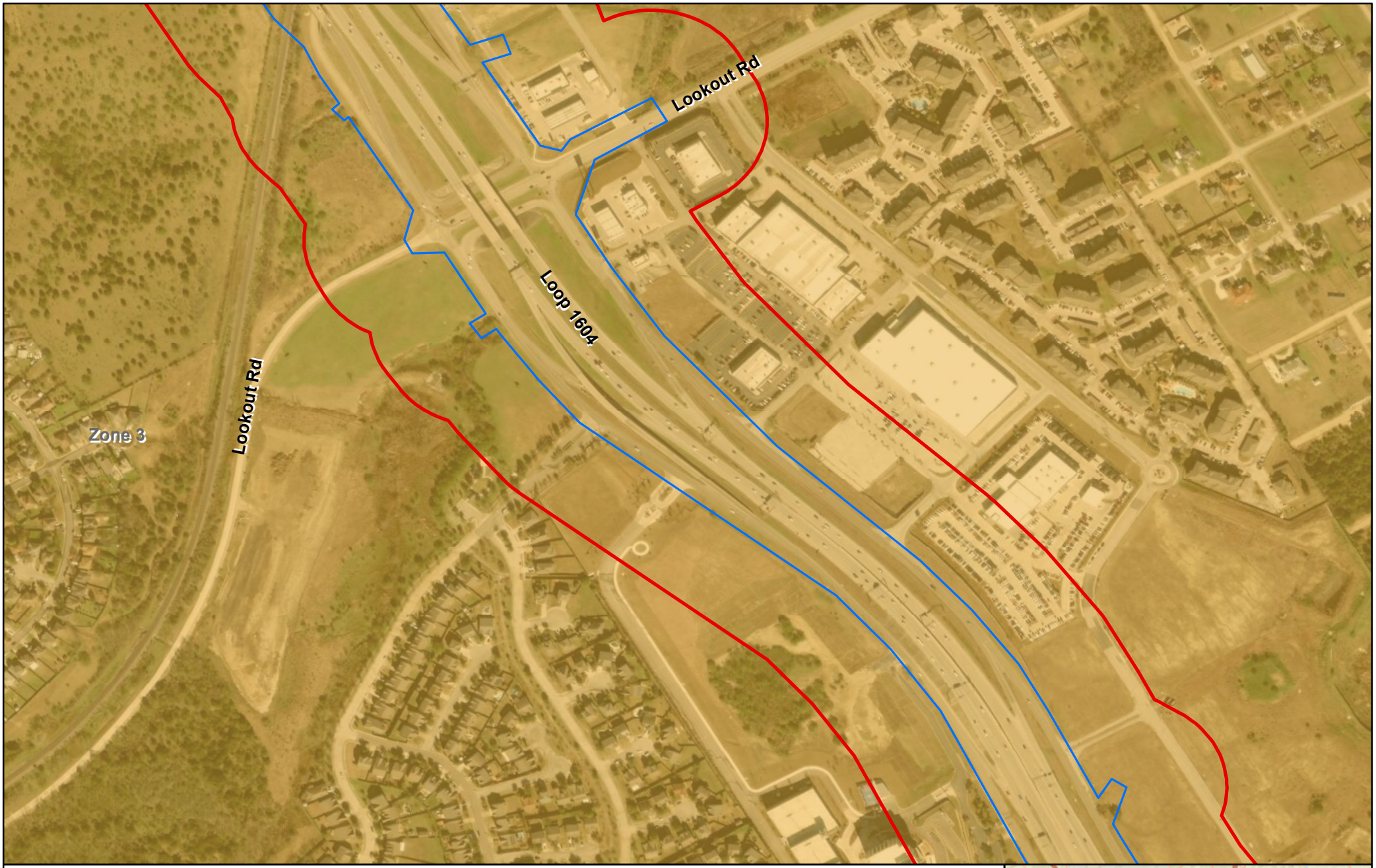
0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 37



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.



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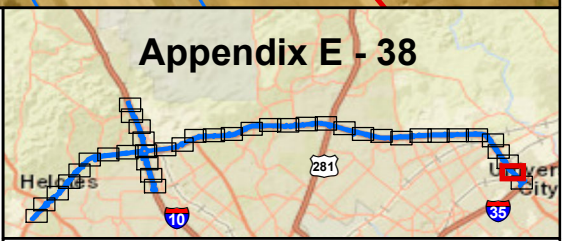
- Action Area
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 38



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

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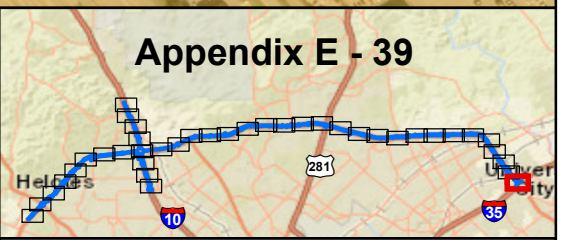
- Critical Habitat Unit
- Streams

0 250 500 Feet
0 50 100 150 Meters

N

Appendix E - 39



Basemap: ESRI 2020; Critical Habitat Units: USFWS 2012; Karst Zones: George Veni Associates 2003; Streams: TCEQ 2000.

Appendix F. Vegetation sketches

Appendix F. Vegetation sketches for features where presence/absence surveys were performed.

Feature 1604-D07

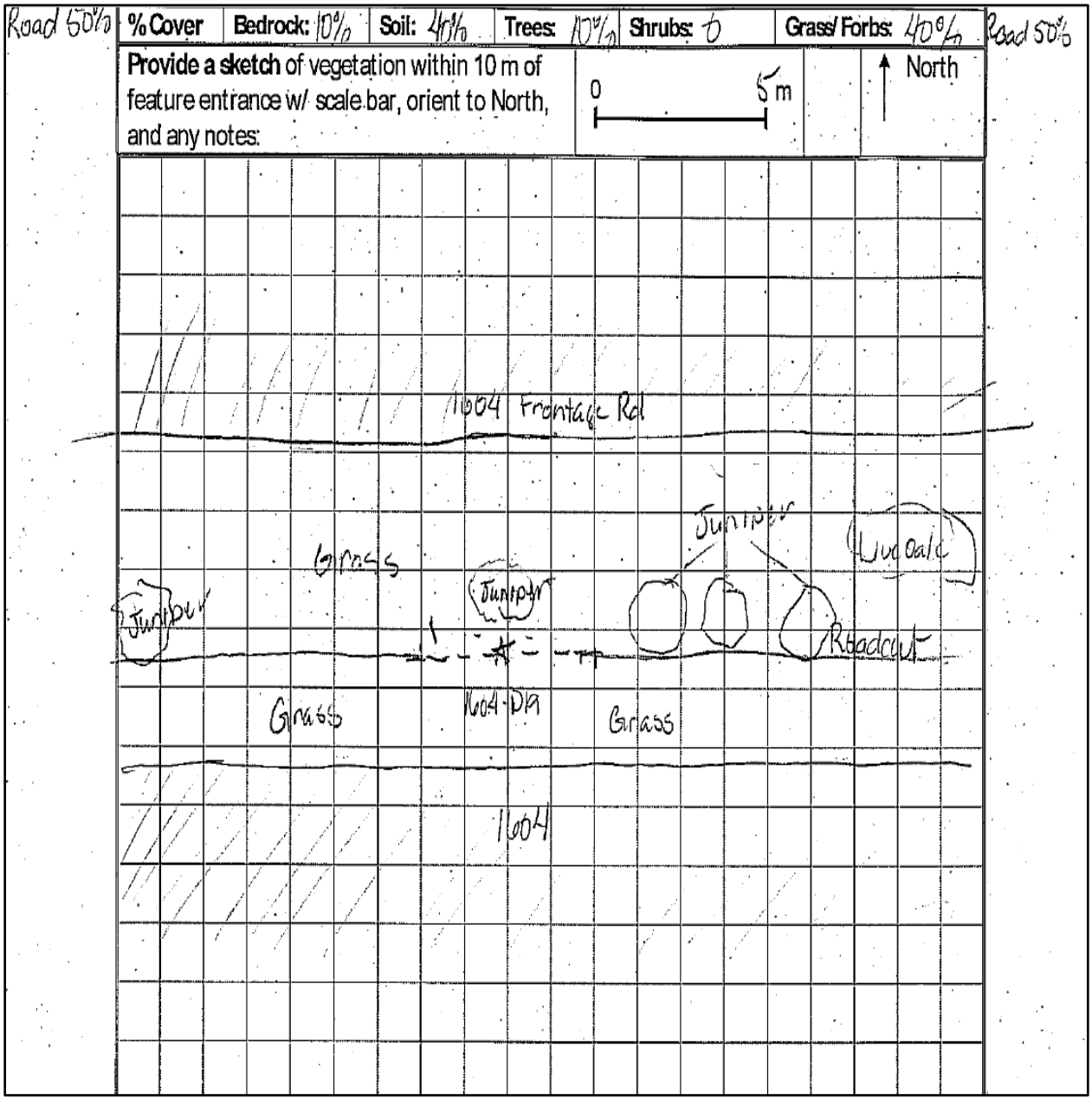


Figure F-1. Vegetation sketch for feature 1604-D07.

Feature 1604-D19

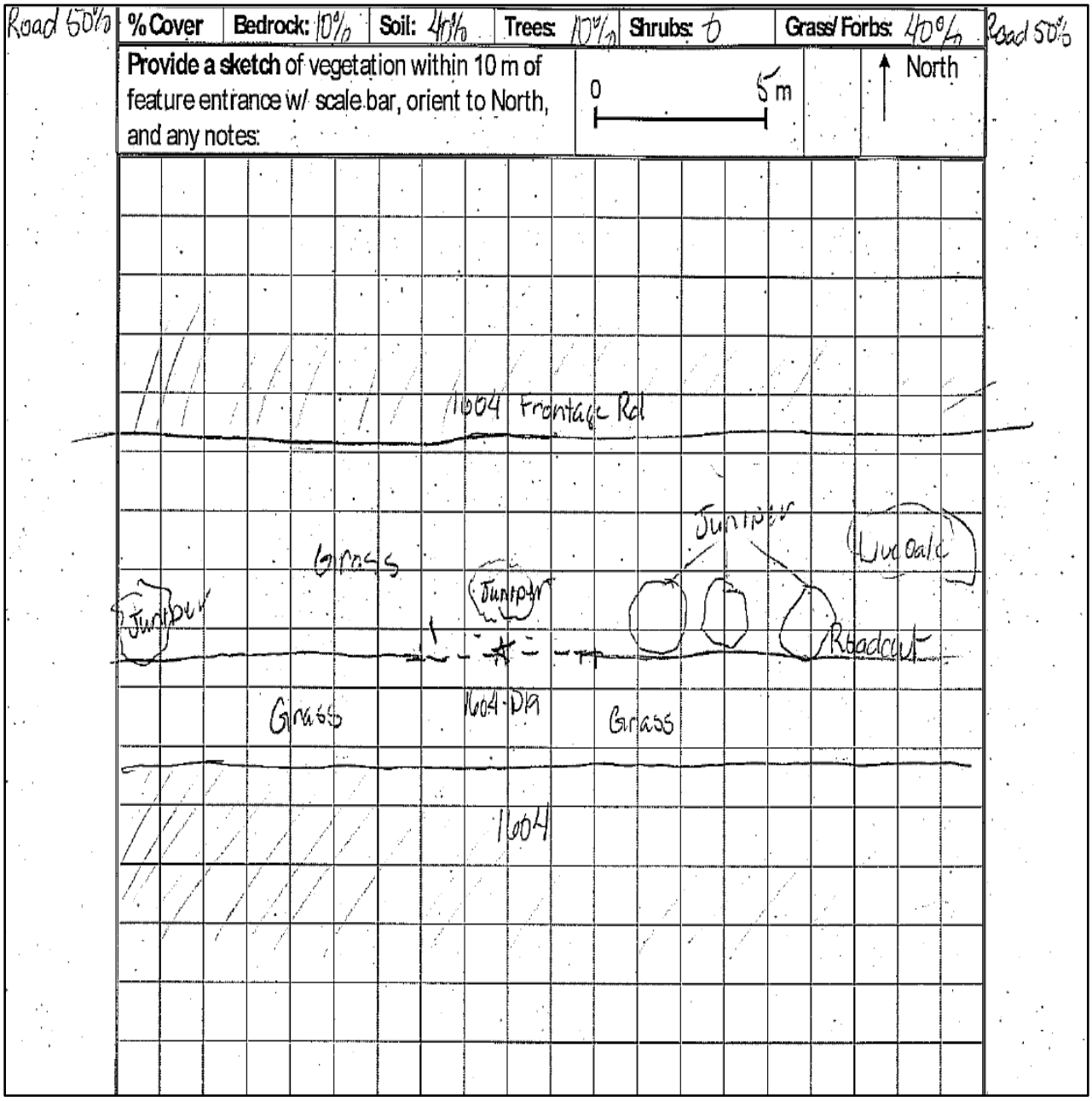


Figure F-2. Vegetation sketch for Feature 1604-D19.

Feature 1604-E09 (Green Mountain Road Cave)

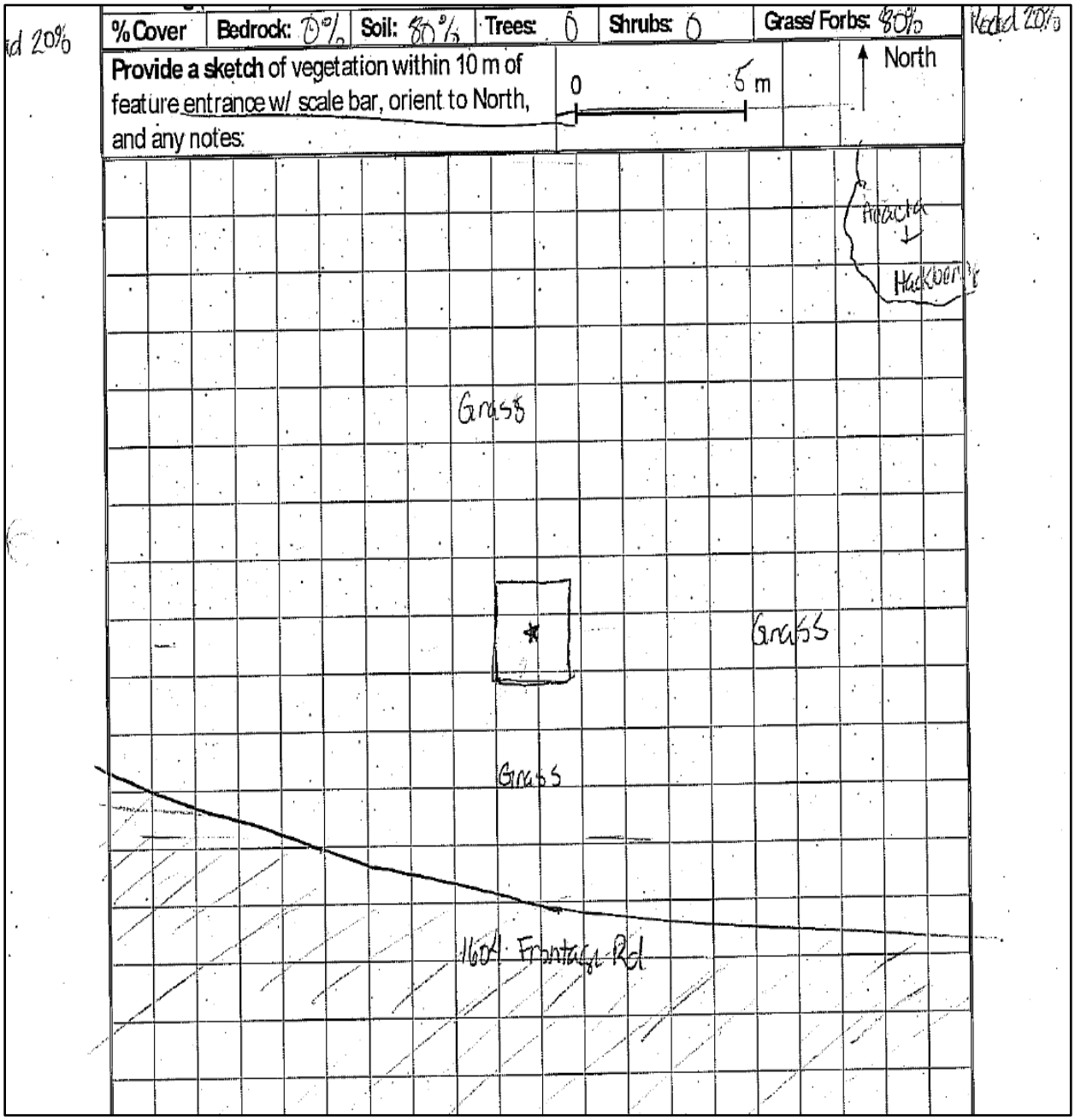


Figure F-3. Vegetation sketch for Feature 1604-E09 (Green Mountain Road Cave).

Feature 1604-F061 (Scottish Beard Cave)

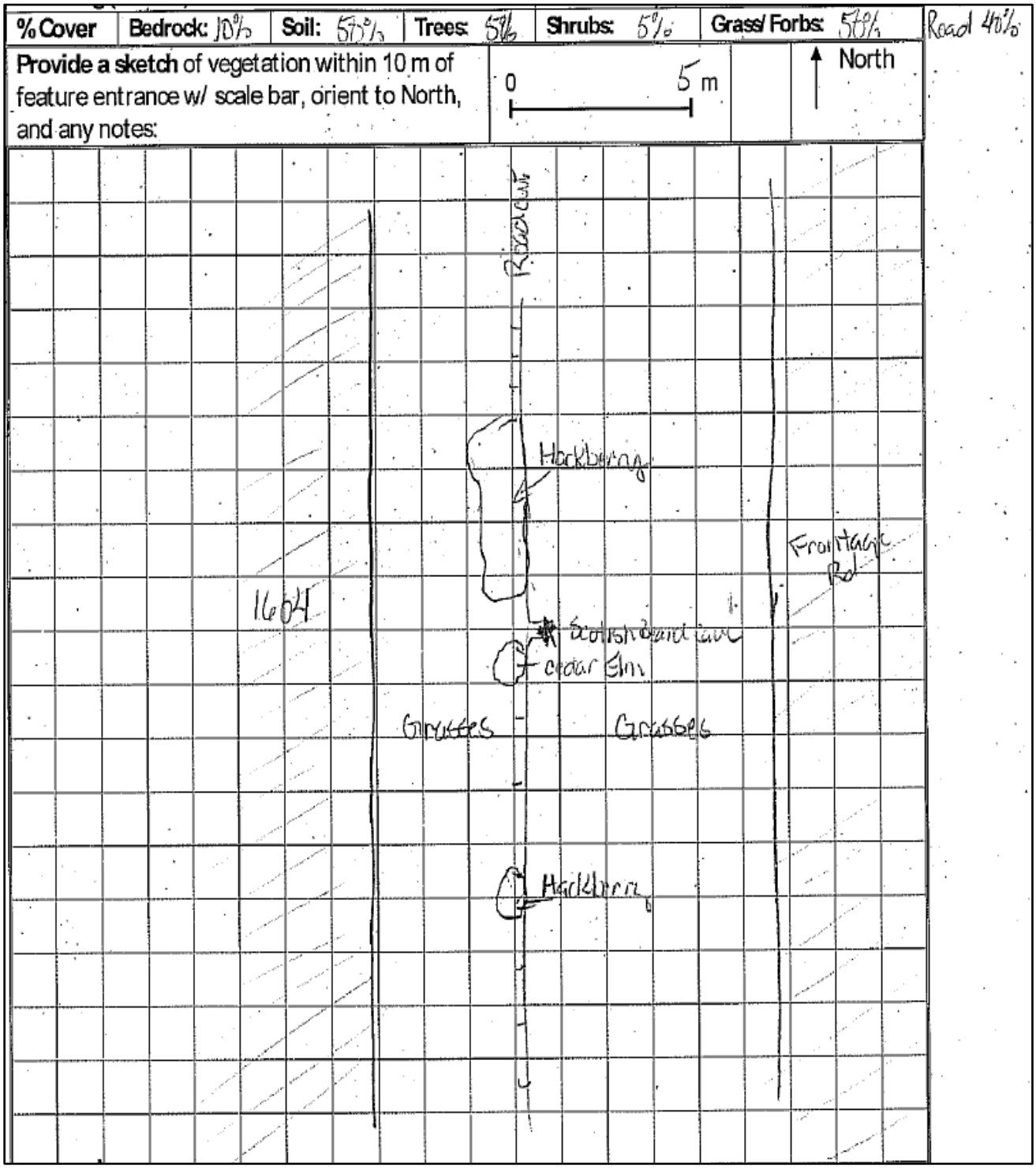


Figure F-4. Vegetation sketch for Feature 1604-061 (Scottish Beard Cave).

Feature 1604-F073

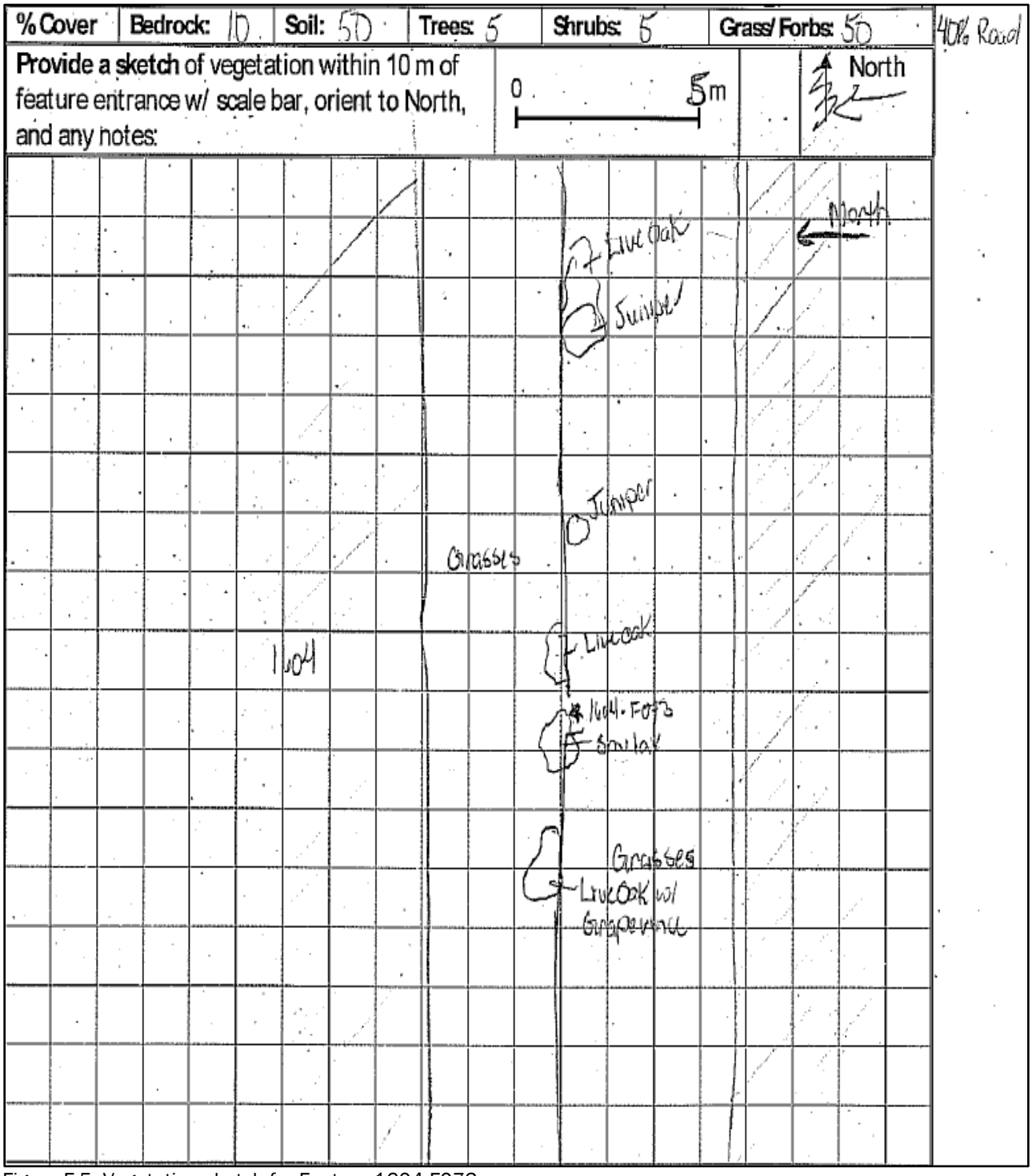


Figure F-5. Vegetation sketch for Feature 1604-F073.

Feature 1604-F077 (Hubcap Cave)

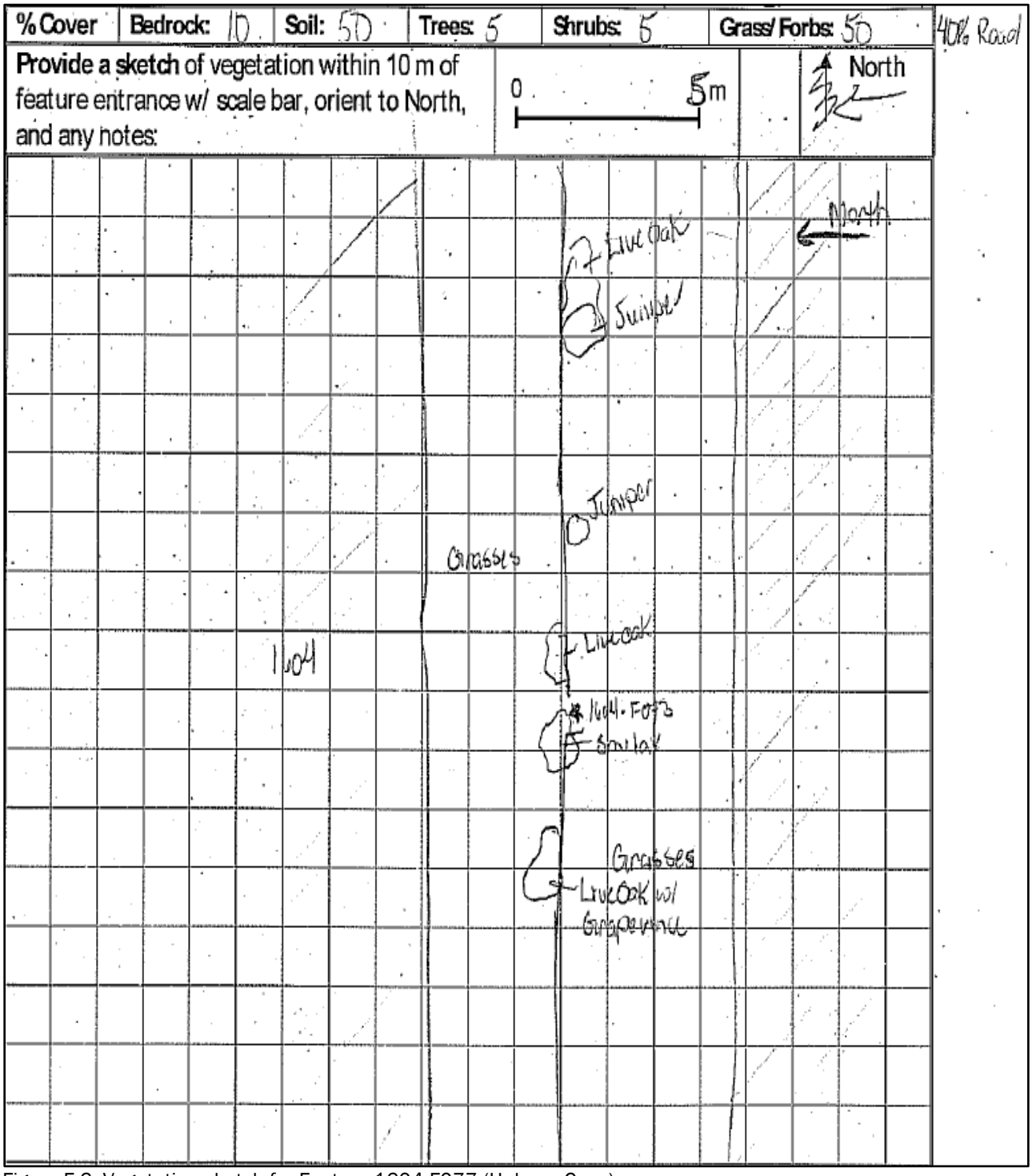


Figure F-6. Vegetation sketch for Feature 1604-F077 (Hubcap Cave).

Feature 1604-F074

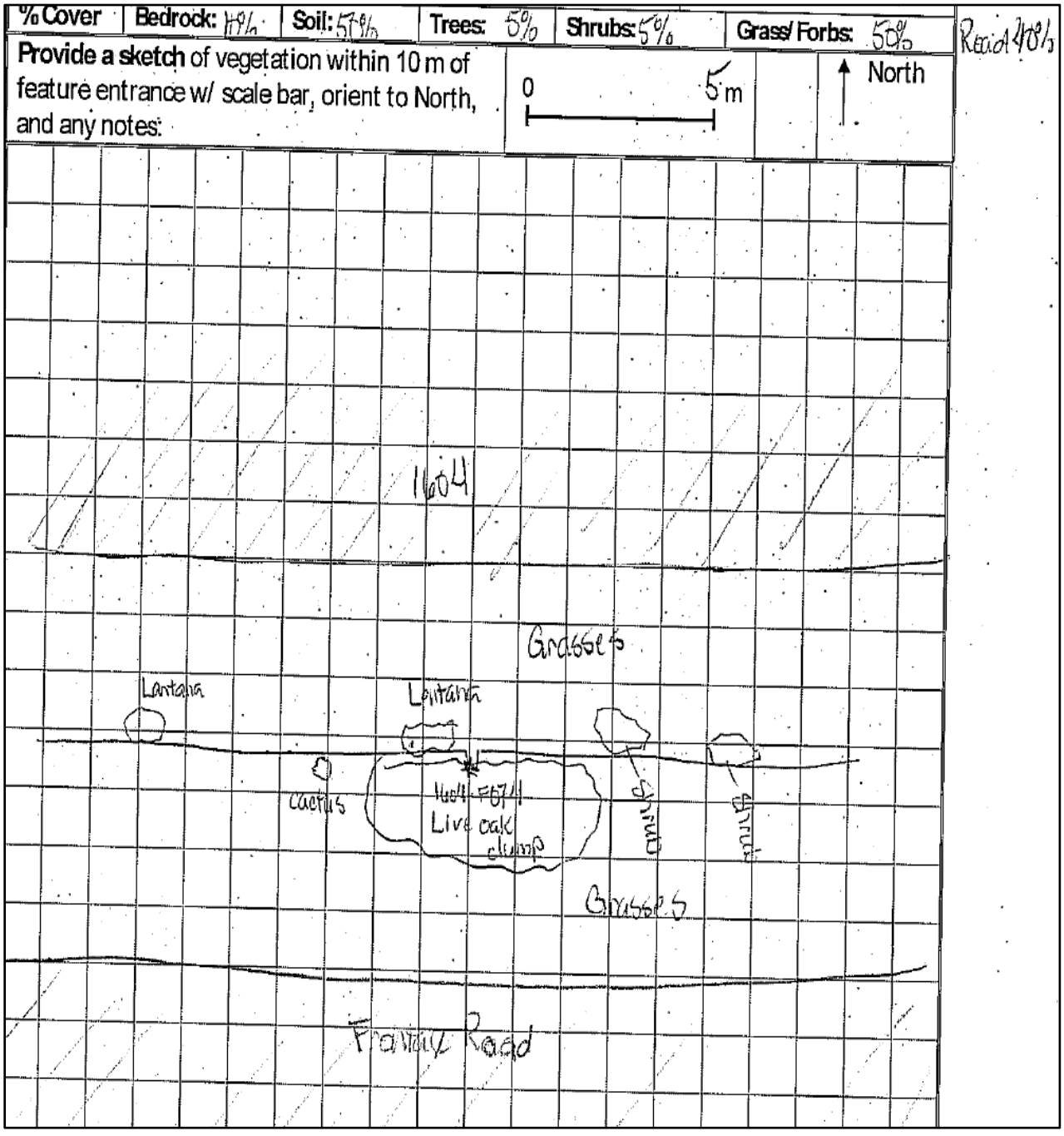


Figure F-7. Vegetation sketch for Feature 1604-F074.

Feature 1604-FZ3

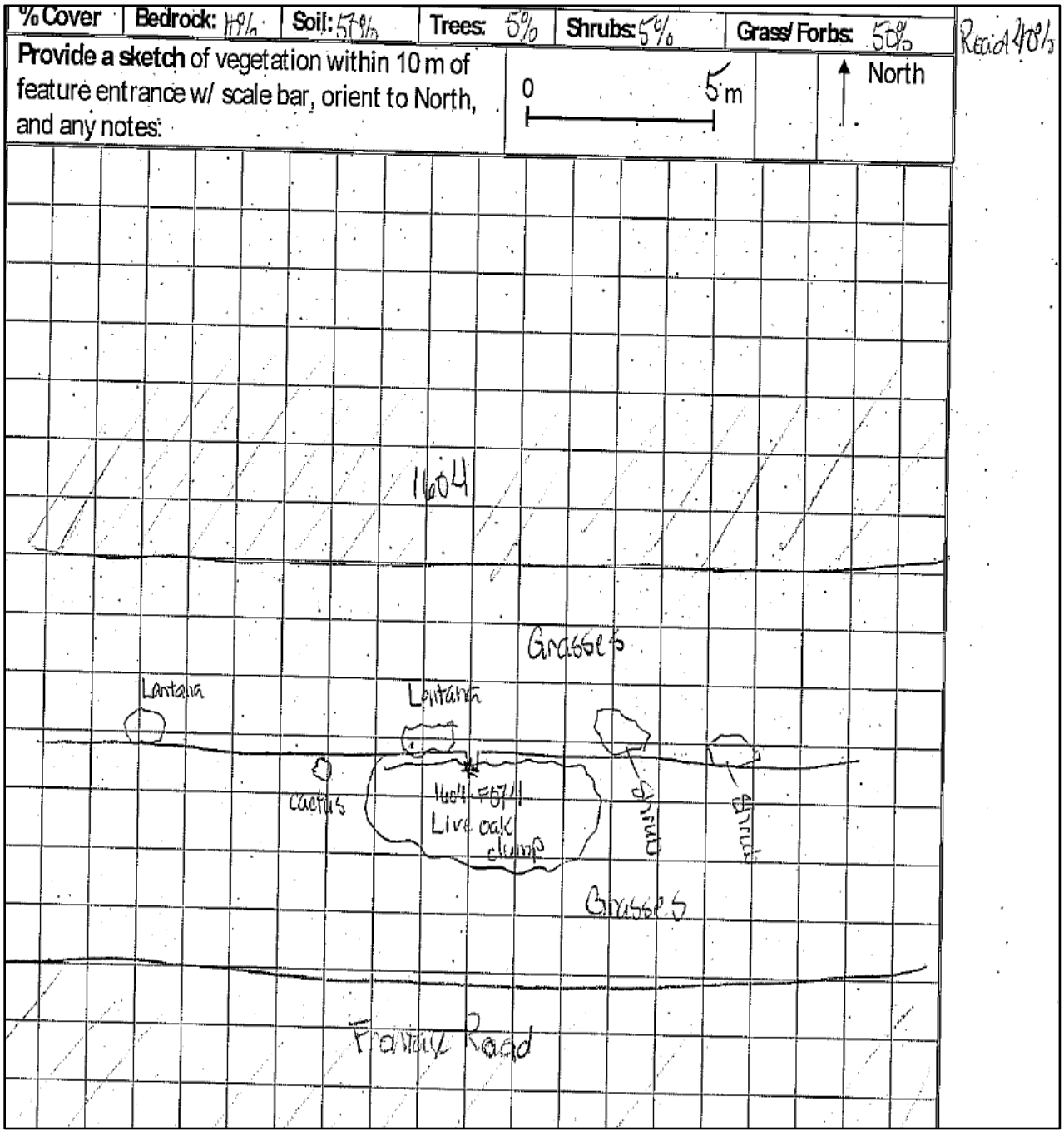


Figure F-8. Vegetation sketch for Feature 1604-FZ3.

Feature 1604-FZ4

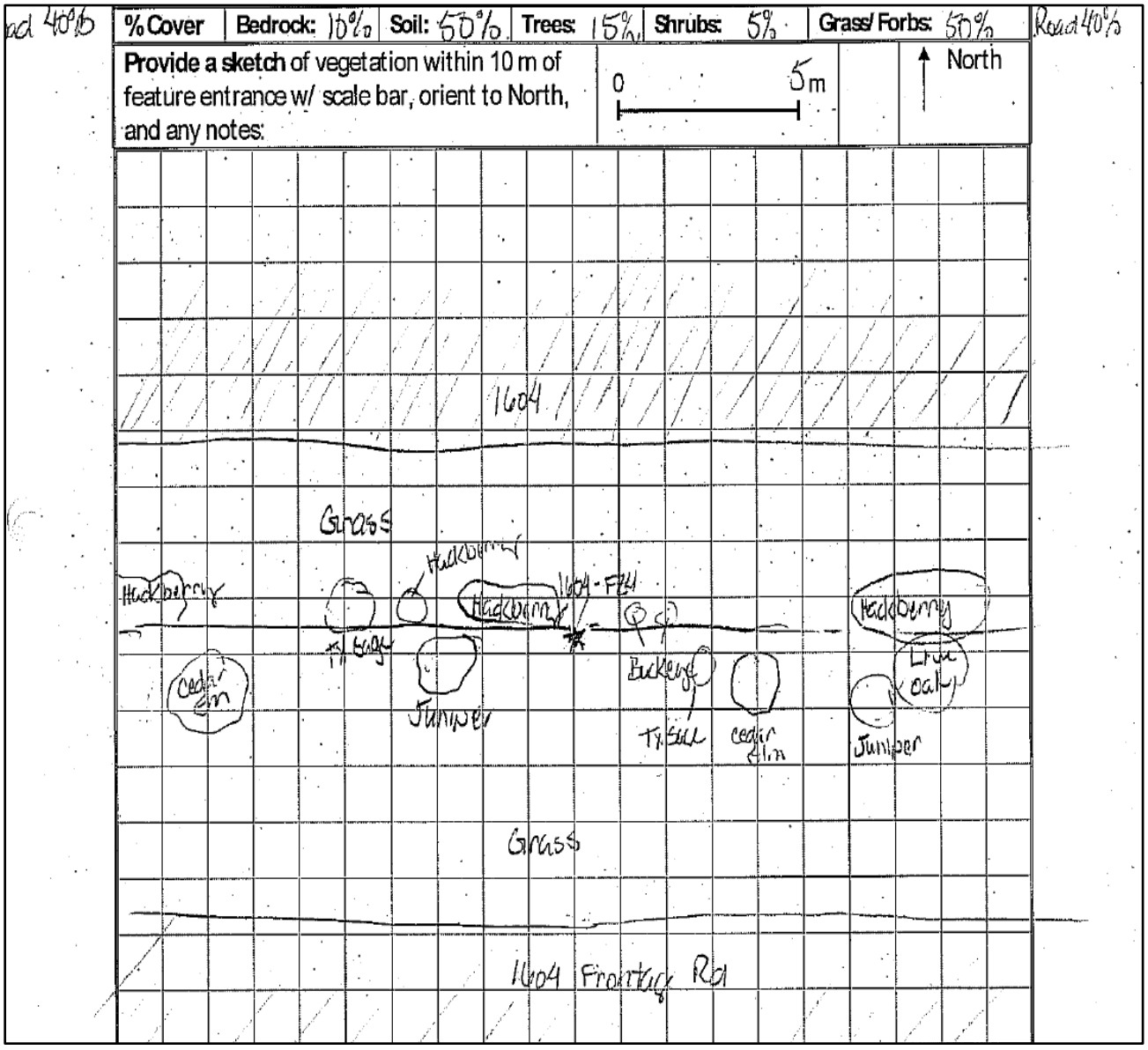


Figure F-9. Vegetation sketch for Feature 1604-FZ4.

Feature 1604-FZ7

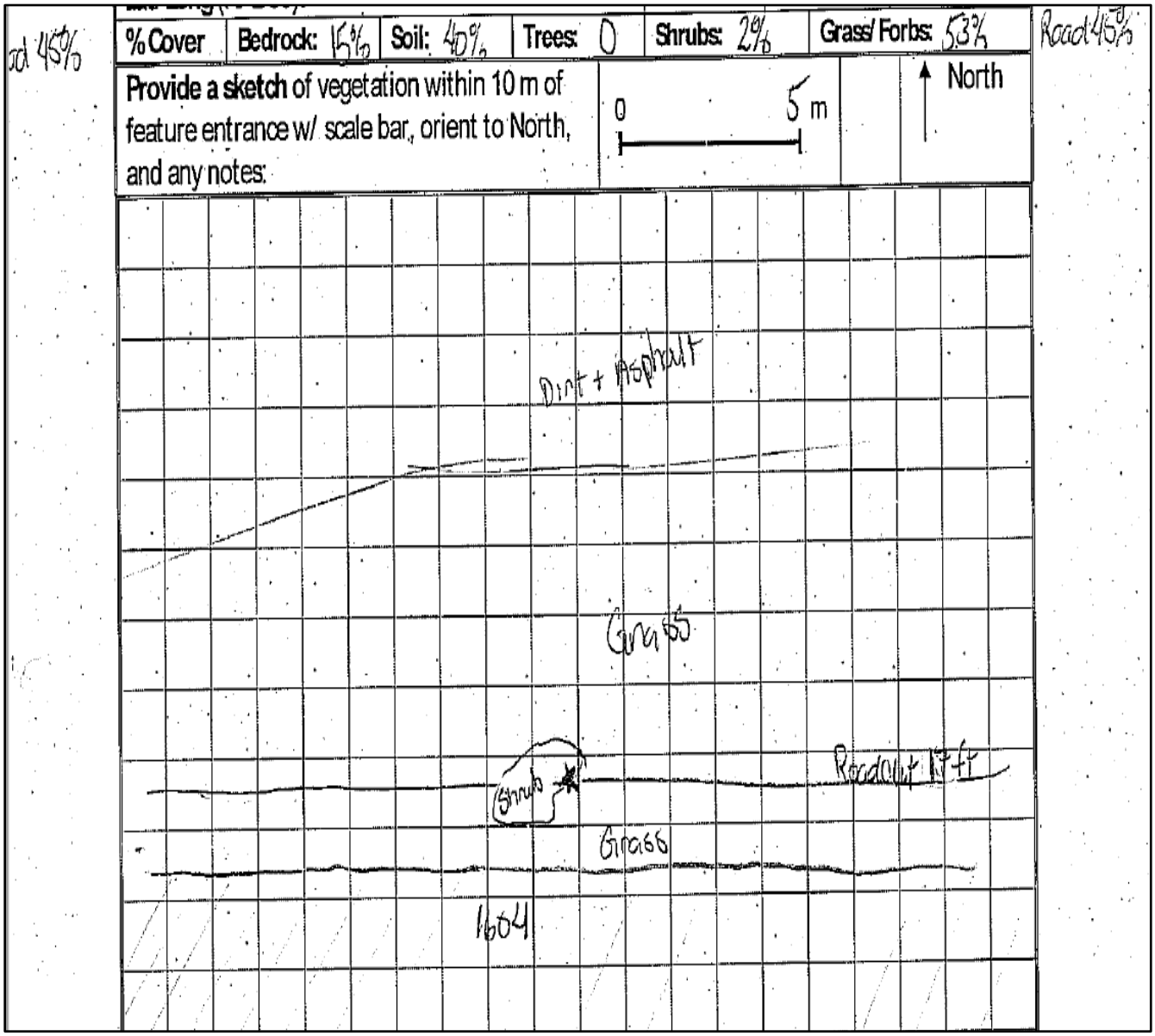


Figure F-10. Vegetation sketch for Feature 1604-FZ7.

Feature 1604-L12

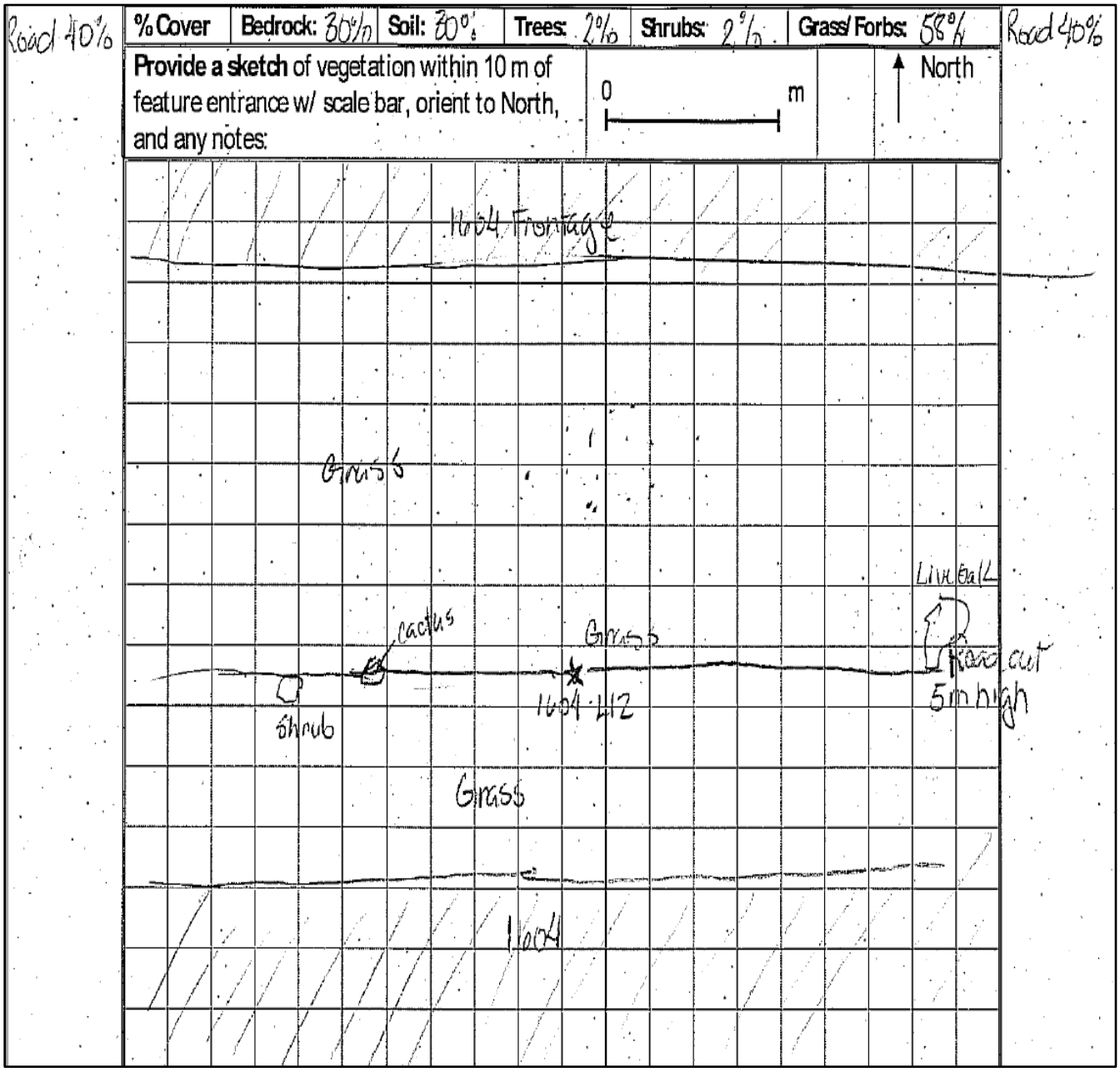


Figure F-11. Vegetation sketch for Feature 1604-L12.

Feature 1604-L13

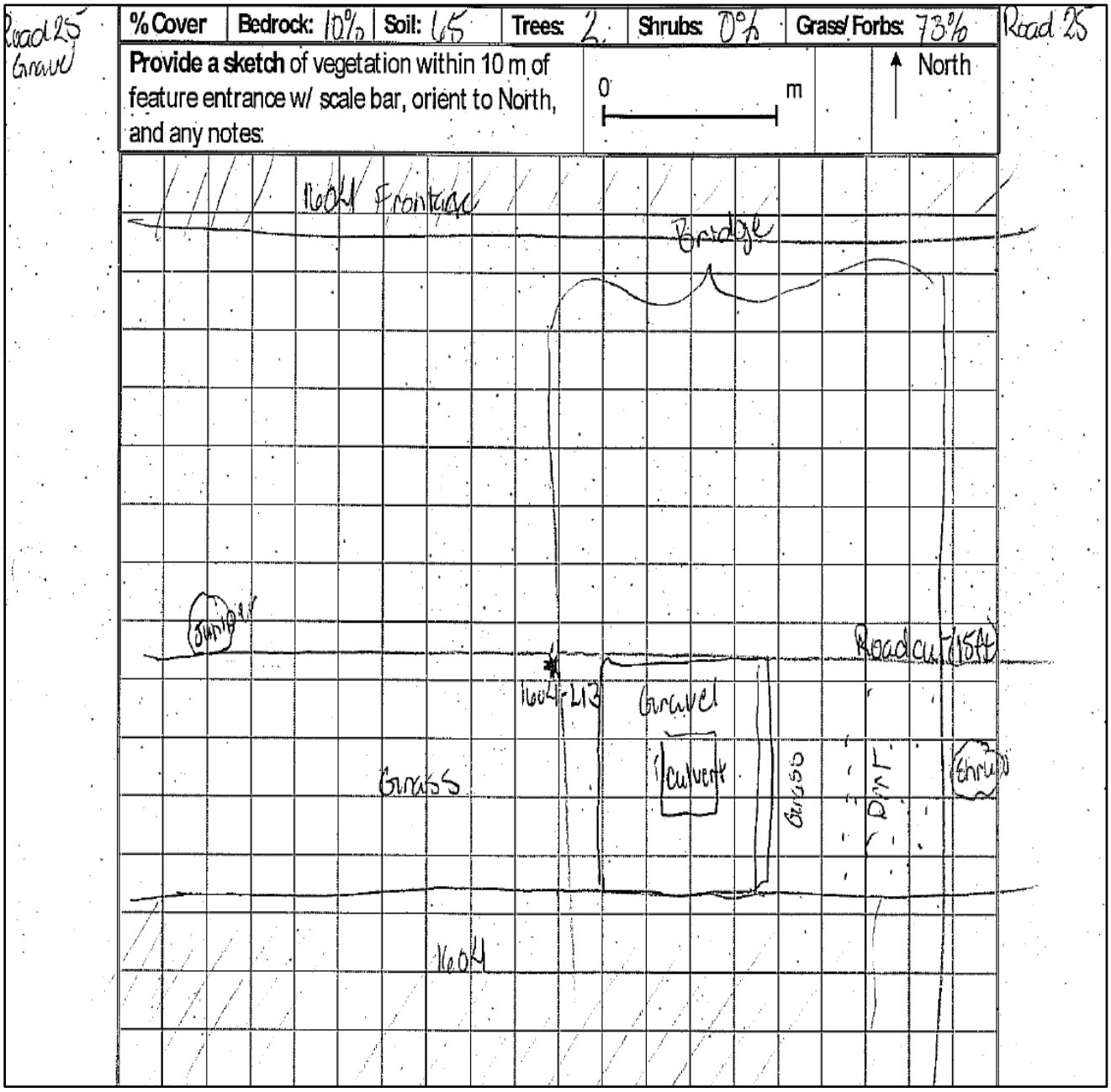


Figure F-12. Vegetation sketch for Feature 1604-L13.

Feature 1604-L16 (12A Cave)

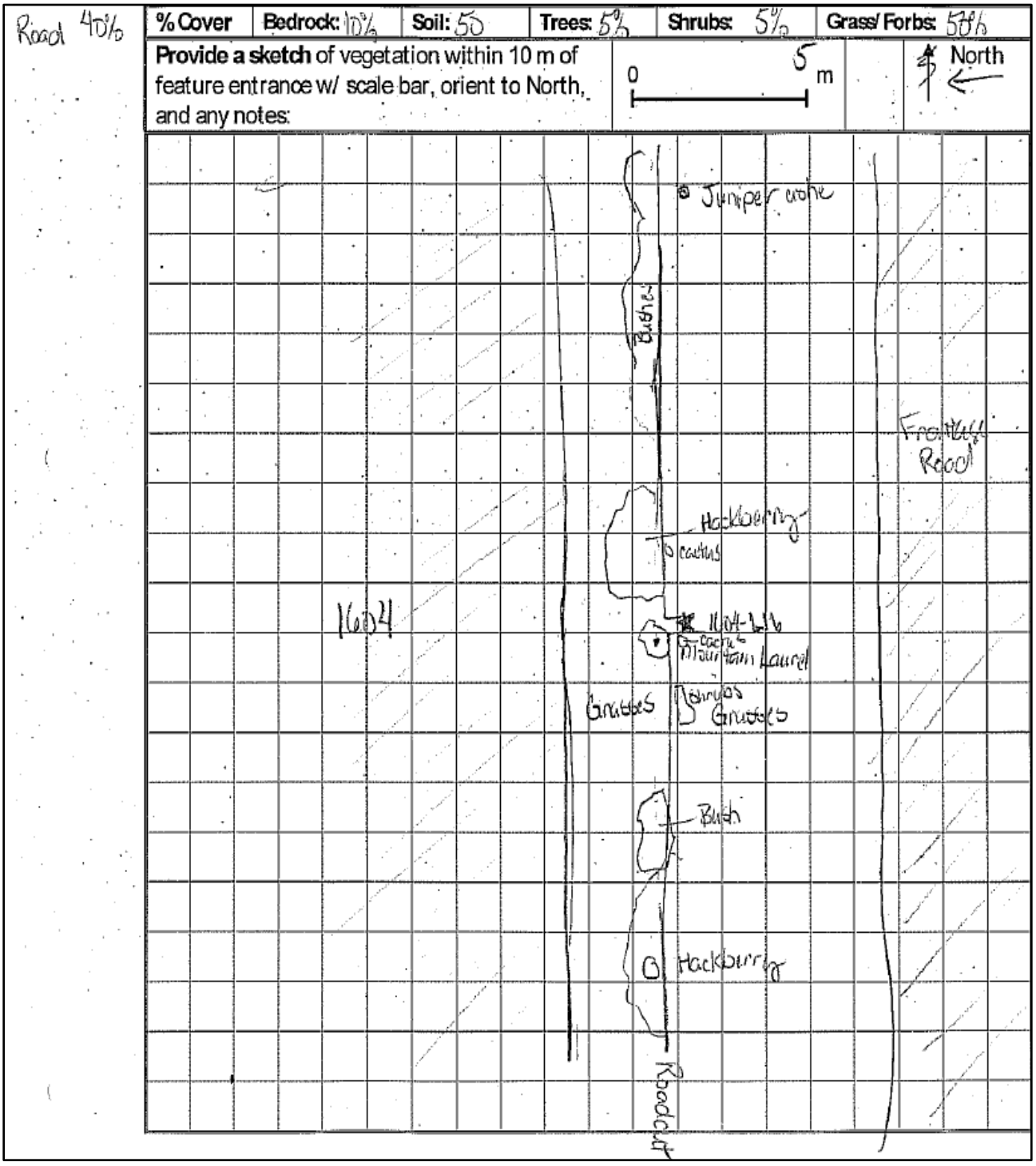


Figure F-13. Vegetation sketch for Feature 1604-L16 (12A Cave).

Feature 1604-R03

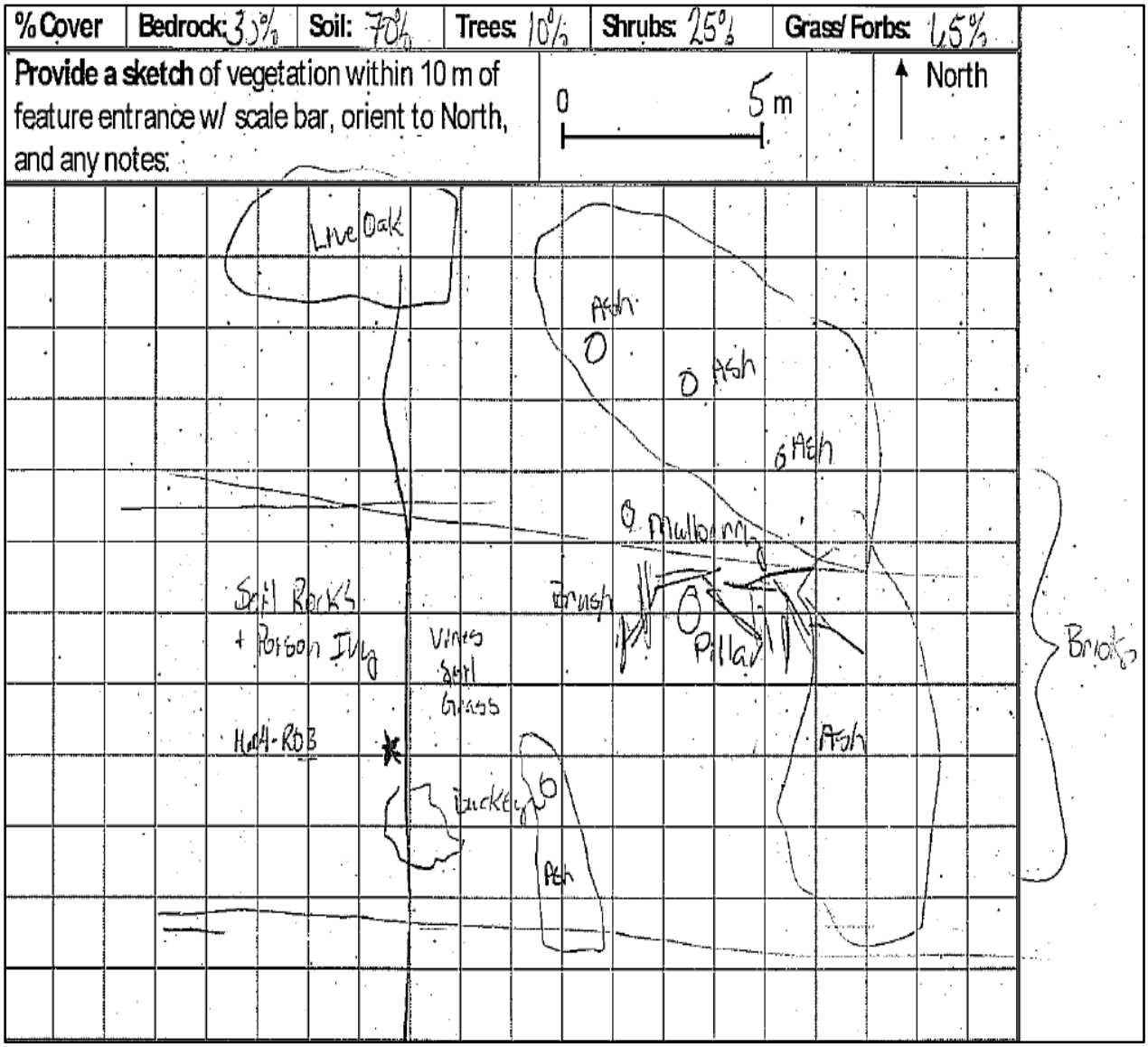


Figure F-14. Vegetation sketch for Feature 1604-R03.

Feature 1604-R04

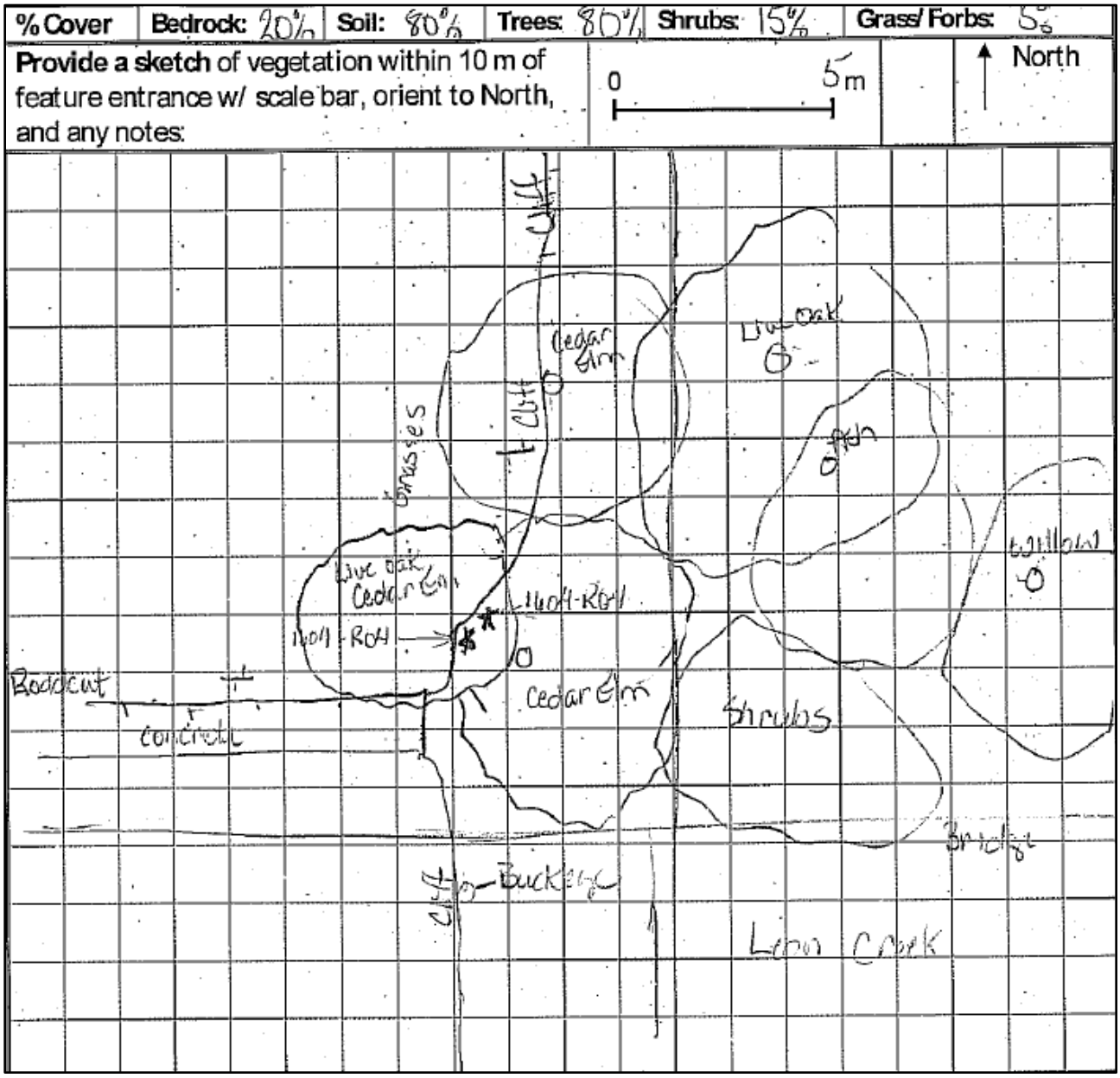


Figure F-15. Vegetation sketch for Feature 1604-R04.

Feature 1604-R05

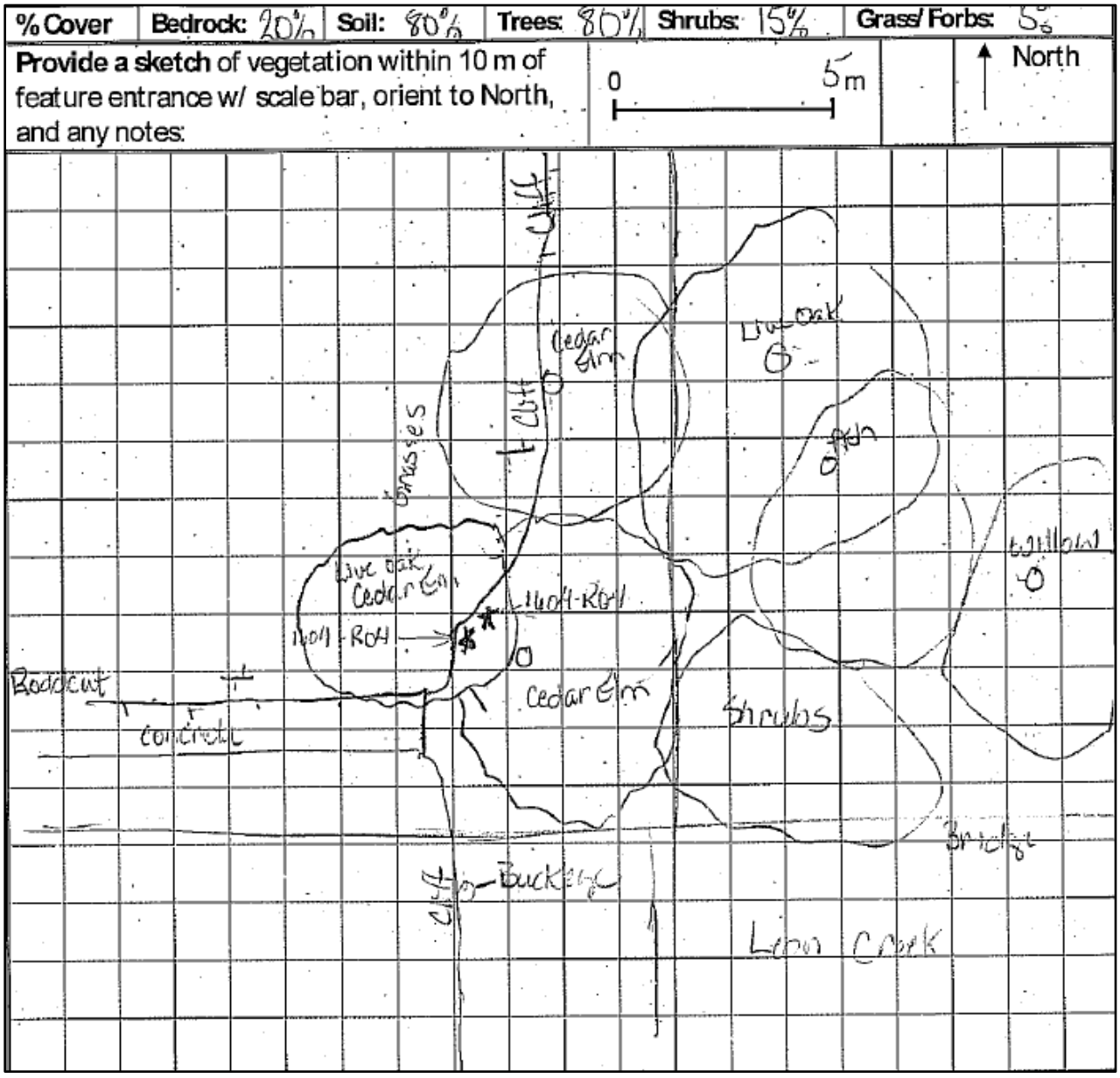


Figure F-16. Vegetation sketch for Feature 1604-R05.

Feature 1604-R06

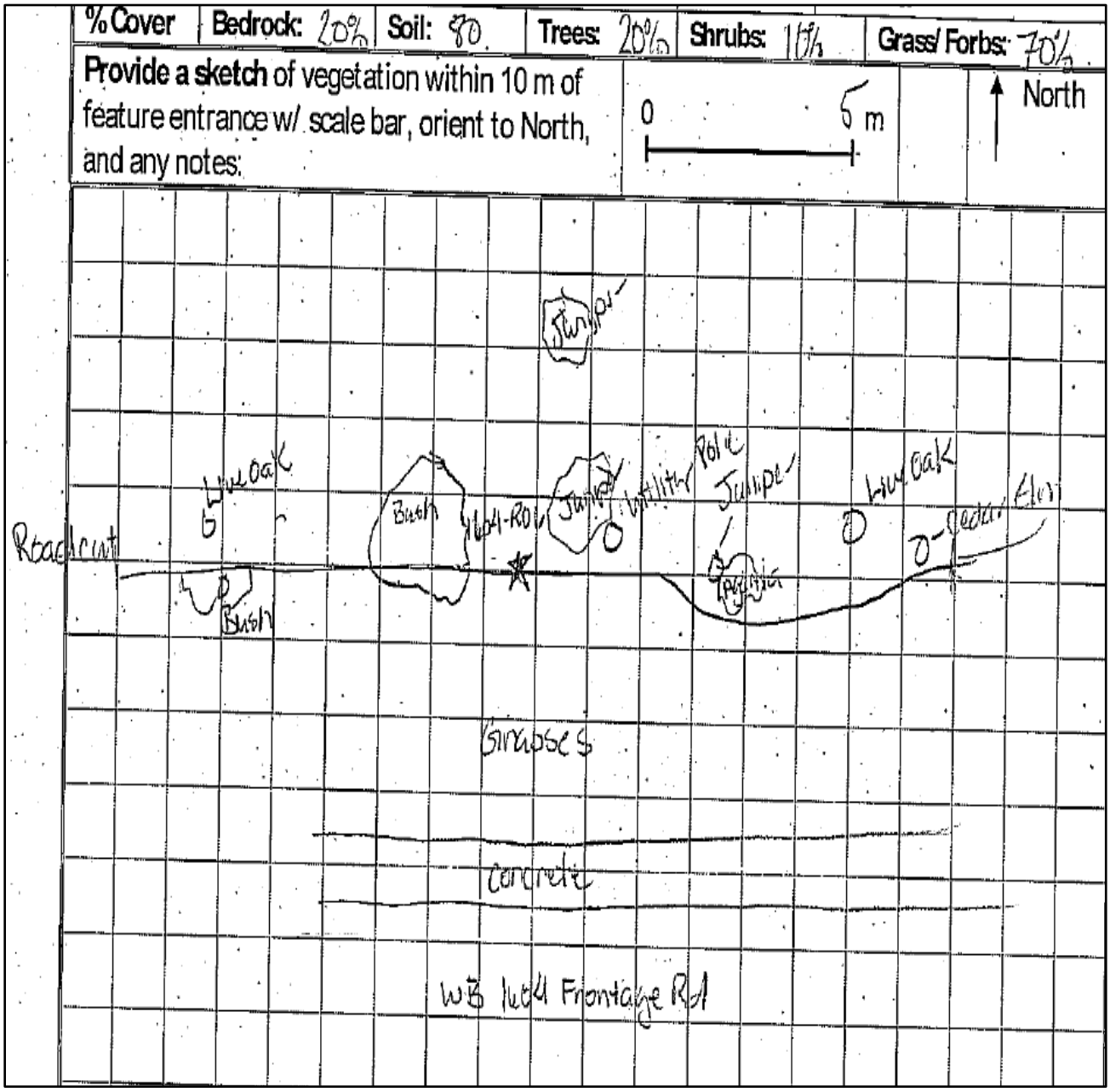


Figure F-17. Vegetation sketch for Feature 1604-R06.

Feature LOOP-009

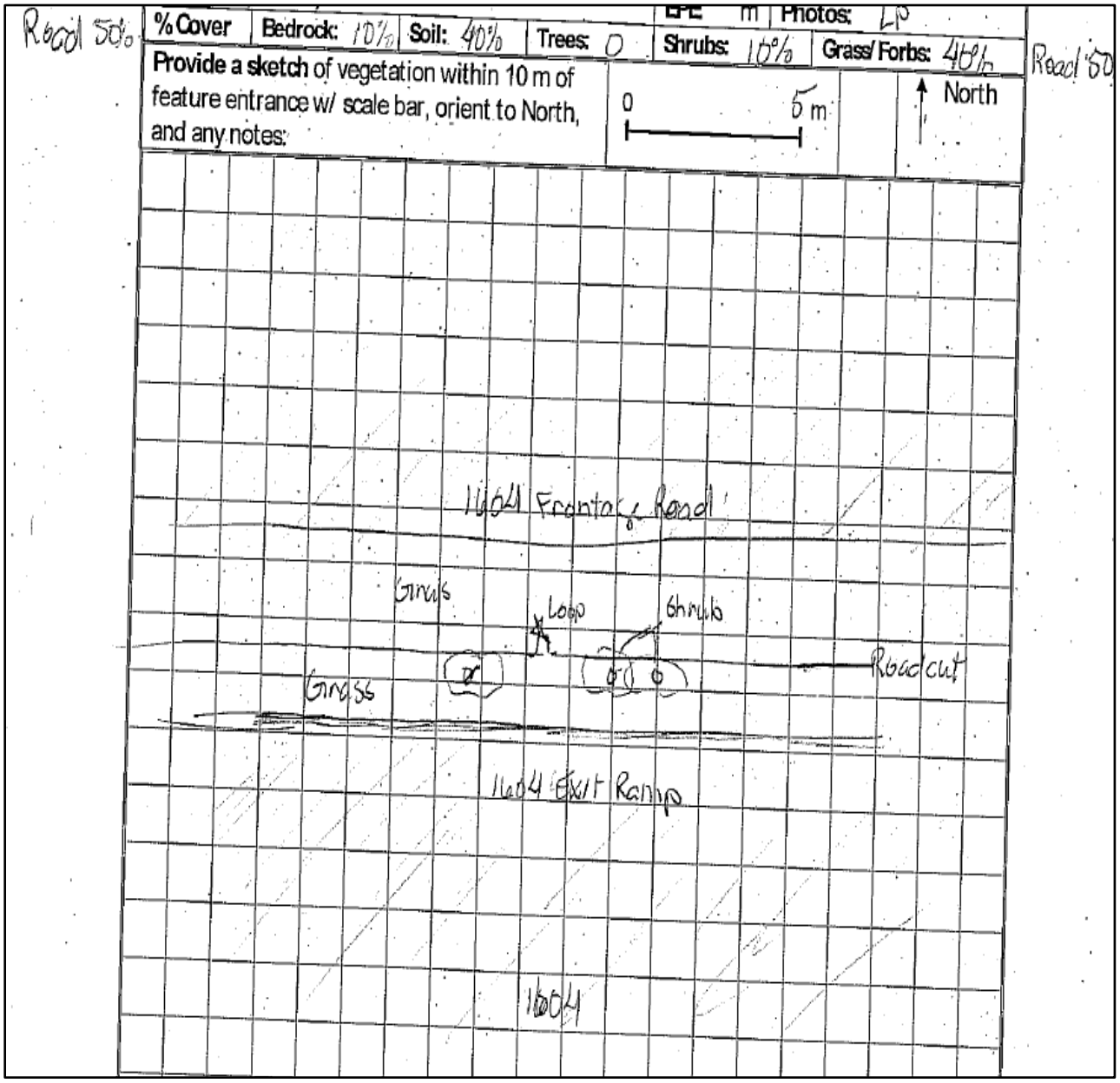


Figure F-18. Vegetation sketch for Feature LOOP-009.

Feature LOOP-102

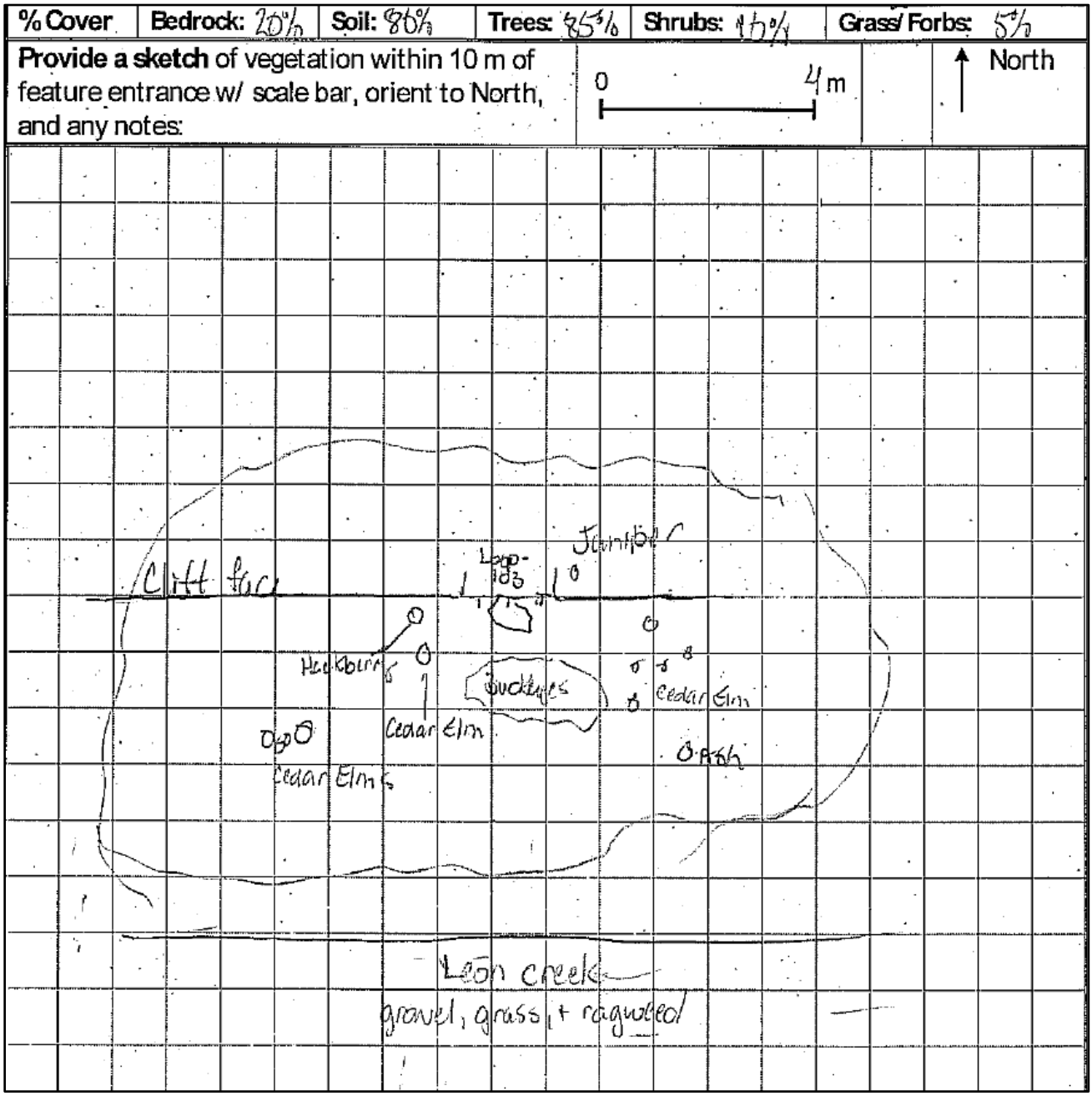


Figure F-19. Vegetation sketch for Feature LOOP-102.

Feature LOOP-103

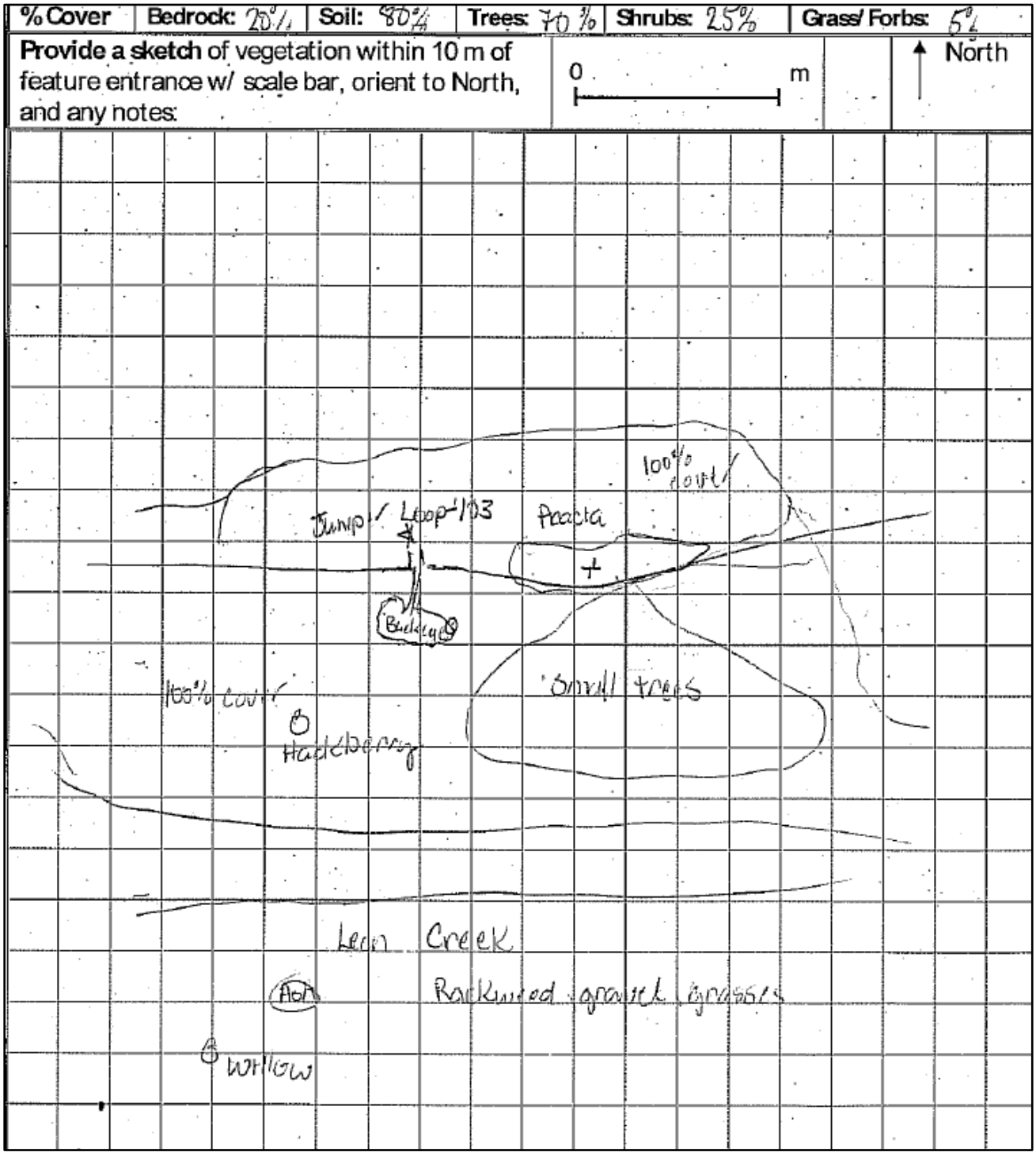


Figure F-20. Vegetation sketch for Feature LOOP-103.

Feature LOOP-207

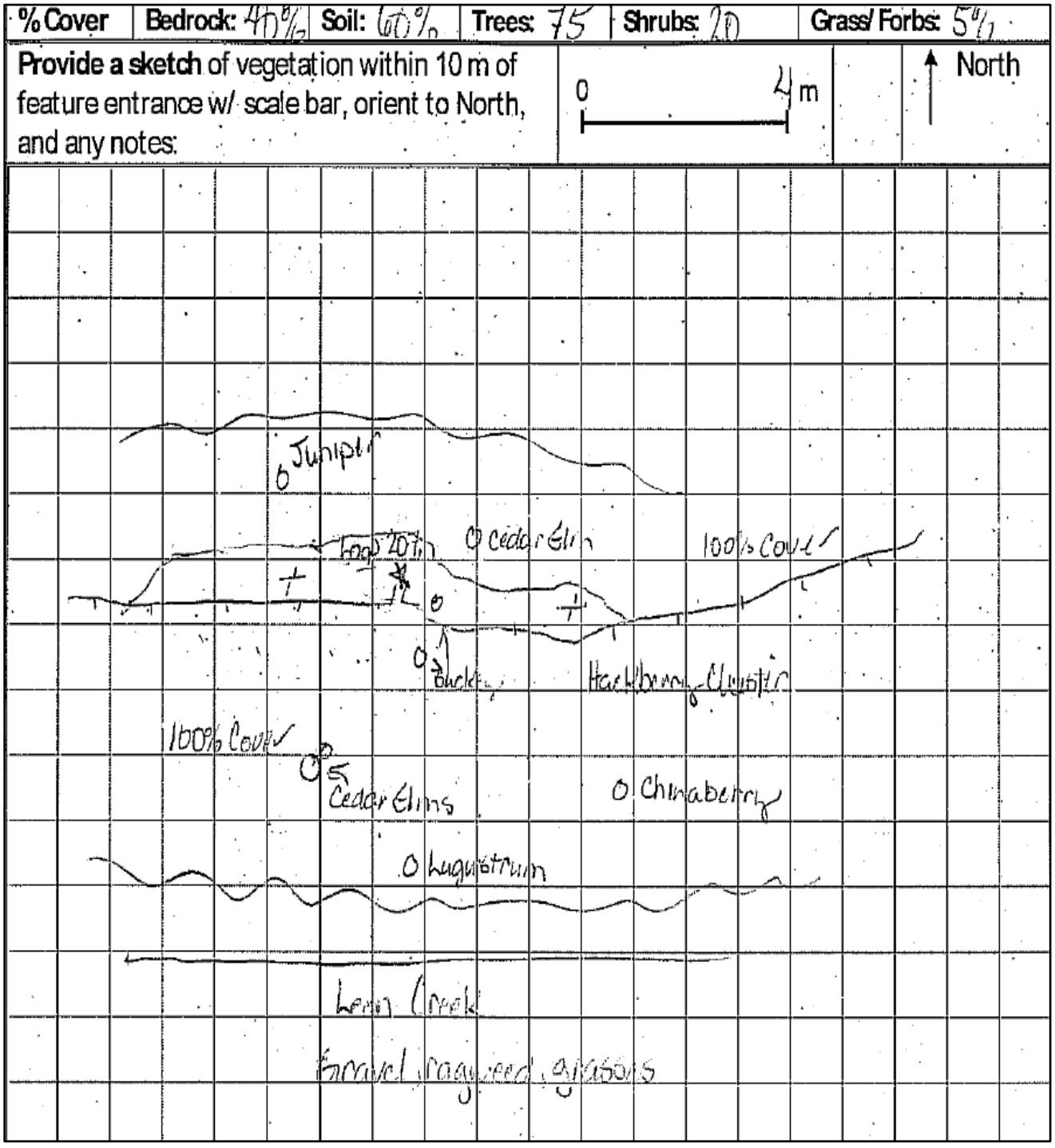


Figure F-21. Vegetation sketch for Feature LOOP-207.

Feature LOOP-215

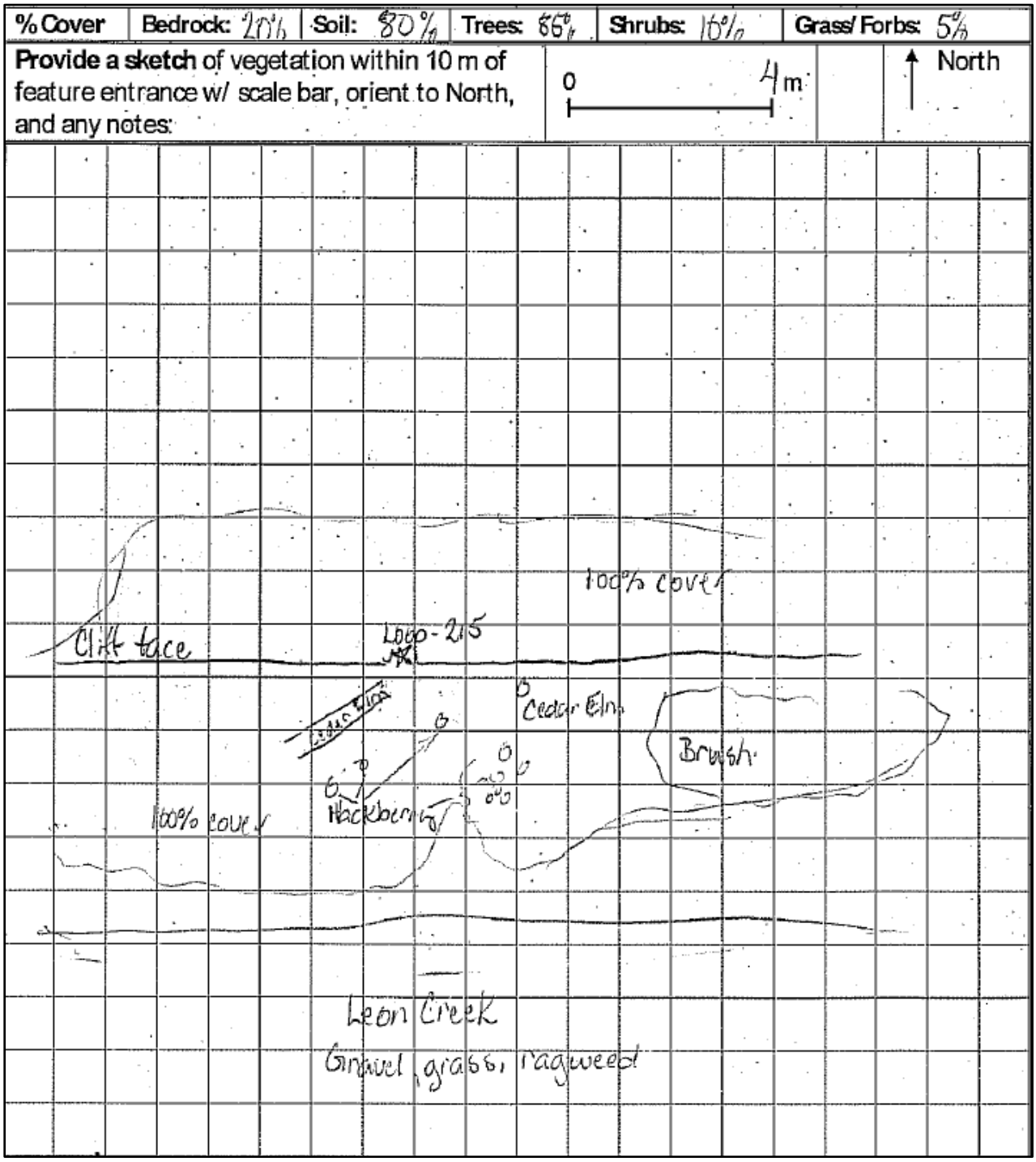


Figure F-22. Vegetation sketch for Feature LOOP-215.

This report was written on behalf of the Texas Department of Transportation by

Jacobs

2705 Bee Cave Road, Suite 300
Austin, Texas 78746

ZARA ENVIRONMENTAL LLC

1707 W. FM 1626
Manchaca, Texas 78652