

# **Anderson Mill Road**

## **Appendix C: ERI**

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# **COA Environmental Resource Inventory of Anderson Mill Road Improvements Project, Spicewood Springs Parkway to US HWY 183, Austin, Texas**

CONTRACT NO. MA PA 150000002



*Prepared for*  
**City of Austin  
Public Works Department  
Austin, Texas**

Project No: 60550489  
September 18, 2017

## **URS**

**URS Corporation**

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Austin, Texas 78729

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## Environmental Resource Inventory

For the City of Austin  
Related to LDC 25-8-121, City Code 30-5-121, ECM 1.3.0 & 1.10.0

The ERI is required for projects that meet one or more of the criteria listed in LDC 25-8-121(A), City Code 30-5-121(A).

1. SITE/PROJECT NAME: Anderson Mill Road Improvements Project - Spicewood Springs Pkwy to US 183
2. COUNTY APPRAISAL DISTRICT PROPERTY ID (#'s): See Figure 1 attached.
3. ADDRESS/LOCATION OF PROJECT: 9601-10501 Anderson Mill Road
4. WATERSHED: Bull Creek
5. THIS SITE IS WITHIN THE (Check all that apply)
 

Edwards Aquifer Recharge Zone* (See note below) .....	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> No
Edwards Aquifer Contributing Zone* .....	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> No
Edwards Aquifer 1500 ft Verification Zone* .....	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> No
Barton Spring Zone* .....	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> No

\*(as defined by the City of Austin – LDC 25-8-2 or City Code 30-5-2)

**Note: If the property is over the Edwards Aquifer Recharge zone, the Hydrogeologic Report and karst surveys must be completed and signed by a Professional Geoscientist Licensed in the State of Texas.**

6. DOES THIS PROJECT PROPOSE FLOODPLAIN MODIFICATION?.....☐ YES\*\* ☒ NO  
If yes, then check all that apply:
 

<input type="checkbox"/> (1) The floodplain modifications proposed are necessary to protect the public health and safety;
<input type="checkbox"/> (2) The floodplain modifications proposed would provide a significant, demonstrable environmental benefit, as determined by a <b>functional assessment</b> of floodplain health as prescribed by the Environmental Criteria Manual (ECM), or
<input type="checkbox"/> (3) The floodplain modifications proposed are necessary for development allowed in the critical water <b>quality zone under LDC 25-8-261 or 25-8-262, City Code 30-5-261 or 30-5-262.</b>
<input type="checkbox"/> (4) The floodplain modifications proposed are outside of the Critical Water Quality Zone in an area determined to be in poor or fair condition by a <b>functional assessment</b> of floodplain health.

**\*\* If yes, then a functional assessment must be completed and attached to the ERI (see ECM 1.7 and Appendix X for forms and guidance) unless conditions 1 or 3 above apply.**

7. IF THE SITE IS WITHIN AN URBAN OR SUBURBAN WATERSHED, DOES THIS PROJECT PROPOSE A UTILITY LINE PARALLEL TO AND WITHIN THE CRITICAL WATER QUALITY ZONE? ..... ☐ YES\*\*\* ☒ NO

**\*\*\*If yes, then riparian restoration is required by LDC 25-8-261(E) or City Code 30-5-261(E) and a functional assessment must be completed and attached to the ERI (see ECM1.5 and Appendix X for forms and guidance).**

8. There is a total of 2 (#s) Critical Environmental Feature(s)(CEFs) on or within 150 feet of the project site. If CEF(s) are present, attach a detailed **DESCRIPTION** of the CEF(s), color **PHOTOGRAPHS**, the **CEF WORKSHEET** and provide **DESCRIPTIONS** of the proposed CEF buffer(s) and/or wetland mitigation. Provide the number of each type of CEFs on or within 150 feet of the site (Please provide the number of CEFs):

0 (#'s) Spring(s)/Seep(s)      2 (#'s) Point Recharge Feature(s)      0 (#'s) Bluff(s)  
 0 (#'s) Canyon Rimrock(s)      0 (#'s) Wetland(s)

**Note: Standard buffers for CEFs are 150 feet, with a maximum of 300 feet for point recharge features. Except for wetlands, if the standard buffer is not provided, you must provide a written request for an administrative variance from LDC 25-8-281(C)(1) and provide written findings of fact to support your request. Request forms for administrative variances from requirements stated in LDC 25-8-281 are available from Watershed Protection Department.**

9. The following site maps are attached at the end of this report (Check all that apply and provide):

All ERI reports must include:

- ☒ **Site Specific Geologic Map with 2-ft Topography**
- ☒ **Historic Aerial Photo of the Site**
- ☒ **Site Soil Map**
- ☒ **Critical Environmental Features and Well Location Map on current Aerial Photo with 2-ft Topography**

Only if present on site (Maps can be combined):

- ☒ **Edwards Aquifer Recharge Zone with the 1500-ft Verification Zone**  
(Only if site is over or within 1500 feet the recharge zone)
- ☐ **Edwards Aquifer Contributing Zone**
- ☐ **Water Quality Transition Zone (WQTZ)**
- ☐ **Critical Water Quality Zone (CWQZ)**
- ☐ **City of Austin Fully Developed Floodplains for all water courses with up to 64-acres of drainage**

10. **HYDROGEOLOGIC REPORT** – Provide a description of site soils, topography, and site specific geology below (Attach additional sheets if needed):

**Surface Soils** on the project site is summarized in the table below and uses the SCS Hydrologic Soil Groups\*. If there is more than one soil unit on the project site, show each soil unit on the site soils map.

Soil Series Unit Names, Infiltration Characteristics & Thickness		
Soil Series Unit Name & Subgroup**	Group*	Thickness (feet)
Fairlie (FaB)	D	4.4
Eckrant (EeB)	D	1.3
San Saba (SaB)	D	3.5
Georgetown (GsB)	D	3.8
See Attachment		

**\*Soil Hydrologic Groups Definitions (Abbreviated)**

- A. Soils having a high infiltration rate when thoroughly wetted.
- B. Soils having a moderate infiltration rate when thoroughly wetted.
- C. Soils having a slow infiltration rate when thoroughly wetted.
- D. Soils having a very slow infiltration rate when thoroughly wetted.

\*\*Subgroup Classification – See Classification of Soil Series Table in County Soil Survey.



**Description of Site Topography and Drainage** *(Attach additional sheets if needed):*

According to the United States Geological Survey (USGS) topographic map of the subject property area (Jollyville quadrangle) and a review of the Google Earth website, the elevation of the subject property is approximately 980 feet above mean sea level (msl). Based on a review of these technical resources and URS's site visit, the subject property and surrounding area appears to slope slightly downward toward open drainage ditches and stormwater drainage inlets located along either side of the roadway.

Additional comments are provided in Appendix A; Project Memorandum - Hydrogeologic Report and Phase I Karst Feature Survey.

**List surface geologic units below:**

Geologic Units Exposed at Surface		
Group	Formation	Member
Fredericksburg (Edwards Group)	Edwards Limestone (Ked)	Basal/Member 1

**Brief description of site geology** *(Attach additional sheets if needed):*

According to the Geologic Map of the Austin Area, Texas (Garner and Young 1976) and general field observations, the project area is underlain by the Edwards Limestone Formation (Ked). The Edwards Formation consists of limestone, dolomitic limestone, and marl; hard, pure variable bedding; solution features common; silicified fossils locally evident; thin soils typical. A map of the bedrock geologic units mapped across the project area is provided in the attached Figure 2.

No major faults or major fractures are shown on the property, nor was evidence of such observed during the assessment of the project site.

Additional comments provided in Appendix A; Project Memorandum - Hydrogeologic Report and Phase I Karst Feature Survey.

**Wells** – Identify all recorded and unrecorded wells on site (test holes, monitoring, water, oil, unplugged, capped and/or abandoned wells, etc.):

There are  $\frac{0}{0}$ (#) wells present on the project site and the locations are shown and labeled  
 $\frac{0}{0}$ (#s) The wells are not in use and have been properly abandoned.  
 $\frac{0}{0}$ (#s) The wells are not in use and will be properly abandoned.  
 $\frac{0}{0}$ (#s) The wells are in use and comply with 16 TAC Chapter 76.  
 There are  $\frac{0}{0}$ (#s) wells that are off-site and within 150 feet of this site.

11. **THE VEGETATION REPORT** – Provide the information requested below:

**Brief description of site plant communities** *(Attach additional sheets if needed):*

The subject property is located in a developed urban area, mostly consisting of planted and landscaped vegetation including green ash (*Fraxinus pennsylvanica*), live oak (*Quercus fusiformis*), Texas oak (*Quercus buckleyi*), pecan (*Carya illinoensis*) redbud (*Cercis canadensis*), crapemyrtle (*Lagerstroemia indica*), and Texas lantana (*Lanata erticoides*). The understory is landscaped with St. Augustine (*Stenotaphrum secundatum*) and Bermuda grass (*Cynodon dactylon*). One vacant lot includes a woodland community dominated by cedar elm (*Ulmus crassifolia*), sugarberry (*Celtis laevigata*), escarpment live oak (*Quercus fusiformis*), ashe juniper (*Juniperus ashei*), and chinaberry (*Melia azedarach*). The understory of the woodland site is dominated by saplings of the previously listed trees, as well as poison ivy (*Toxicodendron radicans*) and greenbrier (*Smilax bona-nox*). This same lot includes a cleared area consisting largely of Johnson grass (*Sorghum halepense*), peppervine (*Ampelopsis arborea*), and sumpweed (*Iva annua*), with some cedar elm and pecan regrowth.

There is woodland community on site ..... ☒ YES ☐ NO *(Check one).*

If yes, list the dominant species below:

Woodland species	
Common Name	Scientific Name
cedar elm	<i>Ulmus crassifolia</i>
sugarberry	<i>Celtis laevigata</i>
escarpment live oak	<i>Quercus fusiformis</i>
ashe juniper	<i>Juniperus ashei</i>
chinaberry	<i>Melia azedarach</i>

There is grassland/prairie/savanna on site..... ☐ YES ☒ NO *(Check one).*

If yes, list the dominant species below:

Grassland/prairie/savanna species	
Common Name	Scientific Name

There is hydrophytic vegetation on site ..... ☐ YES ☒ NO *(Check one).*

If yes, list the dominant species in table below *(next page):*

Hydrophytic plant species		
Common Name	Scientific Name	Wetland Indicator Status

A tree survey of all trees with a diameter of at least eight inches measured four and one-half feet above natural grade level has been completed on the site.

☐ YES ☒ NO (Check one).

**12. WASTEWATER REPORT –** Provide the information requested below.

Wastewater for the site will be treated by (Check of that Apply):

- ☐ On-site system(s)  
☒ City of Austin Centralized sewage collection system  
☐ Other Centralized collection system

*Note: All sites that receive water or wastewater service from the Austin Water Utility must comply with City Code Chapter 15-12 and wells must be registered with the City of Austin*

The site sewage collection system is designed and will be constructed to in accordance to all State, County and City standard specifications.

☒ YES ☐ NO (Check one).

Calculations of the size of the drainfield or wastewater irrigation area(s) are attached at the end of this report or shown on the site plan.

☐ YES ☐ NO ☒ Not Applicable (Check one).

Wastewater lines are proposed within the Critical Water Quality Zone?

☐ YES ☒ NO (Check one). If yes, then provide justification below:

Is the project site is over the Edwards Aquifer?

☒ YES ☐ NO (Check one).

If yes, then describe the wastewater disposal systems proposed for the site, its treatment level and effects on receiving watercourses or the Edwards Aquifer.

No wastewater disposal systems are proposed for this project.

**13. One (1) hard copy and one (1) electronic copy of the completed assessment have been provided.**

Date(s) ERI Field Assessment was performed: August 25 and September 1, 2017

Date(s)

My signature certifies that to the best of my knowledge, the responses on this form accurately reflect all information requested.

Douglas E. Zarker

512-472-4519

Print Name

*Douglas E. Zarker*

Telephone

doug.zarker@aecom.com

Signature

URS

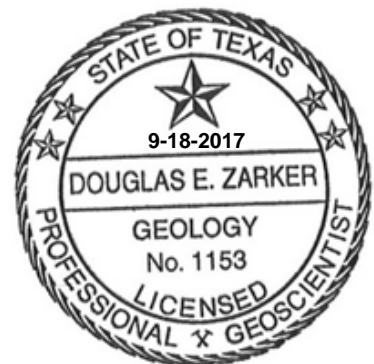
Email Address

September 18, 2017

Name of Company

Date

For project sites within the Edwards Aquifer Recharge Zone, my signature and seal also certifies that I am a licensed Professional Geoscientist in the State of Texas as defined by ECM 1.12.3(A).



*Douglas E. Zarker*

## City of Austin Environmental Resource Inventory - Critical Environmental Feature Worksheet

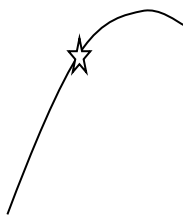
1	Project Name:	Anderson Mill Road Improvements Project
2	Project Address:	9601-10501 Anderson Mill Road
3	Site Visit Date:	August 25 and September 1, 2017
4	Environmental Resource Inventory Date:	September 18, 2017

5	Primary Contact Name:	Chuck Neeley, PE
6	Phone Number:	512 472-4519
7	Prepared By:	Doug Zarker, PG
8	Email Address:	doug.zarker@aecom.com

9	FEATURE TYPE {Wetland, Rimrock, Bluffs, Recharge Feature, Spring}	FEATURE ID (eg S-1)	FEATURE LONGITUDE (WGS 1984 in Meters)		FEATURE LATITUDE (WGS 1984 in Meters)		WETLAND DIMENSIONS (ft)		RIMROCK/BLUFF DIMENSIONS (ft)		RECHARGE FEATURE DIMENSIONS				Springs Est. Discharge cfs
			coordinate	notation	coordinate	notation	X	Y	Length	Avg Height	X	Y	Z	Trend	
	Recharge Feature	S-1	-97.79450	DD	30.44821	DD					30	18	10	N340W	
	Recharge Feature	S-2	-97.79446	DD	30.44802	DD					12	2	4	N320W	

City of Austin Use Only	
CASE NUMBER:	

For rimrock, locate the midpoint of the segment that describes the feature.



For wetlands, locate the approximate centroid of the feature and the estimated area.



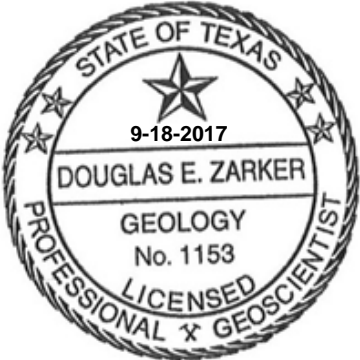
For a spring or seep, locate the source of groundwater that feeds a pool or stream.



**Please state the method of coordinate data collection and the approximate precision and accuracy of the points and the unit of measurement.**

Method	Accuracy
GPS <input checked="" type="checkbox"/>	sub-meter <input type="checkbox"/>
Surveyed <input type="checkbox"/>	meter <input checked="" type="checkbox"/>
Other <input type="checkbox"/>	> 1 meter <input type="checkbox"/>

Professional Geologists apply seal below










Source: CoA; TCAD

### Legend

-  Project Site Boundary (Approximate)
-  150 Foot Buffer
-  TCAD Parcels

**SCALE**

0 250 500 1,000 1,500 2,000 Feet



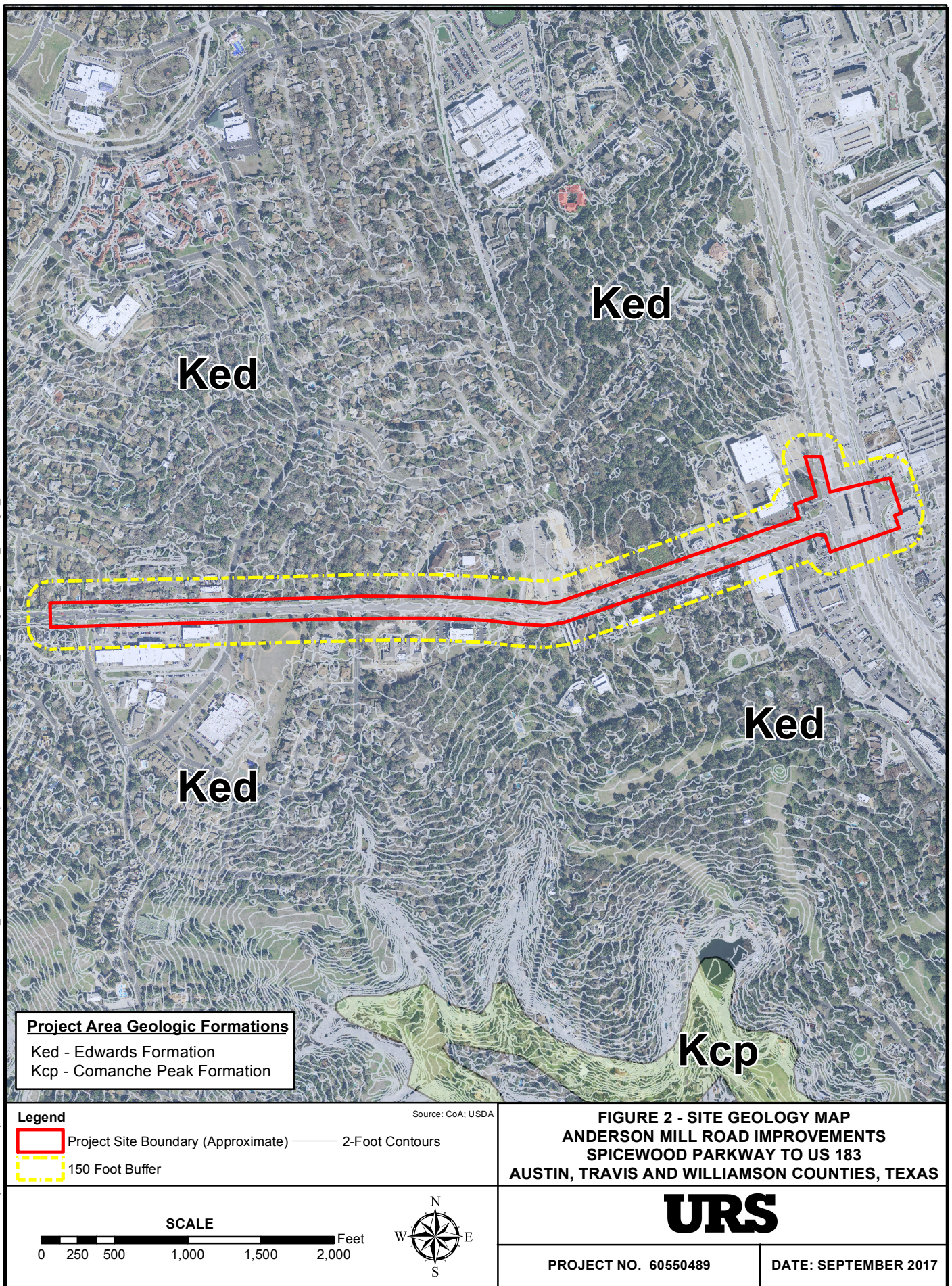
**FIGURE 1 - PROJECT LOCATION**  
**ANDERSON MILL ROAD IMPROVEMENTS**  
**SPICEWOOD PARKWAY TO US 183**  
**AUSTIN, TRAVIS AND WILLIAMSON COUNTIES, TEXAS**

**URS**

PROJECT NO. 60550489

DATE: SEPTEMBER 2017











### Legend

-  Project Site Boundary (Approximate)
-  150 Foot Buffer

Source: CoA; USDA

**FIGURE 3 - 1996 AERIAL PHOTOGRAPH  
ANDERSON MILL ROAD IMPROVEMENTS  
SPICEWOOD PARKWAY TO US 183  
AUSTIN, TRAVIS AND WILLIAMSON COUNTIES, TEXAS**

**SCALE**

0 250 500 1,000 1,500 2,000 Feet



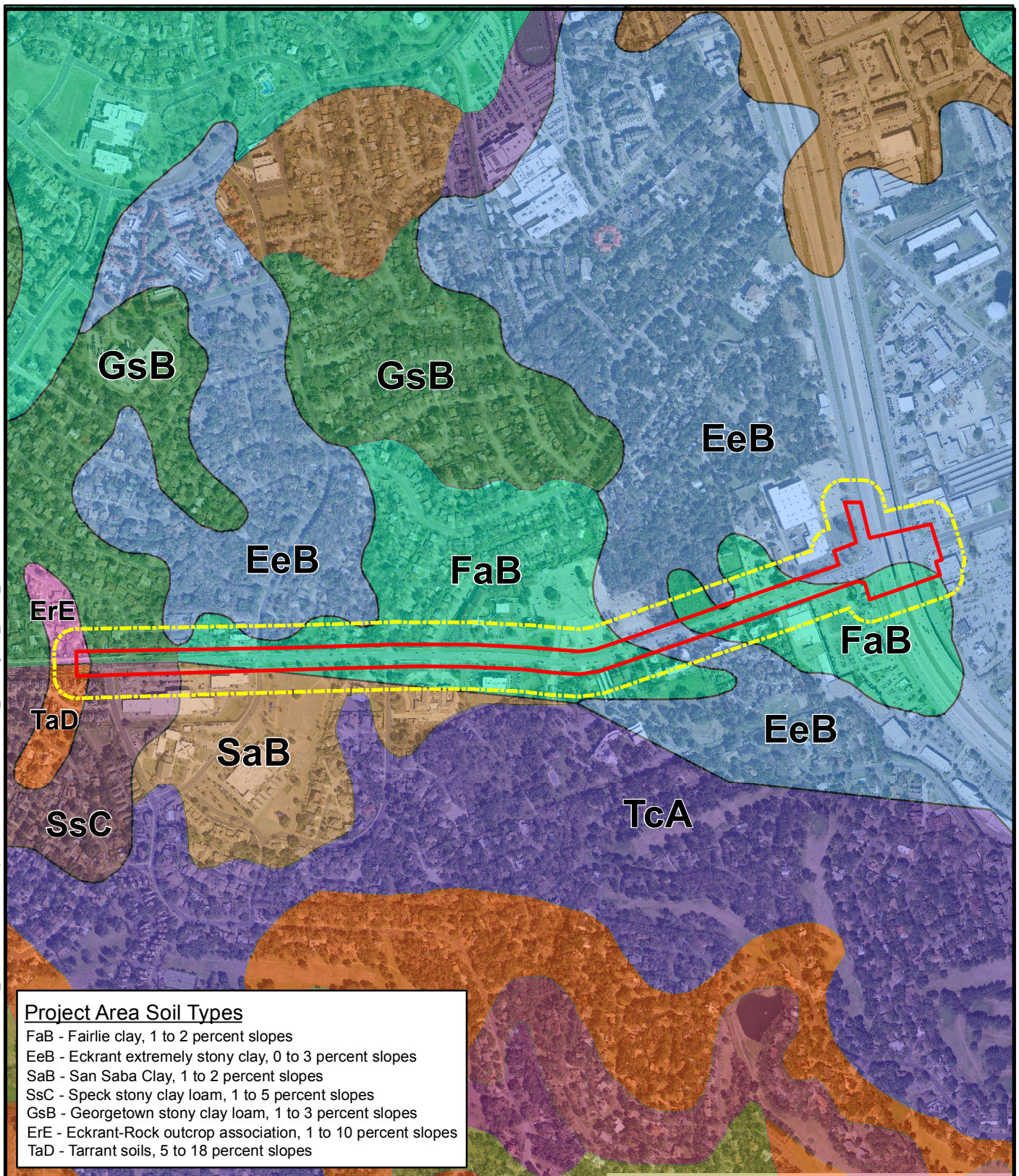
**URS**

PROJECT NO. 60550489

DATE: SEPTEMBER 2017



Path: L:\AGE\Projects\INFR\City of Austin\Env Sys Rot List 2014-2016\10\_Anderson Mill Road Improvements\900-CAD-GIS\GIS\_ERIs\Figure4\_ANMR\_Soils.mxd



### Legend

- Project Site Boundary (Approximate)
- 150 Foot Buffer

Source: CoA; USDA

**FIGURE 4 - SITE SOIL MAP**  
**ANDERSON MILL ROAD IMPROVEMENTS**  
**SPICEWOOD PARKWAY TO US 183**  
**AUSTIN, TRAVIS AND WILLIAMSON COUNTIES, TEXAS**

**URS**

PROJECT NO. 60550489

DATE: SEPTEMBER 2017

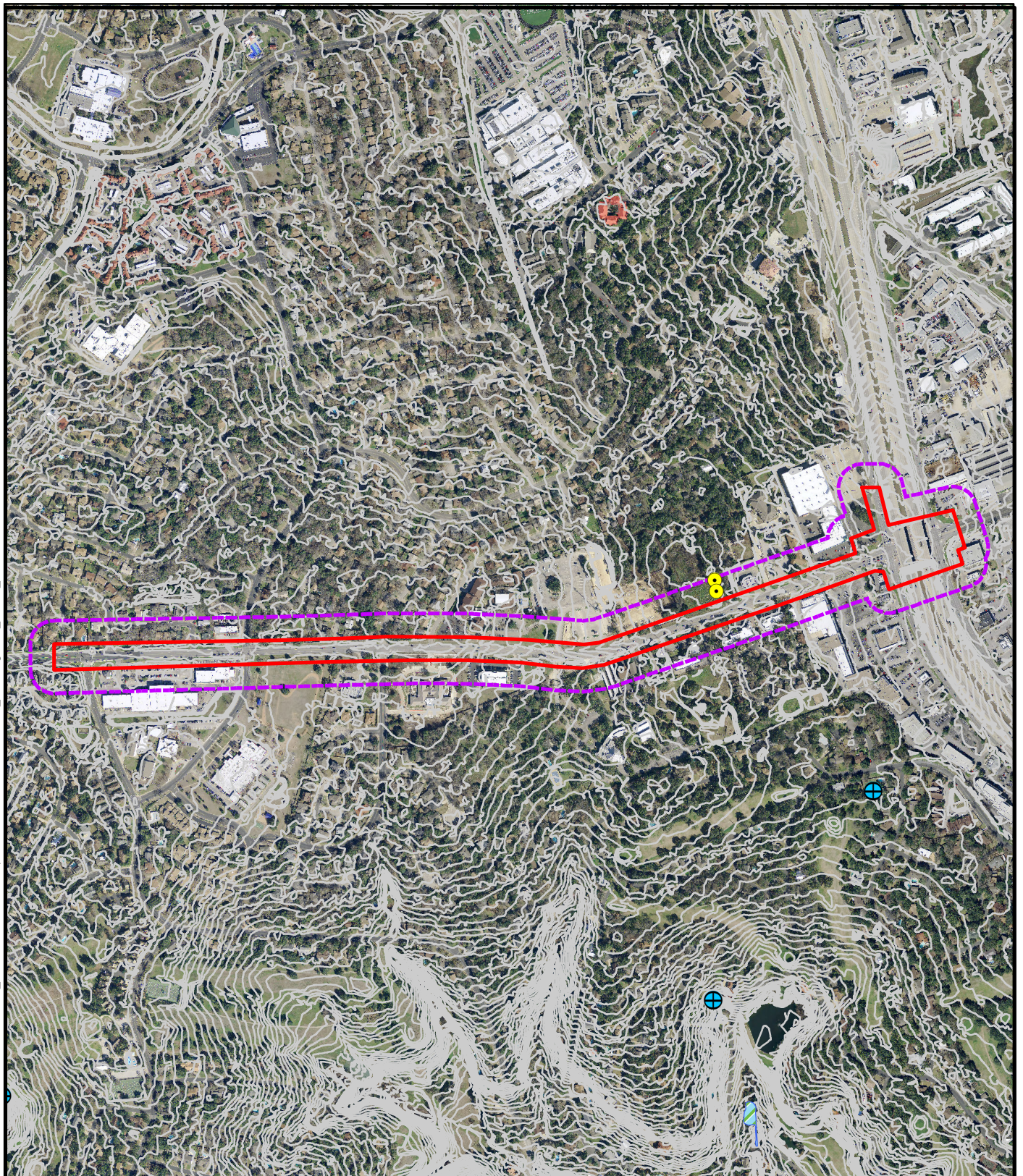
**SCALE**

0 250 500 1,000 1,500 2,000 Feet



Note: AECOM does not warrant the accuracy of this map, either to scale, accuracy or completeness.





**Legend**

- Karst Feature
- Subject Property (Approximate)
- 150 Foot Buffer
- TWDB Wells
- CoA Wetlands
- 2-Foot Contours

Source: CoA; TWDB

**FIGURE 5 - CRITICAL ENVIRONMENTAL FEATURES  
AND WELL LOCATION MAP**  
**ANDERSON MILL ROAD IMPROVEMENTS**  
**SPICEWOOD PARKWAY TO US 183**  
**AUSTIN, TRAVIS AND WILLIAMSON COUNTIES, TEXAS**

**SCALE**

0 220 440 880 1,320 1,760 Feet



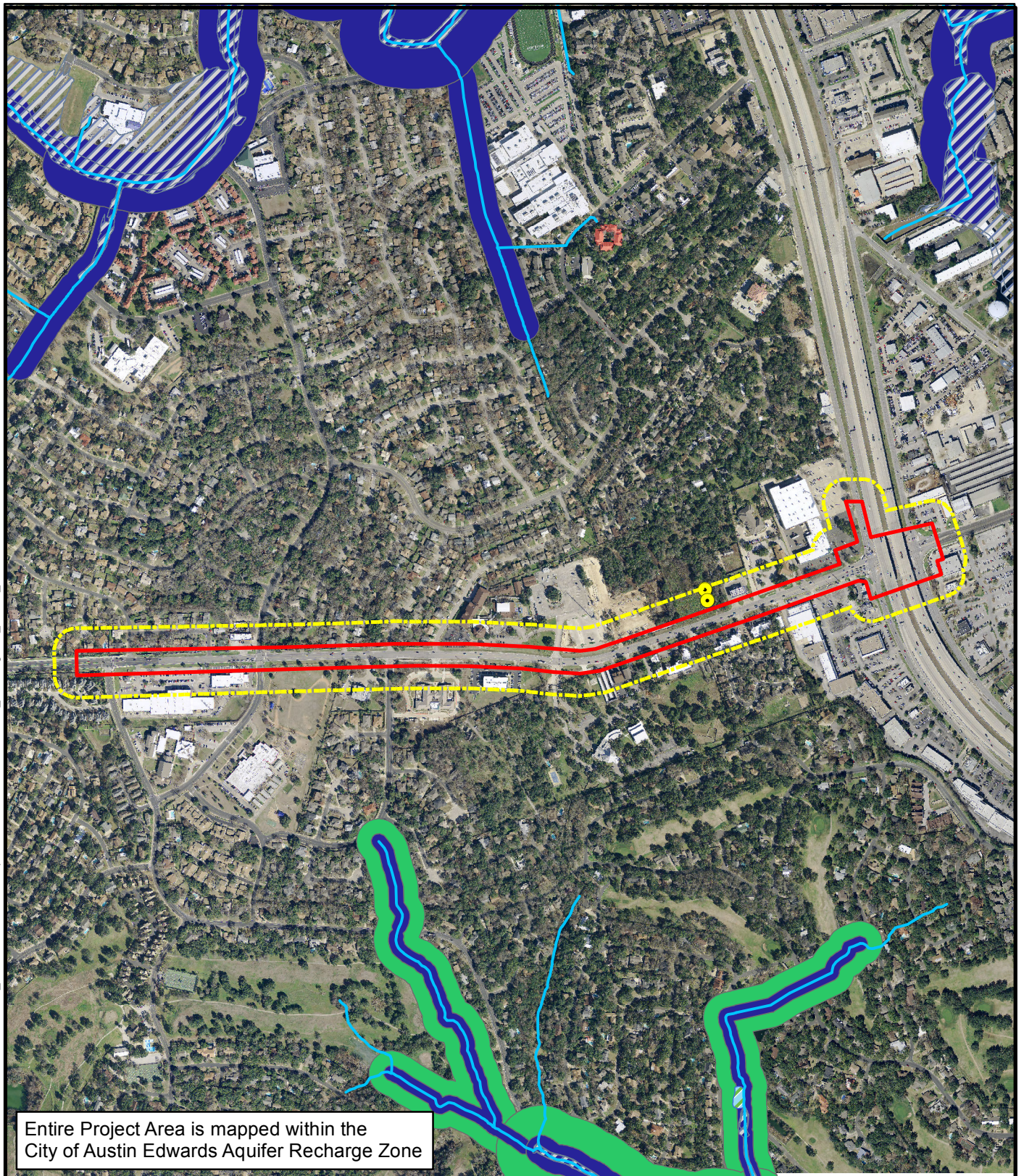
Note: AECOM does not warrant the accuracy of this map, either to scale, accuracy or completeness.

**URS**

PROJECT NO. 60550489

DATE: SEPTEMBER 2017





Entire Project Area is mapped within the  
City of Austin Edwards Aquifer Recharge Zone

**Legend**

- Project Area Boundary (Approximate)
- 150 Foot Buffer
- ▨ CoA Wetlands
- Streams
- ▨ CoA 100-year Floodplain
- ▨ Critical Water Quality Zone (CWQZ)
- ▨ Water Quality Transition Zone (WQTZ)
- Karst Feature

Source: CoA

**FIGURE 6 - ENVIRONMENTAL CONSTRAINTS  
ANDERSON MILL ROAD IMPROVEMENTS  
SPICEWOOD PARKWAY TO US 183  
AUSTIN, TRAVIS AND WILLIAMSON COUNTIES, TEXAS**

**SCALE**

0 250 500 1,000 1,500 2,000 Feet



**URS**

PROJECT NO. 60550489

DATE: SEPTEMBER 2017



## **Appendix A**

### **Project Memorandum – Hydrogeologic Report and Phase I Karst Feature Survey**

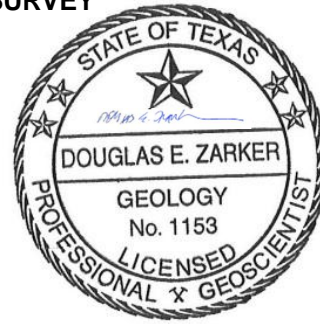


**PROJECT MEMORANDUM - DRAFT  
HYDROGEOLOGIC REPORT AND PHASE I KARST FEATURE SURVEY  
Anderson Mill Road Improvements Project –  
Spicewood Springs Parkway to US HWY 183  
Austin, Travis County, Texas**

Prepared for:  
City of Austin

Prepared by:  
URS - Douglas E. Zarker, PG

September 18, 2017



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## **1.0 Introduction**

URS Corporation (URS) was retained by City of Austin (COA) to perform an Environmental Resource Inventory (ERI) of Anderson Mill Road Improvements Project, from Spicewood Springs Parkway to US HWY 183 in Austin, Travis County, Texas (project site). A Project Location Map is provided in *Figure 1* of the ERI. The ERI was performed under the Environmental Services Rotation List (2014 – 2016) Contract (COA Contract No. PA 150000002) dated November 13, 2014, and the scope of work for a Phase I ESA as described in Work Order No. DO 6100 effective July 24, 2017.

The COA is currently in the preliminary design phase for the proposed roadway improvements for the project in Austin, Texas. The site is mapped within the Edwards Aquifer Recharge Zone as defined by the COA and the Texas Commission on Environmental Quality (TCEQ). According to Title XXV of the COA Land Development Code Section §25-8-121, an ERI is required for this location. Because the site is mapped within the Edwards Aquifer Recharge Zone, the ERI requires that a hydrogeologic report and karst feature<sup>1</sup> survey be performed by a professional geologist (PG) licensed in the State of Texas as defined by the Environmental Criteria Manual. A summary of our findings is presented below.

## **2.0 Hydrogeologic Report and Karst Survey**

According to the COA Land Development Code (§25-8-122), a hydrogeologic report must: (1) generally describe the soils, topography, and geology of the site; (2) identify springs and significant point recharge features on the site; (3) demonstrate that proposed drainage patterns will protect the quality and quantity of recharge at significant point recharge features; and (4) identify all recorded and unrecorded water wells, both on the site and within 150 feet of the boundary of the site.

As mentioned above, the project site is located within an area mapped as the Edwards Aquifer Recharge Zone, an environmentally sensitive area regulated by the Texas Commission on Environmental Quality (TCEQ), as well as the U.S. Fish and Wildlife Service (USFWS) and the COA. Generally speaking, the recharge zone of the Edwards Aquifer is the area where the geologic layers of the Edwards and associated limestone outcrop at the surface and water (rainfall and surface runoff/streamflow infiltration) enters the aquifer through cracks, fractures, caves and sinkholes (karstic features). This relatively rapid infiltration of water into the aquifer, combined with the thin soils typical of the Edwards outcrop, make the aquifer sensitive to surface conditions. The purpose of the Karst Feature Survey is to locate karst features within the boundaries of the proposed project study area and to determine if karst features identified, if any, are likely to support federally listed karst invertebrates and/or that meet the criteria of a point recharge feature that may transmit recharge to the underlying aquifer. For the purposes of this study, the project site is defined as the portion of the project located within the public street right of way (ROW) and the project study area is defined as the 150 foot buffer area as prescribed in the COA code. This area is herein referred to as “project area”. It is important to note, however, that much of the natural ground cover in the project area has been altered from its “natural state” due to regrading, street and storm drain

<sup>1</sup> Karst Feature – geomorphic, topographic, and hydrological feature formed by solution of limestone by water. Caves, solution cavities, sinkholes, swallow holes, solution enlarged fractures are common types of karst features; many more can be found in a textbook or glossary of karst terms (Texas Commission on Environmental Quality [TCEQ], Instructions to Geologists for Geologic Assessments as revised October 1, 2004, Section IV).



construction, commercial and residential development and the introduction of ornamental turf and landscaping. In addition, it was not feasible during the time of the investigation, to observe the entirety of the land surface of the project area due to private property concerns and accessibility to residential back yard areas located primarily on the western portion of the project limits. URS's investigation is limited to information regarding the observed physical characteristics of the project area where accessible and from "over the fence" observations.

## 2.1 Soils

The soils on the project area are generally thin and rocky. According to the *Soil Survey of Williamson County, Texas*, soils of the Fairlie Clay series (approximately 62%) are mapped across the majority of the project area, followed by the Eckrant Series (approximately 25%). In general, soils that formed on the outcrop of the Edwards Formation are typically composed of dark brown, grayish brown, and reddish brown, silty to clayey loams (SCS 1974, 1983). Other soils mapped in the project area include San Saba (SaB), Speck (SsC), Georgetown (GsB), and Tarrant (TaD) Soils. All of these soil units are hydrologically described as Group "D" soils, which have a very slow infiltration rate (high runoff potential) when wet. They consist mostly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a clay layer near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission. A Site Soils Map of the project area is provided in *Figure 4*.

Using available soil publications and GIS ArcMap data layers, the percentages of soil units mapped in the project area and their general thicknesses is provided below. The project site contains seven soil types derived from the Web Soil Survey service provided by the United States Department of Agriculture (USDA). The western portion of the project site occurs along the Travis/Williamson County line, thus the project site includes more than one soil survey area. The survey areas may have been mapped differently, resulting in discrepancies in map units or soil properties across soil survey area boundaries. In Travis County, the project site contains three soil units:

- Speck stony clay loam, 1 to 5 percent slopes (SsC)
  - § Thickness = 1.6 feet
  - § 4.6% of the project site
- San Saba clay, 1 to 2 percent slopes (SaB)
  - § Thickness = 3.5 feet
  - § 2.3% of the project site
- Tarrant soils, 5 to 18 percent slopes (TaD)
  - § Thickness = 1 foot
  - § 0.7% of the project site

In Williamson County, the project site contains the following four soil units:

- Fairlie clay, 1 to 2 percent slopes (FaB)
  - § Thickness = 4.5 feet
  - § 61.8% of the project site
- Eckrant extremely stony clay, 0 to 3 percent slopes (EeB)
  - § Thickness = 1.3 feet
  - § 25.5% of the project site
- Georgetown stony clay loam, 1 to 3 percent slopes (GsB)
  - § Thickness = 4.5 feet
  - § 4.3% of the project site
- Eckrant-Rock outcrop association, 1 to 10 percent slopes (ErE)
  - § Thickness = 1 foot
  - § 0.7% of the project site

## 2.2 Site Topography and Drainage

According to the United States Geological Survey (USGS) topographic map of the subject property area (Jollyville quadrangle) and a review of the Google Earth website, the elevation of the subject property is approximately 980 feet above mean sea level (msl). Based on a review of these technical resources and URS's site visit, the subject property and surrounding area appears to slope slightly downward toward open drainage ditches and stormwater drainage inlets located along either side of the roadway.

## 2.3 Geology

The surface bedrock units mapped in the project area consist of limestone and related carbonate rocks, including dolomite, argillaceous limestone and marl. According to the *Geologic Map of the Austin Area, Texas* (Garner and Young 1976), GIS ArcMap layers, and our field observations, the surface geologic units mapped on the project site is the Cretaceous-age Edwards Formation. The Edwards Formation consists of thick- to thin-bedded, hard, fossiliferous limestone, dolomitic limestone and marl.

The Edwards Formation in the Austin area is subdivided into four members based on lithic character (south of the Colorado River in Austin, the Edwards has been elevated to group status and has been subdivided into the Person Formation [upper] and Kainer Formation [lower], but north of the river, the Edwards retains its single formational rank). For consistency and for the purpose of this memorandum, however, the nomenclature of Barnes (1974) and Garner and Young (1976) is used to describe the Edwards Formation. The majority of the project area overlies the basal member, or Member 1 of the Edwards Formation. The basal member is composed of carbonate rocks such as porous dolomite, dolomitic limestone, and hard limestone. The total thickness of Member 1 in the Austin area is estimated to be 200 feet. Gray to black, nodular chert is common in Member 1 and a 20-foot-thick cavernous solution collapse zone or "soluble horizon" containing iron-stained and brecciated limestone, dolomite, chert, calcite, and red clay occurs near the top.

According to the *Geologic Map of the Austin Area, Texas* (Garner and Young 1976), no major faults or major fractures are shown on the property, nor was evidence of such observed during our assessment of the project area. A Geologic Map of the project area is provided in *Figure 2*.

## 2.4 Water Wells

A search was conducted for water wells on and within 150 feet of the boundary of the project site. According to the Environmental Data Resources (EDR) database, several water wells are plotted beyond 150 feet but within one-half mile of the subject property. Additional information regarding the offsite water wells is provided in the EDR Regulatory Database provided under separate cover (see URS's Report of Phase I Environmental Site Assessment prepared for this site). In addition, review of the Texas Water Development Board (TWDB) website reveals several water wells in the general area, but beyond 150 feet from the boundary of the project site. No evidence of water wells were observed within the 150 feet of the project site during the field visit.

## 2.5 Karst Survey

In the early 1990s, the USFWS commissioned a study that delineated four geographic zones that reflect the likelihood of finding karst features on a particular property. These four karst zones were delineated based on lithology of the surface geology, distribution of known caves and cave fauna, and geologic controls on cave development. According to karst zone maps published by the USFWS, the karst zone mapped within the project area includes Karst Zone 1. Karst Zone 1 is defined as those areas known to contain endangered karst invertebrate species. In accordance with *Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas* (USFWS, 2015), a Karst Feature Survey is required if the project is located in Karst Zones 1, 2, or 3.

The URS team conducted the field reconnaissance or pedestrian survey of the project area on August 25 and September 1, 2017. The methodology for the karst field survey was conducted in general accordance with TCEQ guidelines (TCEQ, 2004) and the methodology described in the USFWS's latest guidance document dated May 21, 2015 (USFWS, 2015). The survey was led and performed by URS employees Mr. Doug Zarker, PG, a qualified geologist per TCEQ requirements with demonstrated experience in karst geology, and environmental scientist, Mr. Joe Jandle. The karst field survey was performed by walking transects spaced approximately 50 feet (15 meters) apart across the project area, where accessible. The Critical Environmental Feature (CEF) Survey was conducted simultaneously while conducting the field survey for the Karst Feature Survey because of the overlap involved while walking transects across the project area, where accessible. CEFs are defined as "features that are of critical importance to the protection of environmental resources, and include bluffs, canyon rimrocks, caves, sinkholes, springs, and wetlands." The findings of the CEF Survey are provided on the ERI form prepared for this project.

Prior to initiating the field survey, available geologic maps and available databases were reviewed for any known features (including caves, sinkholes, and faults) within approximately 0.6 miles (one kilometer) of the project limits. Aerial photographs of the project limits and immediately adjacent areas were also reviewed for evidence of fractures, lineaments, sinkholes, faults and other relevant features. Using ArcMap GIS, the next step required downloading available digital data and plotting the boundary of the project area onto a topographic and aerial base map showing the contour data and boundaries established for the project area. This data was also imported into a portable GPS receiver and Avenza Maps for iOS. Using the aerial base maps and GPS device, the team was able to maintain proper transect width for the field survey. Using the GPS unit or compass, a bearing was obtained and the two person survey team proceeded in walking transects across the project area, gradually conducting the survey across the project area where accessible.

Based on the field survey and review of available literature, two karst features or point recharge features were identified within the project area. No other CEFs were observed within the project area. We contacted the Watershed Protection and Development Review (WSPDR) Department of the COA to see if any previous geologic data was available for these two features. Ms. Sylvia Pope, with WSPDR, provided a brief history and background information for the two features identified. An easement for the water quality/CEF buffer zone established for the features was also forwarded for review. We understand that there are previous karst surveys, environmental assessments and ERI studies that have been conducted for the site, but none of this information has been made available at this time, other than general confirmation of the limited descriptions and measurements of the karst features presented below. Brief descriptions of the two features as observed during the karst survey are provided below. A map showing the approximate location of the two karst features identified is provided in *Figures 5 and 6*.



**Karst Feature No. 1 (S-1) - Sinkhole** - This feature appeared as an open sinkhole measuring approximately 30 feet long by 18 feet wide and dropping about 10 feet to a moderately soil filled compact floor. The feature developed along a vertical joint fracture bearing approximately N340° W. Evidence of dry, intermittent, very shallow drainages or rivulets about 12 to 16-inches across and no more than two inches deep were noted draining towards the western perimeter of the feature, indicating that the feature receives surface water runoff during rain events. An open bedding plane was also noted near the floor on the north-northeast side of the feature, extending about 15 feet horizontally into the subgrade. Very slight airflow was detected at the time of our site visit. It was reported that the landowner previously conducted an excavation of the sinkhole in 2015 in order to open the open bedding plane or cave passage at the north end. The excavation was later terminated due to safety concerns that additional excavation could potentially lead to collapse. Based upon the characteristics observed in the field,



the relative infiltration rate for this feature was determined to be moderate and it was evaluated as “sensitive” per the TCEQ’s Edwards Aquifer Protection Program. Silt fencing was noted around the perimeter of the feature. We understand that this feature is called the Anderson Mill Road/ZFB sinkhole by the WSPDR staff.



**Karst Feature No. 1 (S-2) - Sinkhole** - This feature appeared as an open sinkhole measuring approximately 12 feet long by 2 feet wide and dropping vertically about 4 feet to a rubble floor. The sinkhole apparently developed along a solution enlarged fracture bearing approximately N320°W. The feature narrows with depth, with evidence of continued subsurface drainage extending into the subgrade along the downgradient wall. Very slight airflow was detected at the time of our site visit. Based upon the characteristics observed in the field, the relative infiltration rate for this feature was determined to be moderate and it was evaluated as “sensitive” per the TCEQ’s Edwards Aquifer Protection Program. Based on our conversation with WSPDR staff, we understand that this feature is located within the catchment basin

of, and is likely associated with the nearby Anderson Mill Road/ZFB sinkhole (S-1) described above.

### 3.0 LIMITATIONS

As previously stated, much of the natural ground cover in the project area has been altered from its “natural state” due to regrading, street, sidewalk and storm drain construction, and residential and commercial development. In addition, it was not feasible during the time of the investigation, to observe the entirety of the land surface of the project area due to private property concerns and accessibility to residential back yard areas. URS’s investigation is limited to information regarding the observed physical characteristics of the project area where accessible and from “over the fence” observations.

No other obvious evidence of karst features, caverns, faults, water wells, or other potential sensitive geologic features were observed during our assessment of the project area. Although this study has attempted to identify the geologic conditions within the project area, karst features or other potentially environmentally sensitive features may have escaped detection as a result of the limitations of this study and the presence of undetected and unreported conditions.

Should additional information regarding any actual or potential geologic conditions within the project area be discovered that differs from that presented in this report, URS should be notified so that the review of the information can be conducted. URS reserves the right to alter the summary and findings of this report based upon the review of additional information provided after the date of this report.

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