



**City of Austin**  
Founded by Congress, Republic of Texas, 1839  
Watershed Protection Department  
P.O. Box 1088. Austin. Texas 78767

---

December 14, 2016

Ms. Paige Najvar  
U.S. Fish and Wildlife Service  
Austin Ecological Services Field Office  
10711 Burnet Road, Suite 200  
Austin, TX 78758  
Ph: (512) 490-0057; ext. 229  
Paige\_Najvar@fws.gov

Dear Ms. Najvar:

Enclosed is the City of Austin's 2016 annual report for the U.S. Fish and Wildlife Service 10(a)1(A) permit (TE-833851) covering scientific activities affecting *Eurycea sosorum*, *E. waterlooensis*, and *E. tonkawae*.

Please do not hesitate to contact me should you require additional information at 512-974-2652, or Nathan Bendik, Watershed Protection Department Environmental Scientist, at 512-974-2040.

Sincerely,

Mike Personett, Assistant Director  
Watershed Protection Department

2016 Annual Report  
U.S. Fish and Wildlife Service Scientific Permit (TE-833851)

Reporting period: December 2015–November 2016

This report documents the activities associated with the Barton Springs and Austin Blind salamanders (*Eurycea sosorum* and *E. waterlooensis*) that are authorized under the above federal endangered species permit for 2016. Tables and figures are numbered by section.

**TE-833851, Section S., Permit Condition 6: General Annual Reporting Requirements for Barton Springs and Austin Blind salamanders**

1) Precise locations of previously undocumented surveyed areas

None.

2) Dates of surveys conducted

Please see # 4, below.

3) Survey methods

Barton Springs and Austin Blind salamander counts were conducted quarterly throughout the year at Parthenia, Eliza, Old Mill (Sunken Gardens) and Upper Barton springs. For each survey, the date, weather, type of flow (base flow or storm flow) and aquifer discharge are recorded by the U.S. Geological Survey station at Parthenia Spring. Each site was searched using a drive survey method where all non-embedded substrate is searched, except for at Old Mill Spring, where a timed survey is used due to the low abundance of salamanders at that site. Every individual salamander found was identified to species and categorized by total length (0–1", 1–2", >2") or measured from photographs (if a mark-recapture survey). For mark-recapture surveys (currently at Eliza and Upper Barton springs), salamanders are captured using small handheld dip nets, photographed, and returned to the spring within 3–4 hours. The total number of salamanders of each species and size class found were recorded, although we only present the totals below.

4) Survey results

Salamander counts from 2016 surveys are presented in Table 1, below.

**Table 1. Barton Springs and Austin Blind salamander counts from 2016.**

<i>Eurycea sosorum</i>			<i>Eurycea waterlooensis</i>		
Site	Date	Total number	Site	Date	Total number
Parthenia	11/17/16	87	Parthenia	11/17/16	0
Old Mill	11/8/16	2	Old Mill	11/8/16	0
UBS	11/8/16	0	UBS	11/8/16	0
Eliza	11/3/16	79	Eliza	11/3/16	1
Eliza	10/31/16	73	Eliza	10/31/16	0
Eliza	10/28/16	102	Eliza	10/28/16	0
Eliza	8/29/16	78	Eliza	8/29/16	0
Eliza	8/26/16	61	Eliza	8/26/16	0
Eliza	8/23/16	77	Eliza	8/23/16	0
Old Mill	8/11/16	5	Old Mill	8/11/16	0
Parthenia	8/11/16	15	Parthenia	8/11/16	1
UBS	8/2/16	1	UBS	8/2/16	0
Eliza	7/11/16	64	Eliza	7/11/16	0

Eliza	7/8/16	44	Eliza	7/8/16	0
Eliza	7/5/16	47	Eliza	7/5/16	0
Old Mill	5/25/16	3	Old Mill	5/25/16	1
Parthenia	5/25/16	0	Parthenia	5/25/16	0
Eliza	5/24/16	63	Eliza	5/24/16	0
UBS	5/5/16	1	UBS	5/5/16	0
*Eliza	3/7/16	81	Eliza	3/7/16	0
Eliza	3/4/16	79	Eliza	3/4/16	0
Eliza	3/1/16	123	Eliza	3/1/16	0
Old Mill	2/11/16	0	Old Mill	2/11/16	0
Parthenia	2/11/16	0	Parthenia	2/11/16	0
UBS	2/4/16	3	UBS	2/4/16	0

\*Totals for Eliza surveys in March 2016 were corrected after report submission to FWS

5) Results of species identifications

None

6) Number of salamanders collected from the wild

Salamanders collected from the wild (salvaged or collected alive for ongoing genetic research) are presented in Table 2, below.

**Table 2. Salamanders collected from the wild (N=18 *E. sosorum*, 1 *E. waterlooensis*). Salvaged individuals were killed or injured during surveys or habitat maintenance activities, or otherwise found dead. Individuals that were collected alive were done so to serve as voucher specimens from localities outside of the Barton Springs complex and to confirm species identity. All collected individuals have been deposited in the Biodiversity Collections at the University of Texas at Austin.**

Field ID	Species	County	Site	Date	Notes
TJD 1050	<i>E. sosorum</i>	Travis	Upper Barton Spring	2/4/16	salvaged
TJD 1055	<i>E. sosorum</i>	Travis	Parthenia Spring	2/11/16	salvaged
TJD 1061	<i>E. sosorum</i>	Travis	Cold Spring	3/7/16	collected alive
TJD 1062	<i>E. sosorum</i>	Travis	Old Mill Spring	3/8/16	salvaged
TJD 1063	<i>E. sosorum</i>	Travis	Old Mill Spring	3/8/16	salvaged
TJD 1064	<i>E. sosorum</i>	Travis	Cold Spring	3/9/16	salvaged
TJD 1065	<i>E. sosorum</i>	Travis	Cold Spring	3/9/16	collected alive
TJD 1066	<i>E. sosorum</i>	Travis	Cold Spring	3/17/16	collected alive
TJD 1067	<i>E. sosorum</i>	Travis	Cold Spring	3/17/16	collected alive
TJD 1068	<i>E. sosorum</i>	Travis	Cold Spring	4/4/16	collected alive
TJD 1084	<i>E. sosorum</i>	Travis	Cold Spring	4/14/16	collected alive
TJD 1088	<i>E. sosorum</i>	Travis	Old Mill Spring	7/15/16	salvaged
TJD 1089	<i>E. sosorum</i>	Travis	Old Mill Spring	7/15/16	salvaged
TJD 1090	<i>E. sosorum</i>	Travis	Old Mill Spring	7/15/16	salvaged
TJD 1097	<i>E. sosorum</i>	Travis	Eliza Spring	8/26/16	salvaged
TJD 1117	<i>E. waterlooensis</i>	Travis	Parthenia Spring	11/10/16	salvaged
TJD 1118	<i>E. sosorum</i>	Hays	spring on Onion Creek	11/15/16	collected alive
TJD 1119	<i>E. sosorum</i>	Travis	Parthenia Spring	11/17/16	salvaged

7) Number of salamanders handled and marked with elastomers

None

8) Observations of abnormal behavior or condition of salamanders handled/marked

A gravid female Barton Springs Salamander was found dying/dead at Upper Barton Spring on February 4, 2016 with gas bubble disease syndrome. Other salamanders and fish have been observed with this same condition at this site in the past, presumably due to dissolved gas supersaturation.

9) Results of any mark-recapture work

We conducted robust-design mark-recapture sampling at Eliza Spring using photographic identification methods in March, July, August, and October. Abundance estimates are provided in Table 3, below.

**Table 3. Salamander abundance estimated from photographic capture-recapture at Eliza Spring for four primary sampling sessions in 2016. Shown are estimates of abundance ( $\hat{N}$ ), standard error, and upper and lower confidence limits.**

Month	N-hat	SE	lower	upper
March	195	11	179	222
July	127	11	112	155
August	151	10	136	177
October	190	11	173	218

10) Results of genetic research conducted as a result of tail-clipping

Collecting for research on the population genetics of *Eurycea sosorum* is ongoing. Samples have not yet been submitted for DNA sequencing. A list of tail-tip samples collected in 2016 (N=38) is found in Table 4, below.

**Table 4. List of tail-tip samples collected for genetic work.**

Field ID	Species	County	Site	Date
TJD 1048	<i>E. sosorum</i>	Travis	Upper Barton Spring	2/4/16
TJD 1049	<i>E. sosorum</i>	Travis	Upper Barton Spring	2/4/16
TJD 1051	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1052	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1053	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1054	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1056	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1057	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1058	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1059	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1060	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	2/11/16
TJD 1069	<i>E. sosorum</i>	Travis	Old Mill Spring	4/4/16
TJD 1070	<i>E. sosorum</i>	Travis	Old Mill Spring	4/4/16
TJD 1071	<i>E. sosorum</i>	Travis	Old Mill Spring	4/4/16
TJD 1072	<i>E. sosorum</i>	Travis	Old Mill Spring	4/4/16
TJD 1073	<i>E. sosorum</i>	Hays	Ashmun Ranch	4/7/16
TJD 1074	<i>E. sosorum</i>	Hays	Ashmun Ranch	4/7/16
TJD 1075	<i>E. sosorum</i>	Hays	Ashmun Ranch	4/7/16
TJD 1076	<i>E. sosorum</i>	Hays	Ashmun Ranch	4/7/16
TJD 1077	<i>E. sosorum</i>	Hays	Ashmun Ranch	4/7/16
TJD 1078	<i>E. sosorum</i>	Hays	Spillar Ranch Spring 1	4/7/16

TJD 1079	<i>E. sosorum</i>	Hays	Spillar Ranch Spring 1	4/7/16
TJD 1080	<i>E. sosorum</i>	Hays	Spillar Ranch Spring 1	4/7/16
TJD 1081	<i>E. sosorum</i>	Hays	Spillar Ranch Spring 1	4/7/16
TJD 1082	<i>E. sosorum</i>	Hays	Spillar Ranch Spring 1	4/7/16
TJD 1083	<i>E. sosorum</i>	Hays	Spillar Ranch Spring 1	4/7/16
TJD 1085	<i>E. sosorum</i>	Travis	Old Mill Spring	5/2/16
TJD 1086	<i>E. sosorum</i>	Travis	Old Mill Spring	5/3/16
TJD 1087	<i>E. sosorum</i>	Travis	Upper Barton Spring	5/5/16
TJD 1091	<i>E. sosorum</i>	Travis	Upper Barton Spring	8/2/16
TJD 1094	<i>E. sosorum</i>	Travis	Old Mill Spring	8/11/16
TJD 1095	<i>E. sosorum</i>	Travis	Old Mill Spring	8/11/16
TJD 1099	<i>E. sosorum</i>	Travis	Old Mill Spring	9/27/16
TJD 1100	<i>E. sosorum</i>	Travis	Old Mill Spring	10/5/16
TJD 1113	<i>E. sosorum</i>	Travis	Old Mill Spring	11/9/16
TJD 1114	<i>E. sosorum</i>	Travis	Old Mill Spring	11/9/16
TJD 1115	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	11/10/16
TJD 1116	<i>E. sosorum</i>	Travis	Parthenia Spring (Barton Springs Pool)	11/10/16

11) Results of any research or management activities authorized by this permit and approved through the submission of study plans to the CPI Branch of the Austin ESFO

- a. City of Austin monitors water quality in the Barton Springs Complex under this permit to meet the requirements of the Habitat Conservation Plan contained in the USFWS 10(a)(1)(B) permit PRT-839031 and the Texas Pollutant Discharge Elimination System permit WQ0004705000 (EPA NPDES TXS000401). Permitted staff collect water samples from each spring in the Barton Springs complex. On an approximately biweekly frequency, tested parameters include total suspended solids, volatile suspended solids, N03+N02-N, NH3-N, Ortho-P, temperature, dissolved oxygen, pH, conductivity, and turbidity. Quarterly sampling includes biweekly parameters plus alkalinity, Ca, Na, K, Mg, Cl, S04, F, As, Cu, Fe, Pb, Ni, Zn. TPDES annual sampling includes all of the above plus Hardness, Ag, Cd, Cr, Hg, TOC, oil and grease, total polycyclic aromatic hydrocarbons, bromacil, organophosphate pesticides, chlorinated herbicides, volatiles, and semi-volatiles. Additionally, the City of Austin in cooperation with the United States Geological Survey maintains continuous monitoring for spring discharge and physiochemical parameters at Barton Springs.
- b. U.S. Geological Survey deploys and maintains water quality sampling equipment in Parthenia Spring. Equipment was serviced by USGS dive teams.
- c. The USGS (Barbara Mahler, PI) also collected water samples to examine concentrations of glyphosphate and atrazine. They have reported non-detections on both atrazine and glyphosate at all four spring sites (Upper, Old Mill, Eliza, and Parthenia). Atrazine detection level: 0.1 ug/L  
Glyphosate detection level: 0.2 ug/L.
- d. City of Austin staff collect sediment samples at Barton Springs for testing to meet requirements of the City's TPDES permit. Samples were collected on 1/7/16, 3/3/16, 4/25/16, 7/8/16, and 12/14/16.
- e. Results of *E. sosorum* and *E. tonkawae* hormone studies are being prepared for publication in collaboration with Texas State University (Caitlin Gabor, PI). A description of the assay for this work and some results have been published (Gabor et al., 2016).

- f. Results from a study of *E. tonkawae* movement and stream occupancy were published in March. The article can be accessed at <https://peerj.com/articles/1817/>.

## TE-833851 Permit Condition: Captive Breeding Annual Reporting Requirements

- 1) The number of *Eurycea sosorum*, *E. waterlooensis*, and *E. tonkawae* held at the captive breeding facility (including the number of wild-caught and captive-bred individuals from each spring site collected).

**Table 1. Inventory of salamanders in the captive breeding program. WC=wild caught, CB=captive bred.**

Species	Spring of Origin	WC	CB>6 mo.	CB<6 mo.
<i>Eurycea sosorum</i>	Parthenia	8	47	0
	Old Mill	6	190	0
	Eliza	30	98	0
	UBS	0	11	0
	Dallas Aquarium <sup>1</sup>	0	3	0
<b>Total</b>		<b>44</b>	<b>349</b>	<b>0</b>
<i>E. waterlooensis</i>	Parthenia	0	NA <sup>2</sup>	NA <sup>2</sup>
	Old Mill	7	NA <sup>2</sup>	NA <sup>2</sup>
	Eliza	1	NA <sup>2</sup>	NA <sup>2</sup>
	UBS	0	NA <sup>2</sup>	NA <sup>2</sup>
<b>Total</b>		<b>8</b>	<b>31</b>	<b>0</b>
<i>E. tonkawae</i>	Bull Creek	6	4	0
	McDonald Well	0	5	0
	SAS Canyon	5	0	0
	Testudo Tube	2	0	0
	Wheless	4	0	0
<b>Total</b>		<b>17</b>	<b>9</b>	<b>0</b>

<sup>1</sup> Founder salamanders for the Dallas Aquarium captive population were collected from more than one spring site (Parthenia and Old Mill) and mixed together. COA has F2's from Dallas F1's that were used for educational purposes at the Splash! Into the Edwards Aquifer exhibit at Barton Springs in Zilker Park.

<sup>2</sup> *E. waterlooensis* are not separated and bred according to spring site of origin due to the fact that the species is primarily aquifer-dwelling.

<sup>3</sup> Eggs preserved to manage the population size and genetic diversity (prevent a disproportionate number of offspring produced from a single reproductive group, or to minimize inbreeding)

- 2) Number of observations of courtship behavior, spermatophores, spermatophore depositions, sperm transfers, and ovipositions.

In 2016, courtship behavior was observed in both wild-caught and captive-bred salamanders. In general, salamanders are not disturbed by City staff during courtship. Because salamanders can store sperm, observed courtship behavior does not necessarily result in immediate egg-laying. Each oviposition with viable offspring represents at least one sperm transfer, and possibly multiple transfers. Oviposition data are presented in Table 2.

**Table 2. Ovipositions in captivity 12/01/15-12/01/16. Tank I.D. indicates spring site of origin, reproductive group, and wild-caught or captive-bred status. Individuals in reproductive groups are recorded in order to follow actual or potential dams and sires. BSP denotes groups from Parthenia Spring, E, groups from Eliza Spring, OM, groups from Old Mill Spring, UBS, groups from Upper Barton Spring, and F, captive-bred**

salamanders.

Estimated Oviposition Date	Tank ID	Clutch Size	No. Hatched
<i>Eurycea sosorum</i>			
12/06/15	BSP (C01B)	13	4
12/06/15	BSPF2 (C156)	9	NA <sup>3</sup>
12/06/15	OMF1 (C176)	18	NA <sup>3</sup>
12/14/15	OMF2 (C225B)	6	NA <sup>3</sup>
12/22/15	OMF1 (C82)	16	NA <sup>3</sup>
12/22/15	OMF2 (C152)	15	NA <sup>3</sup>
12/22/15	EF1 (C154)	1	NA <sup>3</sup>
12/25/15	OMF2 (C227)	10	NA <sup>3</sup>
12/28/15	OMF1 (C109)	7	NA <sup>3</sup>
12/28/15	OMF2 (C184)	13	NA <sup>3</sup>
12/28/15	OMF1 (C146B)	23	NA <sup>3</sup>
12/31/15	EF2 (C236)	18	NA <sup>3</sup>
12/31/15	EF1 (C150)	12	NA <sup>3</sup>
01/01/16	BSPF2 (C226)	5	NA <sup>3</sup>
01/06/16	OMF1 (C146C)	12	NA <sup>3</sup>
01/13/16	OMF1 (C146A)	15	NA <sup>3</sup>
01/26/16	EF1 (C154)	15	NA <sup>3</sup>
03/07/16	EF2 (C243)	11	NA <sup>3</sup>
04/25/16	OMF1 (C176)	13	NA <sup>3</sup>
05/08/16	OMF2 (C227)	1	NA <sup>3</sup>
10/01/16	OMF1 (C187)	6	NA <sup>3</sup>
10/31/16	OMF1 (C159)	1	NA <sup>3</sup>
11/04/16	OMF1 (C146C)	10	NA <sup>3</sup>
<i>Eurycea waterlooensis</i>			
03/21/16	CB (CW20)	16	15

3) Information on clutch sizes (range, mean, and standard deviation) and hatching success (range, mean, and standard deviation)

**Table 3. Salamander clutch size and hatching success – 12/01/15-12/01/16**

	Range	Mean	Standard Deviation
<i>E. sosorum</i>			
Clutch Size	1-23 (N=23)	10.9	5.8
No. Hatched	NA	4 (N=1)	NA
% Hatching	NA	31.0 (N=1)	NA
<i>E. waterlooensis</i>			
Clutch Size	NA	16 (N=1)	NA
No. Hatched	NA	15 (N=1)	NA
% Hatching	NA	93.7 (N=1)	NA

5) Salamander Mortalities (including age and cause of death, if known)

**Table 4. Salamander Mortalities 12/01/15–12/01/16**

Species	Wild-Caught	Age (years)	No.	Cause of Death (health
---------	-------------	-------------	-----	------------------------

	or Captive- Bred		Mortalities	condition observed)
<i>Eurycea sosorum</i>	WC	10-13* <sup>4</sup>	6	Senescence (3 with edema)
	CB	3-5	3	Unknown (1 with scoliosis)
	CB	5-7	6	Unknown
	CB	7-9	14	Unknown (5 with scoliosis)
	CB	9-11	3	Senescence (1 with edema)
	CB	2-6 6-10 10-15	6 7 5	Euthanized for pathology work
<i>Eurycea waterlooensis</i>	WC	15* <sup>4</sup>	2	Senescence
	CB	13	1	Senescence (also scoliosis)
	CB	7	4	Possible problem with tank flow
<i>Eurycea tonkawae</i>	WC	11-12 <sup>4</sup>	4	Senescence

<sup>4</sup> Age of wild-caught salamanders is estimated based on size at collection, with a maximum estimated age of 1.5 years for salamanders > 2 inches total length at collection.

#### 6) Information on Obvious Health Conditions or Behavioral Aberrations

We submitted captive-raised salamanders, as listed in the table below, to veterinary pathologist Dr. Allan Pessier at Washington State University for investigation of health issues. Preliminary results (attached) indicate that *Batrachochytrium dendrobatidis* may be a factor. More in-depth pathology work is in progress. In addition, an experiment on the effect of antifungal treatment on salamander feet is planned.

Health Condition	No. Salamanders	Ages (years) of Individuals
Edema	2	6, 10
Scoliosis	6	5, 5, 6, 9, 10, 14
Swims in circles	1	13
Toe Loss	5	3, 3, 6, 6, 6
No problem	4	2, 4, 6, 6

#### 7) Special Projects

The captive breeding program provides support and salamanders for the public display tank at the Splash! Into the Edwards Aquifer Educational Exhibit. WPD staff are working with Splash! staff to adjust display tank maintenance practices.

### **TE-833851, Section T, Permit Condition 6: General Annual Reporting Requirements for Jollyville Plateau Salamanders**

No research activities were performed on Jollyville Plateau salamanders or within Jollyville Plateau

salamander habitat.

**TE-833851, Section U, Permit Condition 6: General Annual Reporting Requirements for San Marcos Salamanders**

No research activities were performed on San Marcos salamanders (*Eurycea nana*) or within San Marcos Salamander habitat.

**TE-833851, Section V., Permit Condition 6: General Annual Reporting Requirements for Karst Invertebrates**

During the course of hydrogeological work, City of Austin permitted staff entered several caves that may harbor protected karst invertebrates. These caves, the dates of entry, City personnel, purpose of visit, and relevant observations are presented in the table below.

<b>Date</b>	<b># Entrants</b>	<b>Cave</b>	<b>Purpose</b>	<b>Individuals</b>
1/9/16	20	Maple Run Cave	Hydrogeological Study-Dye Receptors Collection, Education for Explore Austin	Justin Shaw, Keenan McDonald, Trish Porter and 17 others
1/11/16	2	Flint Ridge Cave	Hydrogeological Study-Flood Damage Assessment and Replacing Dye Receptors	Justin Shaw, Vivian Loftin
1/16/16	19	Goat Cave	Hydrogeological Study-Geologic Mapping and Education for Explore Austin	Nico Hauwert, Justin Shaw, Lee Jay Graves, Keenan McDonald and 15 others
1/29/16	3	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup in Balcony Room	Justin Shaw, Drew Thompson, Patty Calabrese
1/31/16	2	Flint Ridge Cave	Hydrogeological Study-Collecting Water Samples	Justin Shaw, Peter Harper
2/2/16	11	Maple Run Cave	Cave Exploration	Drew Thompson, Patty Calabrese and 9 UT Grotto Members
2/6/16	4	Flint Ridge Cave	Hydrogeological Study-Haul out autosampler computer control units, Excavation in Balcones Room	Justin Shaw, Galen Falgout, Tom Rogers, Amy Morton
2/7/16	8	District Park Cave	Youth Education and Download HOBOS for BCCP drip monitoring	Justin Shaw, Davey Siddons, Ken Demarest, Jennifer Demarest, Will Demarest, Isabel Veber, Vivian Veber, Nikolas Veber
2/15/16	4	District Park Cave	Service HOBOS for BCCP drip monitoring	Justin Shaw, Davey Siddons, Elliott Morneault, Peter Dash Gott
2/25/16	3	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup in Cheese and Chocolate Room	Justin Shaw, Davey Siddons, Vivian Loftin
2/28/16	2	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup in Fault Dome and Drip Pit	Justin Shaw, Ken Demarest
3/12/16	2	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup in Balcony Room	Justin Shaw, Peter Dash Gott
3/13/16	6	Midnight Cave	Cave Exploration	Drew Thompson and 5 UT Grotto Members
3/14/16	3	Maple Run Cave	Cave Exploration	Drew Thompson, Patty Calabrese and 1 UT Grotto Member
3/16/16	2	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup in Balcony Room	Justin Shaw, Davey Siddons
3/21/16	2	Flint Ridge Cave	Hydrogeological Study-Deploy HOBOS	Justin Shaw, Davey Siddons
3/23/16	2	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup	Justin Shaw, Davey Siddons
3/25/16	2	Flint Ridge Cave	Upper Upset Passage Discovery	Justin Shaw, Davey Siddons
3/27/16	4	Midnight Cave	Cave Exploration	Drew Thompson and 3 UT Grotto Members
3/28/16	3	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup	Justin Shaw, Davey Siddons, Peter Dash Gott
3/31/16	3	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup	Justin Shaw, Davey Siddons, Vivian Loftin
4/2/16	3	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup	Justin Shaw, Davey Siddons, Mimi Alexander
4/3/16	3	Midnight Cave	Cave Exploration	Drew Thompson and 2 UT Grotto Members

4/6/16	2	Flint Ridge Cave	Hydrogeological Study-Replacing Dye Receptors upper Flint Ridge	Justin Shaw, Davey Siddons
4/7/16	2	Flint Ridge Cave	Hydrogeological Study-HOBO Servicing	Justin Shaw, Davey Siddons
4/9/16	2	Flint Ridge Cave	Hydrogeological Study-Deploy Hydrolab	Justin Shaw, Davey Siddons, Vivian Loftin
4/11/16	3	Flint Ridge Cave	Hydrogeological Study-Monitoring Setup	Justin Shaw, Davey Siddons
4/15/16	4	Flint Ridge Cave	Hydrogeological Study-Replacing Dye Receptors lower Flint Ridge, Collecting Water Samples and Activate Autosamplers for sampling	Justin Shaw, Davey Siddons, Vivian Loftin, Yazmin Avila
4/17/16	8	Midnight Cave	Cave Exploration	Drew Thompson and 7 UT Grotto Members
4/20/16	6	Flint Ridge Cave	Hydrogeological Study-Collecting Water Samples	Justin Shaw, Davey Siddons, Vivian Loftin, Yazmin Avila, Brian Cowan, Jessica Gordon
4/25/16	5	Flint Ridge Cave	Hydrogeological Study-Collecting Water Samples and Replacing Dye Receptors upper Flint Ridge	Justin Shaw, Davey Siddons, Vivian Loftin, Yazmin Avila, Dash Gott

## References

- Bendik, N.F., Morrison, T.A., Gluesenkamp, A.G., Sanders, M.S., O'Donnell, L.J. 2013. Computer-assisted photo identification outperforms visible implant elastomers in an endangered salamander, *Eurycea tonkawae*. PLoS One 8, e59424. doi:10.1371/journal.pone.0059424
- Gabor, C.R., Zabierek, K.C., Kim, D.S., Alberici Da Barbiano, L., Mondelli, M.J., Bendik, N.F. and Davis, D.R. 2016. A non-invasive water-borne assay of stress hormones in aquatic salamanders. *Copeia* 104(1) 172–181.