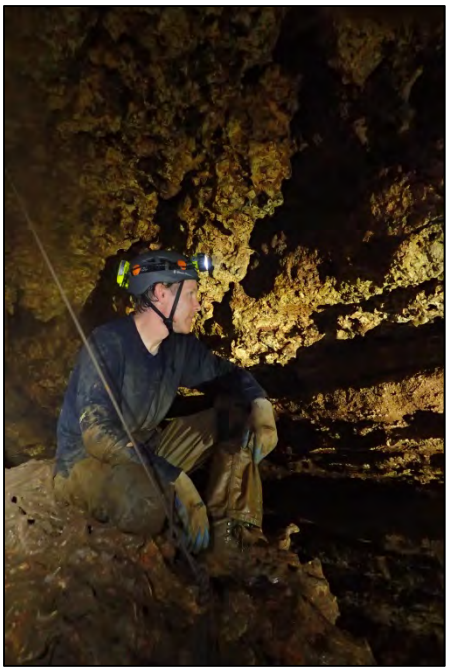
Balcones Canyonlands Preserve
Karst Monitoring and Management
FY 2016 Annual Report



Todd Bayless after completing a survey in Flint Ridge Cave, Travis County.
Photo by Jonny Scalise

Travis County
Department of Transportation and Natural Resources
Natural Resources and Environmental Quality Division
and
City of Austin BCP – Austin Water Utility (AWU)

October 1, 2015 – September 30, 2016

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CITY OF AUSTIN (36 REPORTS)

1.0 REGIONAL PERMIT

There are six species of endangered karst invertebrates (ES; Table 1) and 25 karst species of concern (SOC; Table 2) covered by the Balcones Canyonlands Conservation Plan (BCCP), a regional 10(a)1(B) permit issued by the U.S. Fish and Wildlife Service (USFWS) to the City of Austin (COA) and Travis County (TC) in May 1996 (USFWS 1996a). If these 25 species of concern become listed as endangered in the future, no additional mitigation will be necessary to protect them, provided that all karst protection requirements outlined in the BCCP are fully implemented.

The Regional Permit requires protection of 35 endangered species caves and 27 additional caves that support SOC, for a total of 62 karst features (60 caves, one mine and one karst spring). Several of these karst features occur in clusters, identified in the Regional Permit's associated Habitat Conservation Plan/Environmental Impact Statement (HCP/EIS) as the Four Points, McNeil, and Northwood cave clusters (USFWS 1996b). As of Fiscal Year 2016 (FY16), 50 of the 62 BCCP karst features have some form of formal protection on properties owned and managed by COA, TC, and BCCP partners, as well as private mitigation lands.

Table 1. Federally Listed Karst Species Covered by the BCCP
Footnotes follow table

Common Name	Scientific Name
Tooth Cave pseudoscorpion	*Tartarocreagris texana*
Tooth Cave spider	*Tayshaneta myopica*[1]
Tooth Cave ground beetle	*Rhadine persephone*
Kretschmarr Cave mold beetle	*Texamaurops reddelli*
Bee Creek Cave harvestman	*Texella reddelli*
Bone Cave harvestman	*Texella reyesi*

[1] *Tayshaneta myopica* is listed in the regional permit as *Neoleptoneta myopica*, but a 2012 study revised the genus *Neoleptoneta*, thus identifying this species in the genus *Tayshaneta* (Campbell et al. 2012).

Table 2. Karst Species of Concern Covered by the BCCP

Footnotes follow table

Common Name	Scientific Name
Flatworm	*Sphalloplana mohri*
Ostracod	*Candona* sp. nr. *stagnalis*
Isopod	*Caecidotea reddelli*
Isopod	*Trichoniscinae N. S.*
Isopod	*Miktoniscus N. S.*
Spider	*Cicurina bandida*
Spider	*Cicurina cueva*
Spider	*Cicurina ellioti*
Spider	*Cicurina reddelli*
Spider	*Cicurina reyesi*
Spider	*Cicurina travisae*
Spider	*Cicurina wartoni*
Spider	*Tayshaneta concinna*[1]
Spider	*Tayshaneta devia*[1]
Spider	*Eidmannella reclusa*
Pseudoscorpion	*Aphrastochthonius* N. S.
Pseudoscorpion	*Tartarocreagris comanche*[2]
Pseudoscorpion	*Tartarocreagris reddelli*
Pseudoscorpion	*Tartarocreagris intermedia*
Pseudoscorpion	*Tartarocreagris* N. S. 3
Harvestman	*Texella spinoperca*
Millipede	*Speodesmus* N. S
Ground Beetle	*Rhadine s. subterranea*
Ground Beetle	*Rhadine s. mitchelli*
Ground Beetle	*Rhadine austinica*

[1] *Tayshaneta concinna* and *Tayshaneta devia* are listed in the regional permit with the genus *Neoleptoneta*, but a 2012 study revised the genus *Neoleptoneta*, thus identifying these species in the genus *Tayshaneta* (Campbell et al. 2012).

[2] *Tartarocreagris comanche* is improperly listed in the regional permit as the New Comanche Trail Cave harvestman.

2.0 CAVE MANAGEMENT SUMMARY

This annual report covers the fiscal year 10/01/15- 9/30/16 (FY16). In FY16, the BCCP partners continued efforts to determine and track the status of the 62 karst features covered by the BCCP 10(a) permit. The permit holders continued efforts to acquire, protect, and monitor the karst species in the caves included in the Permit (see Tables 3 and 5 for species localities).

A total of 50 of the BCCP caves are "protected" in some way, with 12 "unprotected". The 50 "protected" BCCP caves are currently managed as follows: 22 caves protected as part of the BCP on COA land; one cave protected on The Nature Conservancy (TNC) land; 13 caves protected as part of the BCP on TC land; two caves protected on Texas Cave Management Association (TCMA) land; eight caves protected as part of private Section 10(a) or Section 7 agreements with USFWS; and four caves that have protection agreements that include development setbacks from the cave entrance. Some of these "protected" caves only have protected entrances, but are threatened by surrounding development or planned development. Ownership and protection status of each of the 62 BCCP caves is detailed in Table 7 below.

In addition to protecting and monitoring caves covered by the BCCP permit, COA and TC also provide protection for other karst features found on the BCP containing ES and SOC (Tables 4 and 6). Some of these additional karst features are incorporated into TC and COA's shared biological monitoring program, as described in Section 6.0. As of FY16, 13 endangered species karst features which were not listed on the BCCP permit are being protected on BCP lands (six features on TC BCP; seven features on COA BCP; Table 4). Additionally, 11 SOC karst features not listed on the Permit are also being protected on BCP lands (six features on TC BCP; five features on COA BCP; Table 6).

To assist with analyzing the adequacy of the current preserve design for each karst feature, including the amount of surface and subsurface habitat needed to support these ecosystems, the COA and TC have been working together to maintain a comprehensive database for the 62 features and other features identified within the BCP since the regional permit was issued in 1996. The database also incorporates monitoring data and management issues for each karst feature. The karst database is discussed in more detail in Section 5.0.

Table 3. Endangered Karst Invertebrate Locations within BCCP caves of Travis County, Texas.

This table, originally in the BCCP 1996 documents, has been revised to show new species location information. *Key and footnotes follow table.*

Cave Name	**Current Preserve Status**	**Karst Fauna Region**	**Tooth Cave Pseudoscorpion** *Tartarocreagris texana*	**Tooth Cave Spider** *Tayshaneta myopica*	**Tooth Cave Ground Beetle** *Rhadine persephone*	**Kretschmarr Cave Mold Beetle** *Texamaurops reddelli*	**Bee Creek Cave Harvestman** *Texella reddelli*	**Bone Cave Harvestman** *Texella reyesi*
Amber Cave	BCP Jollyville/ TC	Jollyville Plateau	X 1996		X 2010 (Reddell)	X 1996		
Bandit Cave	Private	Rollingwood					P 1996 X 2009	
Beard Ranch Cave	BCP Ivanhoe/COA	Jollyville Plateau						X 1996
Bee Creek Cave	Private	Rollingwood					X 1996	
Broken Arrow Cave	BCP Lime Creek Preserve/COA	Cedar Park			X 1996			
Cold Cave	Private	McNeil/Round Rock						X 1996
Cotterell Cave	BCP Spicewood Springs Park/COA	Central Austin						X 1996
Disbelievers Cave	BCP Private 10(a)	Jollyville			X 1996			
Eluvial Cave	BCP Private 10(a)	Jollyville						X 1996
Fossil Cave	BCP Schroeter Park/COA	McNeil/Round Rock						X 1996
Fossil Garden Cave	Private	McNeil/Round Rock						X 1996
Gallifer Cave	BCP Jollyville/TC	Jollyville Plateau		P 1996 X 2010 (Ledford)	P 1996 X 2005	X 2009 (Chandler)		X 1996
Hole-in-the-Road Cave	Private	McNeil/Round Rock						X 1996
Japygid Cave	BCP Private 10(a)	Jollyville			X 1996	P 1996 X 2005		
Jest John Cave	BCP Forest Ridge/COA	Jollyville Plateau					X 1996	

Cave Name	**Current Preserve Status**	**Karst Fauna Region**	**Tooth Cave Pseudoscorpion** *Tartarocreagris texana*	**Tooth Cave Spider** *Tayshaneta myopica*	**Tooth Cave Ground Beetle** *Rhadine persephone*	**Kretschmarr Cave Mold Beetle** *Texamaurops reddelli*	**Bee Creek Cave Harvestman** *Texella reddelli*	**Bone Cave Harvestman** *Texella reyesi*
Jester Estates Cave	BCP Forest Ridge/COA	Jollyville Plateau	X 2008 (Cokendolpher)	X 2010 (Ledford)			X 1996	
Jollyville Plateau Cave	BCP Private 10(a)	Jollyville			X 1996			X 1996
Kretschmarr Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996	X 1996		
Kretschmarr Double Pit	BCP Jollyville/TC	Jollyville Plateau	P 1996 X 2005		P 1996 X 2005	X 2016 (Reddell)	P 1996	
Lamm Cave	Private Section 7	Jollyville Plateau			X 1996			
Little Bee Creek Cave	BCP Ullrich WTP/COA	Rollingwood					X 1996	
McDonald Cave	BCP Jollyville/TC	Jollyville Plateau						X 1996
McNeil Bat Cave	Private	McNeil/Round Rock		X 2010 (Ledford)				X 1996
M.W.A. Cave	BCP Private 10(a)	Jollyville	P 1996 X 2005		X 1996	P 1996 X 2005		X 1996
New Comanche Trail Cave	BCP Lake Travis/TC	Jollyville Plateau		X 1996				X 1996
No Rent Cave	Private	McNeil/Round Rock						X 1996
North Root Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996			
Rolling Rock Cave	BCP Lime Creek Preserve/ COA,Sec.10(a)	Cedar Park			X 1996			
Root Cave	BCP Jollyville/TC	Jollyville Plateau		X 2010 (Ledford)	X 1996			X 1996
Spider Cave	BCP Park West/COA	Jollyville Plateau			X 2004 (Reddell)		X 2004 (Reddell)	

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion *Tartarocreagris texana*	Tooth Cave Spider *Tayshaneta myopica*	Tooth Cave Ground Beetle *Rhadine persephone*	Kretschmarr Cave Mold Beetle *Texamaurops reddelli*	Bee Creek Cave Harvestman *Texella reddelli*	Bone Cave Harvestman *Texella reyesi*
Stark's North Mine Cave	BCP Stark's/TC	Not within a KFR					X 2009 (USFWS)	
Stovepipe Cave	BCP Canyon Creek/ COA	Jollyville Plateau			X 1996	X 1996		P 1996 X 2009 (USFWS)
Tardus Hole	BCP Jollyville/TC	Jollyville Plateau			X 1996	X 2009 (Chandler)		
Tooth Cave	BCP Jollyville/TC	Jollyville Plateau	X 1996	X 1996	X 1996	X 1996		X 1996
Weldon Cave	Private	McNeil/Round Rock						X 1996

Sources: BCCP Permit 1996, Elliott 1992, USFWS 1994, Reddell 2004 and 2005, HNTB 2005, USFWS 2009a, 2009b, Ledford 2010

Key and Footnotes

X 1996 = confirmed occurrence based on collected specimen, the designation in the 1996 BCCP permit
P 1996 = probable occurrence based on observation but not confirmed with collected specimen, the designation in 1996 BCCP permit
X 2004 (Reddell) = confirmed by J. Reddell (pers. comm 2004)
X 2005 = was listed as confirmed in the HNTB summary of James Reddell's data, 2005 report for USFWS
X 2008 = Cokendolpher (pers. comm 2008) confirmed that Jester Estates Cave is a new site for *Tartarocreagris texana*
X 2009 = USFWS - according to the 2009 5 year review on *Texella reyesi* the report lists *T. reyesi* as confirmed for Stovepipe Cave; *Texella reddelli* 5-year review confirms *T. reddelli* for Stark's North Mine (USFWS 2009c).
X 2009 (Chandler) = confirmed by D. Chandler, as reported in USFWS 5-year review (2009b).
X 2010 (Ledford) = confirmed by J. Ledford (pers. comm 2010)
X 2010 (Reddell) = confirmed by J. Reddell (pers. comm 2010)
X 2016 (Reddell) = confirmed by J. Reddell (pers. comm 2016)

Table 4. Non-BCCP listed Caves/Karst Features with Listed Invertebrates Protected on BCP

Key follows table

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion *Tartarocreagris texana*	Tooth Cave Spider *Tayshaneta myopica*	Tooth Cave Ground Beetle *Rhadine persephone*	Kretschmarr Cave Mold Beetle *Texamaurops reddelli*	Bee Creek Cave Harvestman *Texella reddelli*	Bone Cave Harvestman *Texella reyesi*
Cortana Cave	COA	Jollyville Plateau		X 2010				X 2008
Down Dip Sink	COA	Jollyville Plateau			X 2007a			
Garden Hoe Cave	COA	Jollyville Plateau			X 2007b			
Geode Cave	TC	Jollyville Plateau		X 2008	X 2008			X 2008
LU-11	TC	Jollyville Plateau		X 2008				
LU-12	TC	Jollyville Plateau						X 2008
IV-3	COA	Jollyville Plateau						X 2010
Little Black Hole	COA	Rollingwood					X 2009c	
Merkin Hole	COA	Jollyville Plateau					X 2010	
Pond Party Pit	COA	Jollyville Plateau			X 2016			X 2010
RI-1	TC	Jollyville Plateau					X 2010	
Tight Pit Cave	TC	Jollyville Plateau		X 2010				
Two Trunks Cave	TC	Jollyville Plateau			X 2008 (USFWS)			

Sources: Reddell 2016; USFWS 2008, 2009c; Zara Environmental 2007a, 2007b, 2008, and 2010.

Key: X = confirmed occurrence based on collected specimen.

Table 5. Karst Invertebrate SOC within BCCP Caves, Travis County, Texas[1,2]

Key and footnotes follow table

Cave Name	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae N.S.*
Adobe Springs Cave																				
Airmen's Cave				X							X						X		X	
Amber Cave					X								X							
Armadillo Ranch Sink		X																		
Arrow Cave				X							X									
Bandit Cave				X							X									X
Beard Ranch Cave					X															
Bee Creek Cave				X							X									
Blowing Sink Cave				X							X									
Broken Arrow Cave																				
Buda Boulder Spring		X																		
Cave X		X	X	X				X			X			X						
Cave Y				X							X									
Ceiling Slot Cave						X														
Cold Cave						X						X								

Cave Name	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae N.S.*
Cotterell Cave					X							X								
Disbelievers Cave						X														
District Park Cave				X							X									
Eluvial Cave																				
Flint Ridge Cave				X							X									
Fossil Cave												X								
Fossil Garden Cave						X						X								
Gallifer Cave					X															
Get Down Cave				X							X									
Goat Cave				X										X						
Hole-in-the-Road Cave						X														
Ireland's Cave				X							X									
Jack's Joint		X				X														
Japygid Cave																				
Jest John Cave					X															
Jester Estates Cave					X							X								

Cave Name	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae N.S.*
Jollyville Plateau Cave																				
Kretschmarr Cave					X								X							
Kretschmarr Double Pit					X															
Lamm Cave																				
Little Bee Creek Cave				X							X									
Lost Gold Cave				X					X		X									
Lost Oasis Cave				X							X									
M.W.A. Cave																		X		
Maple Run Cave				X							X									
McDonald Cave					X					X										
McNeil Bat Cave												X								
Midnight Cave				X							X									
Moss Pit																				
New Comanche Trail Cave						X	X									X				
No Rent Cave												X								
North Root Cave					X															

Cave Name	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Tayshaneta concinna*	*Tayshaneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae N.S.*
Pennie's Cave											X			X						
Pickle Pit					X															
Pipeline Cave														X						
Rolling Rock Cave						X								X						
Root Cave					X															
Slaughter Creek Cave				X																
Spanish Wells Cave		X													X					
Spider Cave					X		X													
Stark's North Mine									X											
Stovepipe Cave	X				X		X													
Talus Springs Cave																				
Tardus Hole																				
Tooth Cave					X		X						X							
Weldon Cave	X											X								
Whirlpool Cave				X							X									

Sources: Elliot 1997, Paquin and Hedin 2005, Paquin et al. 2008, TMM 2007, Zara Environmental 2008, 2010, Hedin 2015, Reddell 2016.

Key and Footnotes

X = confirmed location based on collected specimen.

[1] *Cicurina ellioti* listed as an SOC in the regional permit is not included in this table because this species has now been synonymized with *Cicurina buwata*, a non-SOC (Cokendolpher 2004).

[2] *Tartarocreagris reddelli* listed as a SOC in the regional permit is not included in this table because this species has now been synonymized with *Tartarocreagris infernalis*, a non-SOC (Muchmore 2001).

[3] Occurrences of *Cicurina bandida* include localities formerly listed as *Cicurina cueva* and *Cicurina reyesi*, which have been formally grouped together into the single species *C. bandida* (Paquin et al. 2008).

[4] Occurrences of *Cicurina travisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. travisae* (Hedin 2015).

Localities of possible SOCs; blind *Cicurina* specimens not yet confirmed to species level.

Table 6. Non-BCCP Caves/Karst Features with Karst SOC Protected on BCP[1,2]

Key and footnotes follow table

Cave Name	BCP Owner	*Aphrastochithonius N.S.*	*Caecidotea reddelli*	*Candona sp. nr. stagnalis*	*Cicurina bandida*[3]	*Cicurina travisae*[4]	*Cicurina sp.*[5]	*Eidmannella reclusa*	*Miktoniscus N.S.*	*Neoleptoneta concinna*	*Neoleptoneta devia*	*Rhadine austinica*	*Rhadine s. subterranea*	*Rhadine s. mitchelli*	*Speodesmus N.S.*	*Sphalloplana mohri*	*Tartarocreagris comanche*	*Tartarocreagris intermedia*	*Tartarocreagris N.S. 3*	*Texella spinoperca*	*Trichoniscinae N.S.*
Brewpot Cave	TC										X										
Cortana Cave	COA						X														
Down Dip Cave	COA						X														
Geode Cave	TC					X		X													
IV-3	COA					X															
LU-29	TC						X														
Pond Party Pit	COA						X						X								
RI-1	TC						X														
RI-3	TC						X														
Siebert Sink	COA				X					X										X	
Two Trunks Cave	TC					X															

Sources: Bayless pers. comm 2013, Paquin and Hedin 2005, Sanders pers. comm 2013, TMM 2007, Zara Environmental 2008, 2010, Hedin 2015, Reddell 2016.

Key and Footnotes

X = confirmed location based on collected specimen.

[1] *Cicurina ellioti* listed as an SOC in the regional permit is not included in this table because this species has now been synonymized with Cicurina buwata, a non-SOC (Cokendolpher 2004).

[2] *Tartarocreagris reddelli* listed as a SOC in the regional permit is not included in this table because this species has now been synonymized with *Tartarocreagris infernalis*, a non-SOC (Muchmore 2001).

[3] Occurrences of *Cicurina bandida* include localities formerly listed as *Cicurina cueva* and *Cicurina reyesi*, which have been formally grouped together into the single species *C. bandida* (Paquin et al. 2008).

[4] Occurrences of *Cicurina travisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. travisae* (Hedin 2015).

[5] Localities of possible SOCs; blind *Cicurina* specimens not yet confirmed to species level.

3.0 OWNERSHIP AND PROTECTION STATUS

Many karst features listed in the BCCP permit have adequate protection, based on the criteria outlined in USFWS's *Karst Preserve Design Recommendations* (USFWS 2012). However, some caves listed in Table 3 as "protected" under individual USFWS Section 10(a) or Section 7 permits may not be adequately protected as defined in USFWS (2012). Efforts are being made by the BCCP Permit Holders to contact owners of privately owned caves to assess their protection efforts and to assist them with protection where possible.

Though not specifically required in the BCCP permit, the updated USFWS karst preserve design recommendations direct that the protected area surrounding the cave should be at least 16–40 ha (40-99 acres) in size to capture the majority of plant and animal community elements needed to support the karst ecosystem, as well as protect the cave footprint and surface/subsurface drainage basins of the cave (USFWS 2014a). Some caves within the BCP meet or exceed these recommendations, while others do not due to conditions that existed before the Permit was issued, such as pre-existing development in the form of subdivisions, roads, power lines, petroleum lines, and sewer lines that preclude complete protection of the recommended preserve areas. BCCP Permit Holders will continue to do what is reasonable to protect these features from pre-existing development and continue efforts to acquire and protect the karst features listed in the BCCP permit.

Per BCCP Permit Conditions S2 and T2, if new karst features "are discovered with a significant diversity of troglobitic fauna, those karst features may be submitted to the Service for consideration for exchange with karst features identified for protection by the BCCP" (USFWS 1996a). In order to allow the Permit holders to implement these Permit conditions, COA and TC created a Cave Substitution Policy that provides a process that allows caves listed in the BCCP permit to be substituted with other suitable caves in a manner that is transparent, science based, and consistent with the vision and intent established for BCCP. This policy includes a definition of "significant diversity of troglobitic fauna" as it applies to eligibility of a cave for substitution, and determines parameters that quantify preservation of environmental integrity for BCCP-listed caves and candidate substitution caves as it applies to management of caves. These defined criteria will be used in determining both the need to substitute a feature listed on the Permit as well as whether the substitution cave will adequately replace the previously identified BCCP cave or caves. The BCCP Cave Substitution Policy was adopted by the BCCP Coordinating Committee in August 2015.

Table 7. FY16 Ownership, protection, monitoring and access status of the 62 BCCP caves/karst features (35 caves with ES and 26 caves with SOC) [1, 2].

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Adobe Springs Cave	SOC	BCP/TNC		Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Airmen's Cave	SOC	BCP/COA	Gated	Protected on parkland	COA weekly surface monitoring (volunteers check on gate); bi-annual cave cricket exit counts; bi-annual species monitoring	Access by permit
Amber Cave	ES	BCP/TC	Gated and fenced	Protected on preserve (very close to road and sewer line)	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; red-imported fire ant (RIFA) survey/ control; bi-annual species monitoring	none
Armadillo Ranch Sink	SOC	Private		Private - Unknown		none
Arrow Cave	SOC	BCP/COA	Gated	Protected in parkland (There are nearby homes immediately south of the cave entrance)	COA quarterly surface monitoring; annual species monitoring	none
Bandit Cave	ES	Private	Gated	Protected by private ecologically concerned landowner		none
Beard Ranch Cave	ES	BCP/COA		Protected on preserve	COA quarterly surface monitoring; annual faunal survey	none
Bee Creek Cave	ES	Private		Private- Unknown		none
Blowing Sink Cave	SOC	BCP/COA	Gated	Protected on preserve	COA semi-monthly surface and annual species monitoring; periodic RIFA control	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Broken Arrow Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	none
Buda Boulder Spring	SOC	BCP/COA		Protected in parkland (close proximity to a hike and bike trail)	COA bi-annual surface monitoring; annual species monitoring	none
Cave X	SOC	Private/COA Protection Agreement	Gated and fenced	Protected by landowner with 4.5 acre setback to protect cave footprint. Protected to some extent (not actively managed and the setback is inadequate).	Occasional species and surface monitoring by COA and SWCA. SWCA completed cave cricket exit counts in October 2015 and one cave faunal survey in February 2016 as part of an agreement to allow for on site construction of a berm to reduce flooding concerns.	none
Cave Y[1]	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface bi-annual species monitoring; bi-annual cave cricket exit counts; periodic RIFA control	none
Ceiling Slot Cave	SOC	Private		Private - Unknown		none
Cold Cave	ES	Private	Gated	Private - Unknown	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Cotterell Cave	ES	BCP/COA	Gated and fenced	Protected in parkland. (There are nearby homes immediately east of the cave entrance)	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	none
Disbelievers Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
District Park Cave	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	1st room open, past 1st room protected by gate, access by permit*

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Eluvial Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Flint Ridge Cave	SOC	BCP/COA	Gated	Protected on Water Quality Protection Land (drainage basin will be negatively impacted by the construction of a proposed highway, if constructed.)	COA quarterly surface monitoring; quarterly cave cricket exit counts; quarterly species monitoring; periodic RIFA control	none
Fossil Cave	ES	BCP/COA	Access protected by large rocks	Protected in parkland	Exact location of cave is unknown. COA quarterly surface monitoring of feature suspected to be Fossil Cave	None
Fossil Garden Cave	ES	Private		Private - Unknown	Occasional COA and TC species monitoring	none
Gallifer Cave	ES	BCP/TC	Gated and fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Get Down Cave	SOC	BCP/COA	Gated and fenced	Protected on preserve Managed by COA Watershed Protection Department (WPD) Inadequate setback from development.	COA WPD staff are currently working on a land management plan that will address monitoring needs	none
Goat Cave	SOC	BCP/COA	Fenced	Protected on preserve	COA monthly surface monitoring annual species monitoring; periodic RIFA control	access by permit*
Hole-in-the-Road	ES	Private		Private –Unknown. (very close to a major roadway)	Occasional COA species monitoring	none
Ireland's Cave	SOC	BCP/ TC	Gated	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Jack's Joint	SOC	Private		Private - Unknown		none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Japygid Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Jest John Cave	ES	BCP/COA		Protected on preserve	COA cave cricket exit count; bi-annual surface monitoring	none
Jester Estates Cave	ES	BCP/COA	Gated and fenced	Protected on preserve (3.2 acre preserve surrounded by homes).	COA monthly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	none
Jollyville Plateau Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Kretschmarr Cave	ES	BCP/TC	Gated and fenced	Protected on preserve. Close to roadway and in power line ROW.	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Kretschmarr Double Pit	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Lamm Cave	ES	BCP/Private Section 7	Gated and fenced	COA negotiated setback (approximately 150')	Occasional surface and species monitoring by COA and TC	none
Little Bee Creek Cave	ES	BCP/COA	Gated	Protected by COA AWU Dept.	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Lost Gold Cave	SOC	Private	Gated	Private – COA WPD has negotiated a small setback from future development.		none
Lost Oasis Cave	SOC	Private/ TCMA	Gated and fenced	Protected by TCMA	Sporadic species and surface monitoring by TCMA	controlled access**

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
M.W.A. Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		
Maple Run Cave	SOC	BCP/COA	Gated	Protected on preserve	COA monthly surface monitoring bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	access by permit*
McDonald Cave	ES	BCP /TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; bi-annual species monitoring	None
McNeil Bat Cave	ES	Private		Private – Unknown (close proximity to high school)	Occasional COA and TC species monitoring	none
Midnight Cave	SOC	BCP/COA	Fenced	Protected on parkland (close proximity to soccer fields)	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	access by permit*
Moss Pit	SOC	Private		Private - Unknown		none
New Comanche Trail Cave	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; Annual species monitoring	none
No Rent Cave	ES	Private		Private - Unknown	TC/COA quarterly surface monitoring; quarterly cave cricket exit counts; quarterly species monitoring	none
North Root Cave	ES	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Pennie's Cave	SOC	Private		Landowner had filled entrance. COA (\WPD\ negotiated with Zara Environmental to excavate the entrance, add a cave gate, and placing a 300 ft buffer around the cave.	Zara Environmental species Monitoring; Zara Environmental RIFA surveys/ control	none
Pickle Pit	SOC	BCP/Private Sec. 7	Gated	Protected by Section 7 permit.	TC/COA occasional species monitoring Monthly surface inspections by concerned neighbor	none
Pipeline Cave	SOC	Private	Gated	COA WPD has negotiated a small setback from future platted development.		none
Rolling Rock Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface and annual species monitoring; periodic RIFA control	none
Root Cave	ES	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Slaughter Creek Cave	SOC	BCP/COA	Gated	Protected on parkland (Nearby homes are immediately south of cave entrance)	COA quarterly surface and annual species monitoring; periodic RIFA control	none
Spanish Wells Cave	SOC	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Spider Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; periodic RIFA control	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Stark's North Mine[2]	ES	BCP/TC	Gated	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Stovepipe Cave	ES	BCP/ COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring periodic RIFA control	none
Talus Springs Cave[3]	N/A	BCP/Private Section 10(a)	Gated	Protected by Homeowners Association and TC, only has 50' setback from houses and is probably affected by uphill development.	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Tardus Hole	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Tooth Cave	ES	BCP/TC	Gated and Fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Weldon Cave	ES	Private		Private - Unknown	TC/COA quarterly surface monitoring; quarterly cave cricket exit counts; quarterly species monitoring	None
Whirlpool Cave	SOC	Private/ TCMA	Gated	Protected by TCMA	TCMA routine surface monitoring; COA/TC quarterly species monitoring and cave cricket exit counts to assess tawny crazy ant impacts	controlled access**

[1]Cave Y was considered an ES cave *(Texella reddelli*) in the 1996 BCCP Permit, but has since been determined not to contain *Texella reddelli* (Reddell 2004).
[2]Stark's North Mine was listed as a SOC cave in the 1996 BCCP Permit, but has since been determined to contain *Texella reddelli* (USFWS 2009c).
[3] Talus Springs Cave has never been known to contain ES or SOC. This cave was placed on the BCCP permit because it contained the amphipod *Stygobromus birfurcatus*, originally considered as a SOC candidate; however, *S. birfurcatus* was not included in the Permit's final list of 25 SOC karst species to be protected.

* Access by Permit - Permit may be issued by COA – Austin Water Utility or Austin Parks and Recreation Department (PARD) staff.
** Controlled Access - Private cave owners control the access.

4.0 ACCESS STATUS AND KARST EDUCATION/RESTORATION ACTIVITIES

Public education on caves and cave ecosystems is recognized as vital for karst species preservation in the BCP Karst Land Management Plan (2007). Currently, most opportunities for children to enter caves and learn about cave ecosystems is through programs provided by COA Watershed Protection Department (WPD) and Austin Nature and Science Center (ANSC) summer camps. Adult wild cave tours in the Austin area are not widely available, although many tours are conducted through TCMA and University of Texas Grotto. Overall there is more demand for cave education than can be met with existing programs.

One factor limiting cave education is a deficit of caves suitable for cave immersion, particularly considering the high demand and its effectiveness as both a teaching tool and management practice to support stewardship for cave ecosystems. Cave education/recreation primarily occurs in 10% of the BCCP permit caves, which have been used for this purpose prior to the 1996 permit. Whirlpool Cave (owned and managed by TCMA) has the highest traffic of all the BCCP caves, totaling 1,510 person trips in FY16. Although studies on human impacts to cave ecosystems are limited, it is assumed that high human traffic in a cave will negatively impact the cave fauna.

In response to the potential negative impacts to BCCP permit caves, BCP staff continues to meet with local educators (COA PARD, WPD Education, TCMA, and Barton Springs/ Edwards Aquifer Conservation District staff) to review existing cave access/ public education issues. The primary focus of these meetings is to review existing policy to see if current access policy is having a detrimental impact to BCCP caves, and if so, try to determine ways to mitigate this damage. To address the overuse issue, COA WPD staff are currently looking for new caves that could be used in lieu of BCCP caves. Also, TCMA has initiated a policy of charging for access, which may reduce total access numbers to Whirlpool Cave.

After Whirlpool Cave, the next most heavily used cave is Wildflower Cave, a relatively small non-BCCP cave on the Lady Bird Johnson Wildflower Center that received 1,630 visitors in FY16. Wildflower Cave has been used for education by COA Earth Camp since 1997 after it was restored by cleaning out trash fill. Wildflower Cave is unsuitable for many cave tours due to its currently limited extent and small size, but is heavily utilized in 5th grade Earth Camp cave education (see Cave Education Summary below).

Restoring Non-BCCP Caves for Education

By developing non-BCCP caves to be safe and accessible for adequately trained and responsible groups for guided education/recreation tours, we can promote education while reducing BCCP cave impacts. Non-BCCP education caves should draw traffic from BCCP caves and provide a greater range of experience. In FY16, considerable progress was made in developing non-BCCP caves for educational use:

During FY16, COA WPD staff continued to make significant progress excavating fill and trash from the following non-BCCP caves:, Hideout and Wade Caves at Goat Cave karst preserve, and Grassy Cove Cave in the COA Slaughter Creek greenbelt. These restoration efforts were largely funded by a COA Capital Improvement Project specifically to facilitate COA WPD cave education programs. The excavation work was primarily conducted by a cave team of COA WPD staff, coordinated by Nico Hauwert. The introduction of new non-BCCP caves such as these for education is expected to reduce traffic in approximately 10% of the 62 BCCP caves, particularly Whirlpool, Maple Run, Goat, and District Park Caves.

McNeil High School is located within the BCCP permit's McNeil cave cluster and its courtyard contains two caves, Millipede and Millipede Annex, with endangered species. In FY16, progress with restoration plans continued (revegetation and RIFA treatment of the courtyard) to enhance the underlying cave ecosystem. McNeil HS science teacher Tina Vick initiated the project with assistance from Mark Sanders of COA BCP, Jean Krejca of Zara Environmental, Cyndee Watson of USFWS, and landscape architect, Vivian Loftin of the COA WPD cave team. Twice annual cave faunal surveys were conducted by BCP staff, In November 2015 and May 2016. Informal presentations on karst biology and geology were also provided by Mark Sanders, Travis Clark, and Jonny Scalise to the McNeil High School Green club and AP Environmental Science classes as the students were introduced to the courtyard caves.

FY16 Cave Education Summary

COA Youth Education Programs:

COA WPD conducts cave education through Earth Camp and Earth School (fifth grade water quality programs), Clean Creek Camp (a summer parent/child water quality program), Watershed Detectives (middle school), Hydrofiles (high school), and adult education such as Groundwater to the Gulf: Summer Institute (professional development for teachers). FY16 updates are detailed below:

Earth Camp is available to Title I (low socio-economic) schools in AISD. Students spend one school day at camp immersed in Wildflower Cave looking for clues that water travels through the cave into the Edwards Aquifer, which includes the discovery of cave biota. Students also investigate a sinkhole and flow through karstic rock, as well as visiting Barton Springs and the Splash! Exhibit to learn of the connection of the recharge zone to the discharge area. In FY16, Earth Camp guided 1,630 students into Wildflower Cave. An additional 4912 fifth-graders in AISD, Eanes ISD and Del Valle ISD received Earth School, a hands-on classroom presentation using an Aquifer Model (Table 8). The Lady Bird Johnson Wildflower Center is partnered with Earth Camp. More details on these programs can be found online at: www.austintexas.gov/EarthCamp and www.austintexas.gov/earthschool.

In summer 2016, **Family Clean Creek Camp** brought 18 children and parents into Whirlpool Cave (Table 8). Clean Creek Camp is a partnership between COA WPD and Keep Austin Beautiful. Activities focus on watersheds, the Edwards Aquifer and citizen actions that improve water quality. Clean Creek Camp is offered in summer to parents and their children ages 9-14. (www.austintexas.gov/department/clean-creek-camp)

Watershed Detectives and **Hydrofiles** reach middle and high school classes with hands-on inquiry based investigations of Austin's water resources. Local field studies involve monitoring local creeks and caving into the Edwards Aquifer. Students learn about hydrogeology and cave biology through "Austin Underground" videos and cave tours led by COA WPD staff. In FY16, 85 middle school students were guided through Lost Oasis Cave, 90 middle school students were guided through wildflower cave, and 128 middle school students were guided through Whirlpool Cave. Additionally, 91 high school students were guided through Whirlpool cave and Lacrosse Cave (Table 8). (www.austintexas.gov/watersheddetectives and www.austintexas.gov/ /hydrofiles)

Adult and Technical Education:

Groundwater to the Gulf- Summer Institute: Groundwater to the Gulf is collaboration among over a dozen local agencies to offer a three-day, field trip-based institute for Central Texas teachers that emphasizes techniques for teaching water-based curricula to students. COA WPD educators take teachers inside Wildflower Cave and give presentations at a sinkhole at the Lady Bird Johnson Wildflower Center and Barton Springs so teachers have the background knowledge to teach about the Edwards Aquifer in their classrooms. In FY16,

48 teachers participated in the Institute (Table 8;. www.keepaustinbeautiful.org/GroundwatertoGulf)

Table 8. Summary of FY16 COA WPD education programs providing cave field trips and aquifer outreach.

Program	Grade	Number reached
Earth Camp	5th	1,684
Earth School	5th	4,912 (presentation does not include cave immersion)
Watershed Detectives	6th-8th	303
Hydrofiles	9th-12th	115
Clean Creek Camp	Adults and 4th-8th	30
Groundwater to the Gulf	teachers	34
Total reached:		7,078

Annual BCCP Infrastructure Workshop

COA, LCRA, and TC staff organized the annual BCCP Infrastructure workshop on October 8, 2015 held at the Ladybird Johnson Wildflower Center. This workshop is primarily intended to help project managers and field supervisors involved in infrastructure projects avoid impacts to the BCP. TC, and COA BCP staff presented on the importance of following BCCP infrastructure protocols when working within endangered species habitat. LCRA presented on how they were able to successfully upgrade the T-160 power line located over endangered species habitat while also adhering to the BCCP infrastructure protocol. TC, COA BCP staff and Texas Forest Service (TFS) staff provided field trips for discussing a range of topics including oak wilt and karst environments, karst biology, and impacts to karst ecosystems. For many of the participants, the highlight of the tour was a trip inside Wildflower Cave.

Austin Parks and Recreation

The Splash Exhibit in Zilker Park includes a simulated cave and indoor displays, movies, and activities regarding the Edwards Aquifer.
(http://www.austintexas.gov/department/austin-nature-science-center)

Texas Cave Management Association Cave Education

In FY16, Whirlpool Cave was managed by Matt Turner while Lost Oasis Cave was managed by Drew Thompson, both volunteers for TCMA. Whirlpool Cave supports the BCP as the most suitable cave currently available for lengthy recreation/education trips.

Access numbers continued to be high this year to both TCMA owned caves, with 1,510 individuals accessing Whirlpool Cave and a total of 60 individuals accessing Lost Oasis Cave.

FY16 Access Status

In FY16, 303 visitors were issued access permits by COA BCP staff to COA BCCP caves for educational/recreational/rescue training including: Airmen's cave (26), District Park Cave (8), Goat Cave (159), Maple Run Cave (81), and Midnight Cave (29). With the exception of Airmen's Cave, cave tours were supervised by trained staff from the Austin Nature and Science Center, COA PARD Rangers, and the UT Grotto. See Table 3 for access and gating status of all of the BCCP caves. This total includes the numbers listed in previous sections describing COA PARD educational activities.

BCCP Cave Preserve Restoration

During the last 200 years, considerable sediment disturbance has occurred over a relatively short period of time, attributed to the introduction of livestock and ranching practices, removal of juniper/oak woodlands, intentional obscuring of caves to reduce trespassing and increase the marketability for development, and urbanization. Caves across the US were commonly filled by ranches to eliminate livestock hazards and dispose of trash. While most BCCP caves were opened by volunteer cave explorers, there have been few funded efforts in Travis County for the purposes of restoring filled caves. Major cleanup projects such as the six year (1994-1999) removal of trash from Midnight Cave, although sponsored by COA staff, were only achieved through the use of volunteers. Even recognizing filled-in caves has been a challenge for geologists conducting site assessments and the subject of numerous field trips. Without recognition and necessary excavation, few of the BCCP caves would likely be preserved today.

Beginning in FY13, COA WPD continued to fund a team of cave specialists to excavate caves of trash, ranch fill, and eroded sediment. Education cave development was funded by COA WPD Education and Water Resource Evaluation divisions. The team consisted of a group of highly trained cave specialists, including Justin Shaw, landscape architect Vivian Loftin, Yaz Avila, Drew Thompson, Lee Jay Graves, and Fernando Hernandez. In FY16, the team primarily worked on opening up non-BCCP caves for public education efforts. Grassy Cove Cave, Hideout Cave, and Wade Cave were the three caves that were targeted for public education, and all three were opened up and gated to allow for future controlled access. The

team also completed restoration work for (Brownlee, Sinky Dinky, Winter Woods, Wyoka, and Sink-in-the-Woods/Williams Well) on the Blowing Sink Research Management Unit. Restoration efforts for these caves are described below.

Blowing Sink Research Management Unit restoration

The Blowing Sink Research Management Unit contains Blowing Sink Cave, one of the longest and deepest of the BCCP caves as well as five other sinkholes/caves that recharge rainwater runoff. Historical ranching practices and lack of proper maintenance led to impairment of the sinkholes, causing them to plug with sediment.

A multi-departmental/agency restoration effort was initiated in FY15 at this management unit, which now largely recharges most runoff generated on site, demonstrating the project's success.

The final phase of the project to revegetate the disturbed areas around each cave was completed in FY16. The revegetation effort has helped stabilize soil and greatly improve habitat for cave crickets by dramatically increasing plant diversity and eventually increasing tree canopy cover. COA WPD and BCP staff along with volunteers will continue to monitor and maintain the recently planted vegetation to ensure success.

5.0 MANAGEMENT COORDINATION AND OVERSIGHT

COA and TC determined that there was a need to create a master database on BCP karst faunal monitoring and management with the ability to analyze these data to determine current status and compliance with the regional permit, as well as determine future needs of the listed species. In 2009, Rob Clayton (COA WPD) developed the Karst Database that houses all faunal survey data from BCCP caves and provides much of the information needed for these karst analyses. This database is now available for use by BCP partners to enter survey data, and all available data have been entered to date. Though the intent is for this database to be a "shared" information source for all the BCP partners, there are still confidentiality challenges on how to establish this protocol. This database focuses on permit compliance, species status, and contribution to recovery.

Based on recommendations made in Dr. Butch Weckerly's analyses of karst survey efforts on the BCP (Weckerly 2010), COA and TC have determined a need to modify and expand the BCP's cave monitoring program. In FY11, COA and TC identified 25 caves within Travis County managed through BCP partners that provide a more evenly distributed dataset

across cave clusters and karst fauna regions (KFRs); this dataset includes both BCCP caves and other ES/SOC caves on the BCP. This new monitoring plan commenced in FY11, and the number and frequency of karst faunal surveys and cave cricket counts are now synchronized among managing partners to better accommodate comparisons and determine species trends. The goal of these changes to the cave monitoring program is to provide a clearer understanding of the species distribution and health of karst ecosystems across the BCP.

BCP staff completed a revision of the 2007 BCP Tier II-A Karst Species Land Management Plan in FY16. Revisions included updates on new karst invertebrate species localities and taxonomic changes, updates to threats of cave ecosystems to include climate change, tawny crazy ants and white nose syndrome, and revisions of karst management goals and conservation actions to reflect new USFWS Karst Preserve Design Recommendations (2012) and recent best practices improvements outlined in new USFWS Karst Preserve Management and Monitoring Recommendations (2011). The BCCP Coordinating Committee approved the revision of this Land Management Plan in March 2016.

In FY16, COA/TC BCP staff collaborated on creating guidelines to provide best management practices (BMPs) at construction sites where tawny crazy ants (TCAs; *Nylanderia fulva*) have not been confirmed, to supplement BMPs created in FY15 focusing on construction activities within known TCA sites. TCAs are a newly discovered non-native ant species which could potentially adversely affect forest and karst ecosystems on the BCP. Implementation of these BMPs will be critical to minimizing the potential of introducing new populations of this destructive species to other parts of Austin and elsewhere. These BMPs have been disseminated to appropriate TC/COA departments and other agencies.

6.0 BIOLOGICAL MONITORING

Caves containing endangered and rare karst invertebrates on BCP properties are monitored to determine long term trends in populations of cave organisms and overall cave conditions. All COA and TC-owned BCP caves with endangered species are surveyed annually. In addition, TC and COA incorporated the newly expanded monitoring plan in FY11, which includes the 25 Travis County caves selected to represent an evenly distributed dataset across cave clusters and KFRs. Caves included in this monitoring plan are surveyed bi-annually, occurring in Spring (May) and Fall (November) or Summer (August) and Winter (mid-January-mid February). Biomonitoring of the caves follow methodology and techniques

supported by USFWS to provide results that can be compared between caves throughout the region for better study and analysis (USWFS 2014a).

Beyond USFWS recommendations, survey methodology also follows guidelines described in the *2016 Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management*. The protocol for research and monitoring cave fauna involves the use of one to four (depending on size of cave and logistics) predesignated, permanent survey zones per cave in which all living organisms encountered are identified and enumerated. Survey zones are either transects approximately 5 meters in length that span the width of the cave, or distinct units of the cave such as a small room or an easily discernible section, so that the size and location of the survey area remains constant during the course of the study for trend comparison. For each survey zone, start and end time and the presence of trash or new vandalism are recorded. Relative humidity, temperature, nutrient input, dampness condition, and the presence of red-imported fire ants (RIFA; *Solenopsis invicta*) and TCAs are also recorded both outside the cave and at each transect or zone. All data collected during cave surveys are entered into the BCP Karst Database.

Any unknown invertebrates observed during faunal surveys are collected and identified by a karst invertebrate specialist. In caves containing endangered species, collecting only occurs with a special collecting permit obtained by USFWS. All collected specimens are deposited within the Texas Memorial Museum or other reputable facility (USFWS 2014a). The date of deposition and collection number is also recorded (USFWS 2014a).

Land managers also monitor the entrances of caves containing endangered species at least once a year for anything that might harm the rare invertebrates including presence of toxic substances, unauthorized access by recreational cavers, and surface disturbances which might have erosive potential or cause changes in surface drainage patterns.

The overall health of caves is also monitored by performing semi-annual cave cricket exit counts. Cave cricket exit counts are done as crickets emerge from caves during good weather nights (i.e. not raining, warm etc.). The duration of the counts is timed for two hours starting at or just after sunset, to maintain consistency with all surveys done between managing partners. Current weather conditions, surface temperature, and relative humidity are documented for each survey. Crickets emerging are placed in one of three age classes: nymph (up to 5 mm), sub-adult/juvenile (5-12mm) and adult (>12mm). Number of individuals exiting the cave is counted in ten-minute intervals. Time of first cave cricket exit and any other vertebrates exiting the cave are also recorded. An evaluation of TC/COA's cave cricket exit count survey protocol determined that this methodology meets criteria necessary to assess cave cricket abundance at caves as well as estimate changes over time in

the number of cave crickets that emerge from cave entrances, both of which are necessary for determining the state of cave ecosystems and evaluating the effectiveness of the BCP's karst management goals (Weckerly 2012).

FY16 TC/COA Collaborative Monitoring Projects

Since FY12, BCP staff have included monitoring for presence of tawny crazy ants (TCAs) at all visits to cave sites, using a TCA monitoring and collection protocol and reporting procedures created by TC and COA BCP staff and updated in FY15. In FY13, at least two BCCP caves (Whirlpool Cave and No Rent Cave) have been confirmed to be infested by TCAs. COA and TC staff have continued to conduct quarterly biological surveys at Whirlpool Cave since FY13 to document TCA use of cave environments and assess impacts of this new invasive species on cave fauna (EXHIBIT A). In FY14, TC and COA also expanded monitoring of Weldon and No Rent Caves to document the arrival and impacts of another TCA population in the vicinity of these caves. In addition, COA and TC BCP staff collaborated with local TCA specialist Ed LeBrun of UT's Brackenridge Field Lab on a USFWS Traditional Section 6 grant proposal to study impacts to karst invertebrate assemblages and design control methods for use within sensitive karst environments, which was awarded in June 2015. Dr. LeBrun is managing the project through 2017, with TC/COA staff providing in-kind contribution in the form of quarterly cave monitoring/cave cricket exit counts and design/implementation of a study to quantify TCA impacts in three BCCP caves (Weldon, No Rent, and Whirlpool). Year one of the two year study was completed in fall of 2016.

TC and COA BCP staff began conducting bi-annual cave faunal surveys of Millipede Cave and Millipede Annex Cave in FY13 and continued surveys for FY16 to gather baseline data for the McNeil High School courtyard restoration project, which commenced in FY15 (EXHIBIT A). Cave cricket exit counts and management activities such as vegetation planting and RIFA control were coordinated with McNeil High School staff and students to improve surface conditions of these two non-BCCP ES caves, with the intent of improving nutrient input and benefiting cave crickets and cave fauna.

TC and COA BCP staff continue to assist with James Reddell's efforts to refine species distribution and range of *Rhadine* beetles of central Texas, by incorporating extensive collecting of *Rhadine* species from known and unknown localities during cave faunal surveys in FY16. For this study, morphological as well as molecular work of collected species will be employed to achieve this goal. To date, TC and COA BCP staff have successfully collected from multiple caves in Hays, Travis, and Williamson County.

Also in FY16, TC and COA BCP staff received a confirmation letter from James Reddell stating that several specimens collected from BCP caves had been formally identified and cataloged into the Biodiversity Collections at the University of Texas at Austin (Reddell 2016). These specimens include a new locality for the endangered *Rhadine persephone* at Pond Party Pit (TMM catalog #80165, #89506) and a new locality for the endangered *Texamaurops reddelli* at Kretschmarr Double Pit (specimen donated to Nathan Parker for use in DNA studies of the Pselphinae). In addition, the SOC *Rhadine subterranea* is now a confirmed locality for Cold Cave (TMM catalog #81088, #89705) and Jester Estates Cave (TMM catalog #91216).

City of Austin FY16 Biological Monitoring

During FY16, COA BCP staff conducted bi-annual monitoring on the following 15 pre-selected caves: Airman's Cave, Broken Arrow Cave, Cave Y, Cortana Cave (non-BCCP cave), Cotterell Cave, District Park Cave, Jester Estates Cave, Little Bee Creek Cave, Maple Run Cave, Midnight Cave, Pond Party Pit (non-BCCP cave), Seibert Sink (non-BCCP cave), Spider Cave, and Stovepipe Cave, and Testudo Tube (non-BCCP cave) (EXHIBIT A). Faunal surveys in these caves were conducted by permitted COA biologists in either Fall 2015/ Spring 2016 or Winter 2016/ Summer 2016. In addition, COA BCP staff conducted quarterly surveys at Flint Ridge Cave (EXHIBIT A). Annual faunal surveys were also conducted in Arrow Cave, Beard Ranch Cave, Blowing Sink, Cave X, Elbowbush Cave, Goat Cave, Leopard Cave, Rolling Rock Cave, and Slaughter Creek Cave (EXHIBIT A).

In FY16, COA BCP staff with the help of volunteers conducted bi-annual cave cricket exit counts (quarterly at Flint Ridge Cave) at the same 15 caves pre-selected for faunal surveys, including Testudo Tube (EXHIBIT B). COA BCP staff also conducted one cave cricket exit count at Jest John Cave (EXHIBIT B).

Travis County FY16 Biological Monitoring

TC's BCP staff conducted bi-annual monitoring on the following ten pre-selected caves: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave (non-BCCP cave), McDonald Cave, Spanish Wells Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Faunal surveys in these nine caves, with permitted TC biologists, were conducted in Fall 2015/ Spring 2016 or Winter 2016/ Summer 2016 (EXHIBIT A). Annual faunal surveys were also conducted in six other TC-owned BCCP caves with federally listed species: Kretschmarr Cave, Kretschmarr Double Pit, New Comanche Trail Cave, North Root Cave, Root Cave, and Tardus Hole (EXHIBIT A). TC staff also conducted annual faunal

surveys at two additional BCCP listed caves: Ireland's Cave and Talus Spring Cave, and one additional TC-owned non-BCCP caves with listed ES: Two Trunks Cave (EXHIBIT A).

In FY16, TC conducted bi-annual cave cricket exit counts at eight of the caves pre-selected for faunal surveys: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Exit counts were conducted in Fall 2015/ Spring 2016 or Winter 2016/ Summer 2016 (EXHIBIT B). TC BCP staff also conducted one cave cricket exit count at Spanish Wells Cave (EXHIBIT B).

RIFA surveys were performed in Fall 2015 and Spring 2016 on all eleven TC-owned BCCP caves with federally listed species, as well as one other TC-owned cave with ES (Geode Cave). RIFA surveys were also conducted at three additional TC-owned BCCP caves (Ireland's Cave, Spanish Wells Cave, and Talus Spring Cave). RIFA mounds were surveyed within an 80 m radius around cave entrances, and all active mounds found during surveys were treated with boiling water as recommended by USFWS (2014b). In Fall of 2015, a total of 145 RIFA mounds were treated within these 80 m cave survey areas, with an additional 10 RIFA mounds treated in the vicinity of caves but outside of survey areas. In Spring of FY16, a total of 218 RIFA mounds were treated within these 80 m cave survey areas, with an additional 31 RIFA mounds treated in the vicinity of caves but outside of survey areas. Survey results and treatments for individual caves are documented in Table 7.

In addition to managing the karst features required in the BCCP permit, TC voluntarily managed other karst features located on BCP land in FY16, including Cactus Pit, Brew Pot Cave, Kretschmarr Sink, and karst features RI-1, LU-11 and LU-12.

Other Biological Monitoring Efforts

Zara Environmental conducted biological monitoring at Pennie's Cave in FY16 as part of an adaptive cave management plan for a development project that began with the reopening of the cave's entrance in 2012. Zara Environmental performed one karst faunal survey and conducted two (Spring and Fall) RIFA treatments with boiling water in FY16. Zara also provided a written report of their work in FY16 (Zara Environmental 2016; APPENDIX P18 of BCCP FY16 Annual Report).

Cambrian Environmental performed biological and air quality monitoring at Cave X for the Regent's School of Austin in FY16. Cambrian performed one karst faunal survey in February 2016, and provided an annual report of survey methods and results (Cambrian Environmental 2016; APPENDIX P6 of BCCP FY16 Annual Report).

TC and COA BCP staff continue to assist James Reddell and the Texas Speleological Society (TSS) in surveying, excavating, and mapping the karst of the USFWS Balcones Canyonlands National Wildlife Refuge. Efforts expand the knowledge base of cave fauna in the karst fauna region shared by two BCCP caves: Jack's Joint and Armadillo Ranch Sink.

7.0 HYDROGEOLOGIC STUDIES

The understanding and protection of water sources to caves is vital for preserving cave life that relies on it. Water sources include surface catchment areas that direct runoff to the cave entrance and subsurface catchment areas where overlying water infiltration from either rainfall or runoff supports cave drips. Surface catchment area delineation generally involves examination of a combination of field GPS delineation of catchment divides and drainages as well as surface topographic contour coverages. Subsurface catchment studies may involve direct tracing, water-quality characterization, drip rate monitoring, geological mapping, cave survey mapping, and cave radio surveying. In FY16, BCP research permits were provided to Brian Cowan and other staff from Zara Environmental, Nico Hauwert and members of the COA WPD cave team, and Roger Glick and hydrology staff of COA WPD.

Flint Ridge Cave

In FY16, additional examinations of surface and subsurface catchment areas to Flint Ridge Cave were conducted in order to complete a hydrogeological study of the cave. Dr. Roger Glick's team of hydrologists from COA WPD continued monitoring runoff in three drainages entering Flint Ridge Cave and sampled runoff quality on selected storms. This team also monitored precipitation at Flint Ridge Cave. A team of cave specialists led by Dr. Nico Hauwert of COA WPD monitored cave drip rate and quality at selected drips, injected 10 tracers on the surface up to a mile from Flint Ridge Cave, and monitored tracer breakthroughs in Flint Ridge Cave drips, other local caves, and Barton Springs (Table 9). Justin Camp of the Barton Springs/Edwards Aquifer Conservation District participated by monitoring up to 30 water wells for the tracer breakthrough. The Texas Department of Transportation and their consultants identified some features on the SH45SW right of way that were selected for injection sites and provided access to allow tracer injections. Observations of runoff in the vicinity of Flint Ridge Cave were also made during storms for the purpose of verifying and refining delineation of the surface catchment area to Flint Ridge Cave. While the Flint Ridge Cave hydrogeological study report is still being prepared, preliminary results indicate drips in Flint Ridge are derived from various sources with the

source areas limited to less than one mile and more than 0.5 miles from the cave, primarily from the northwest, north, and northeast directions (Figure 1).

Table 9. Tracer Injection Sites along Highway 45 SW ROW near Flint Ridge Cave

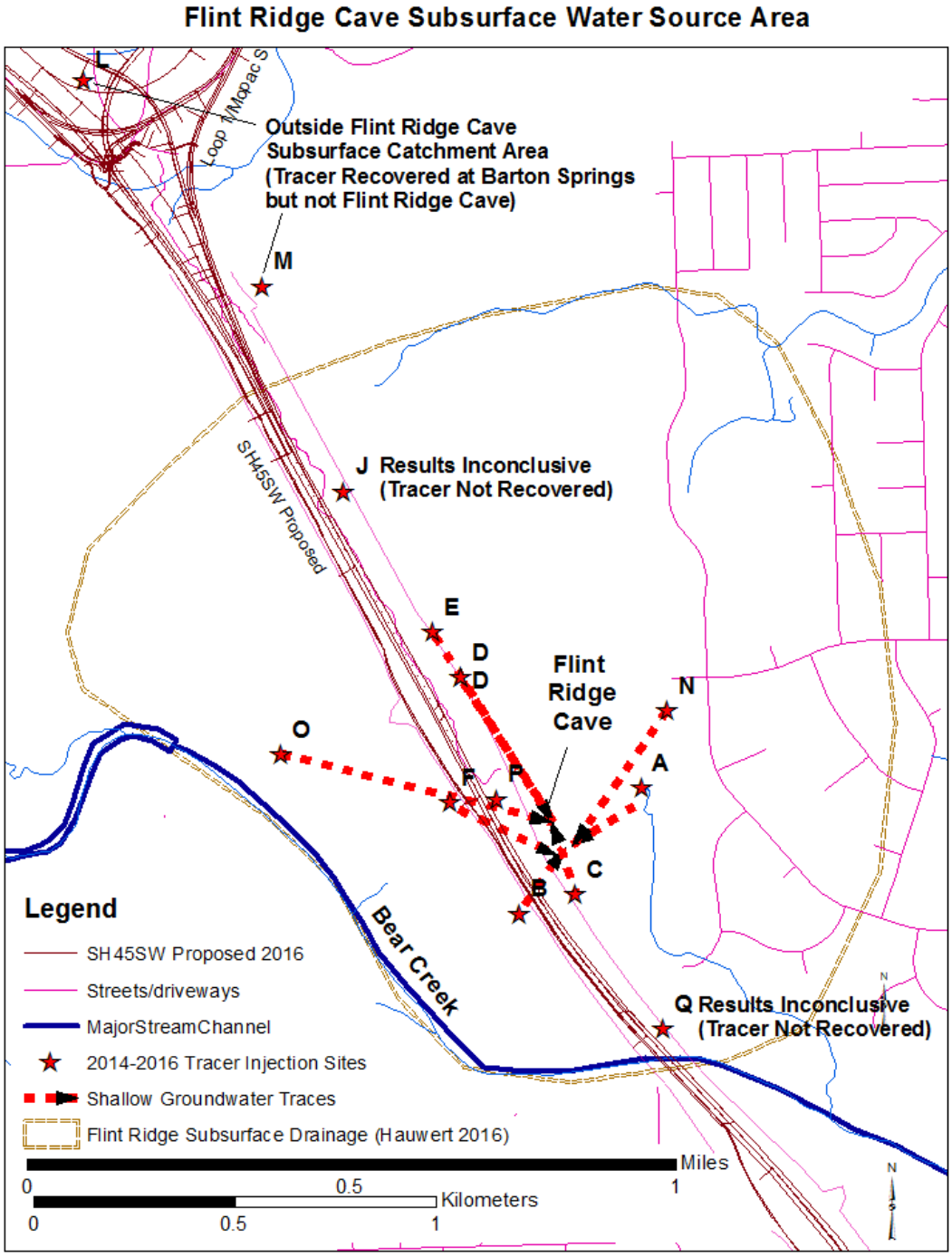
Phase I 2014

Phase	Feature	Name	Tracer	Mass (kg)	(lb)	Injection Date/approx. time	Results	Comments
I	A	Quadborder	KBr	12	26	11/22/2014 22:00	Unclear Result. 0.04 mg/l rise in Br at Culvert Crawl Upper Pool, 2 mg/l increase in K at Flint Ridge Fault Dome and 7 mg/l rise in K at Mudmight Drips	K and Br peaks not corresponding in magnitude.
I	B	TAB11 Funnel	Ammonium Carbonate	4	9	11/4/2014 23:30	Possible hit in Breakdown Pool, Culvert Crawl Upper & Lower Pools, Cheese & Chocolate Pool, and Fault Dome Drip	Inside Flint Ridge Subsurface Catchment Area
I	C	Soil Pipe	Tinopal	1	3	11/5/2014 0:00	Possible hits in Flint Ridge Balcony Room and Tabor Crevice Sparkles Infeeder.	Inside Flint Ridge Subsurface Catchment Area
I	D	FR North Trib	Fe	0.50	1	11/22/2014 19:30	Elevated Fe in Culvert Crawl Lower and Upper Pool, and Cheese and Chocolate Pool Post Injection. Large Fe pulse in Culvert Crawl 4/19-22/2016. Rust spot observed in Balcony Room post injection assumed hit.	Inside Flint Ridge Subsurface Catchment Area
I	E	MW	DY96	2	4	11/5/2014 0:30	Detected at Flint Ridge entrance gate and Balcony Room after 11/24/14. Possible 2016 hits at Balcony Joint and Tabor Crevice Sparkles Infeeder 2/17-4/22/2016.	Flint Ridge and Tabor Crevice Subsurface catchment areas
I	F	Honeycomb Drainage	LiCl	6	13	11/22/2014 14:00	Elevated pulses in Flint Ridge Drip Pit, Fault Dome Drip; Possibly Culvert Crawl	LiCl elevated post injection through 6/11/15
I	G	North Tabor Valley	Pyranine	1	2	11/22/2014 19:00	Observed/photographed surface flow from west of SH45SW.	Intended to visually trace surface flow only.

Phase II 2016

Phase	Feature	Name	Tracer	Mass (kg)	(lb)	Injection Date/approx. time	Preliminary Results	Comments
II	**H**	Danz Creek	Eosine	2.3	5	4/18/2016 8:35	Hits at Lancaster well, USGS well end of Wyldwood, and Barton Sp	Outside Flint Ridge Subsurface Catchment Area
II	**I**	Spillar Ranch Sink	Pyranine	1.8	4	8/16/2016 12:15	First receptors pulled week of Sept 1	Results pending
II	**J**	F29	SRB	1.8	4	4/21/2016 12:43	Not detected as of 5/20 lab results. Tracer may be trapped.	Trace inconclusive
II	**L**	F157a SH45 Cave	RWT	3.6	8	4/17/2016 16:30	Detected at Barton Springs	Outside Flint Ridge Subsurface Catchment Area
II	**M**	Pocohontas	Fl	2.3	5	4/21/2016 10:40	Flushed 4/26/2016 15:00 using well. Hits detected at Barton Springs.	Outside Flint Ridge Subsurface Catchment Area
II	**P**	F58	Ammonium Carbonate	7.3	16	4/18/2016 11:00	Insufficient monitoring to detect this injection.	Trace canceled.
II	**D**	F62a North Trib mudsink	KBr	6.8	15	4/18/2016 11:20	Balcony B Red Spot	Trace verified 11/22/2014 iron trace interpretation
II	**N**	Green Emerald gate sink	LiCl	9.5	21	4/18/2016 10:15	Balcony B Red Spot, Culvert Crawl Upper & Lower Pool, Fault Dome	Inside Flint Ridge Subsurface Catchment Area
II	**O**	Agravita	Tinopal	2.3	5	5/19/2016 10:15	Hit Flint Ridge Left Hand Tunnel, Gate, Gnome Garden, Balcony Room, Culvert Crawl Upper Pool, Fondue Drip, Balcones Drip, and Drip Pit. Possible hit High Barton Spr.	Clearly Inside Flint Ridge Subsurface Catchment Area
II	**Q**	TxDOT2885/ F65 Cave	DY96	3.6	8	5/19/2016 11:30	Unlikely but possible hit Balcony B Red Spot	Inside Flint Ridge Subsurface Catchment Area

Figure 1. Phase 1& 2 Preliminary Interpretation Results of Surface Tracing to Flint Ridge Cave



District Park Cave

As part of an ongoing hydrological study, COA WPD staff continued to monitor temperature and drip rates in the Aquifer room and Aggie level Room in FY16.

8.0 RECOMMENDATIONS

COA and TC should continue to attempt to contact the owners of each privately-owned BCCP cave in order to assess current faunal assemblages and negotiate protection of these caves. The precise location of some of these privately owned caves is currently unknown; therefore, COA and TC should attempt to locate these caves in order to make a meaningful assessment. Additionally, COA and TC will also continue to evaluate the adequacy of protection for all 62 BCCP caves during FY17, and prioritize efforts accordingly.

Future research needs for the BCP should include an effort to determine to species level for currently unknown troglobites such as *Speodesmus* sp., *Eidmannella* sp., and Trichoniscidae found in BCP caves. A recent research need has also been identified by James Reddell concerning Rhadine beetles in the region, and the possibility that potentially two undescribed species could be found within BCP caves. Future research and funding may be needed to answer these research questions.

KARST MANAGEMENT ACTIVITIES

The BCP Karst Land Management Plan (2016) outlines planned activities concerning the 62 BCCP karst features. Table 11 below includes a summary of monitoring and management activities for these features completed in FY16.

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Adobe Springs Cave The Nature Conservancy 1. TC was granted continued permission from TNC to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program. 2. TC performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 3. TC/COA conducted bi-annual cave faunal surveys (see EXHIBIT A). 4. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Airmen's Cave City of Austin 1. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 2. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B) 3. COA installed a cave gate within 18 feet of the entrance of the cave. The cave gate not only protects the cave from ongoing vandalism, but also serves to protect the public from future accidents involving un-trained access. Access is still allowed via permit and the COA and volunteers host an "open house day" once a month allowing the public access to the cave. 4. Volunteers monitor the cave gate weekly, and in the past have helped COA staff make cave gate and sign repairs. 5. With the heavy rain events in late May and late August, Airmen's Cave became a wet cave with strong stream flow. COA WPD staff (with assistance from BCP staff) took flow measurements and collected water samples in an effort to determine water quality and get a better idea on flow paths to Barton Springs. 6. COA BCP staff set up bait traps in the stream passage, but no new aquatic species were detected.
Amber Cave Travis County 1 .Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 19 mounds in Spring 2016. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Armadillo Ranch Sink Private
Arrow Cave City of Austin 1. Completed annual cave faunal survey (See EXHIBIT A). 2. Conducted quarterly site inspections. City staff continues to deal with ongoing dumping problems from the adjacent neighborhood. COA PARD Rangers continue to conduct periodic patrols at these problematic sites. 3. Inspected site for RIFA infestations. On all visits RIFA were observed within close proximity of the cave (but not inside the cave).

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Bandit Cave Private
Beard Ranch Cave (Featherman's Cave) City of Austin 1. Completed annual cave faunal survey (See EXHIBIT A). 2. Conducted quarterly site inspections. 3. No RIFA were found. A healthy population of native fire ants was found in close proximity to the cave.
Bee Creek Cave Private
Blowing Sink Cave City of Austin 1. Inspected monthly, continued to operate security cameras, repaired perimeter fence, added "no trespass" signs, and met with COA PARD Rangers and WPD staff in an effort to increase on site patrols. 2. Completed cave faunal survey (See EXHIBIT A). 3. COA staff removed invasive non-native vegetation from the preserve. 4. COA WPD staff successfully completed the restoration of five major karst features located on the tract. The work is considered a major success by allowing clean recharge into the aquifer and reducing negative impacts to Blowing Sink Cave. 5. The lower passageways are currently inaccessible; however, it is possible that some of the recently restored adjacent caves may lead to the water table.. 6. COA WPD contracted for a new perimeter fence for some of the most problematic sections of the property. Construction will be complete in FY17.7. COA WPD with assistance from BCP staff and volunteers helped protect and water recently planted vegetation around the restored caves with the goals of improving habitat for cave crickets and stabilizing the soil.
Broken Arrow Cave City of Austin 1. Inspected quarterly with no sign of human visitation or vandalism. 2. Completed bi-annual faunal surveys (See EXHIBIT A). 3. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).
Buda Boulder Spring City of Austin 1. Visited the site twice and noted no new negative impacts to the spring. 2. Searched for aquatic invertebrates in the spring, no SOC were observed.
Cave X Private 1. COA entered into a Private Landowner Agreement "Cave X, Management and Monitoring Plan, Covenants and Restrictions", with the property owners (Regent's School) in Oct. 1999. The agreement sets aside a 4.5 acre area to protect the cave footprint. USFWS was involved in the discussions on protection. 2. Cave entrance is gated and also has a fence for added protection. 3. Regents staff conduct periodic surface inspections of the cave including gate and lock maintenance. 4. COA WPD negotiated with the property owner to increase biological monitoring (bi-annual cave faunal and cave cricket exit count surveys) and management of the cave as part of an agreement for a variance for on-site construction of a berm to reduce the area currently listed as within the 100 year flood plain. Regents hired SWCA to do the above mentioned work. One cave faunal survey conducted (Cambrian Environmental 2016).
Cave Y City of Austin 1. Visited this cave 6 times and noticed no signs of vandalism to the cave or cave gate. 2. Completed bi-annual cave faunal survey(See EXHIBIT A). 3. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Ceiling Slot Cave Private
Cold Cave 1. TC is negotiating with the landowners concerning the possibility of purchase, conservation easement, or a management agreement for this 8 acre tract. 2. TC gained continued permission from landowner to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program. 3. TC performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 4. TC conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Cotterell Cave City of Austin 1. Conducted quarterly site inspections. 2. RIFA surveys determined that the ants were located approximately 300 feet from the cave so no treatment was needed. 3. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 4. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Disbelievers Cave Private 10a Permit: PRT-808694
District Park Cave City of Austin 1. BCP staff conducted bi-annual cave faunal surveys (See EXHIBIT A). 2. BCP staff and volunteers conducted bi-annual cave cricket exit counts (See EXHIBIT B). 3. Conducted site surveys quarterly, other than trash at the entrance no new major problems noted. 4. Permitted access to this cave was allowed. 5. BCP staff removed trash from the un-gated portion of the cave. 6. COA WPD Hydrogeologist continued to work on a hydrological study to determine the sub-surface drainage and to see if the adjacent developed area of the park could negatively impact the cave (ongoing).
Eluvial Cave Private 10a Permit: PRT-808694
Flint Ridge Cave City of Austin 1. Conducted six site visits and noted no signs of illegal trespass. 2. Conducted quarterly cave faunal surveys (See EXHIBIT A). 3. BCP staff and volunteers conducted quarterly cave cricket exit counts (See EXHIBIT B). 4. COA WPD continued monitoring the storm water catchment area of Flint Ridge cave. . 5. COA WPD continued to work on phase 2 hydrogeologic study that will delineate the subsurface catchment area to determine potential negative impacts from a newly proposed roadway.
Fossil Cave City of Austin 1. Inspected quarterly and found no new signs of vandalism 2. Inspected for RIFA infestations on all visits. RIFA were observed within close proximity of the “suspected” cave

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Fossil Garden Cave Private
Gallifer Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 25 mounds in Spring 2016. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Get Down Cave City of Austin 1. COA WPD assumed ownership of the Village of Western Oaks Karst Preserve. Staff are currently working on a Land Management Plan to address multiple issues such as karst monitoring and management of Get Down cave and public education. 2. BCP staff continued to work with neighbors regarding ways to limit negative impacts to cave crickets while treating for RIFA on adjacent private property. The protocol was posted on their web site in FY16.
Goat Cave City of Austin 1. Completed annual faunal survey (See EXHIBIT A). 2. With the help of volunteer stewards, conducted monthly site inspections, removed trash from preserve area and reported on anything out of the ordinary. 3. Allowed permitted access to this cave . 4. Continued to periodically repair the perimeter fence cuts and tagged signs by vandals, many of these incidents were reported by our volunteer land steward and in some cases the volunteer made the needed repairs. 5. COA WPD staff initiated efforts to purchase the adjacent private preserve, which would greatly enhance protection to 2 BCCP caves. 6. COA BCP, WPD, and PARD staff collaborated with the non-profit Save Barton Creek Association to enhance the preserve through grants. SBCA was awarded a grant that will replace the existing non-functional kiosk, add educational signs to Wade, Hideout, and Goat Cave, and install one additional bench. These efforts will greatly improve the educational experience at this site.
Hole-in-the-Road Cave Private
Ireland's Cave Travis County 1. TC acquired the 4.8 acre tract containing the cave from Muirfield Homeowner Association and began full management of the cave and surrounding property in FY12. 2. Fencing was completed in FY15 on the perimeter of the Ireland's Cave tract to protect the cave preserve from trespass. 3. Surveyed site for RIFA. Treated 62 mounds in Spring 2016. 4. TC conducted an annual cave faunal survey (see EXHIBIT A).
Jack's Joint Cave Private
Japygid Cave Private 10a Permit: PRT-808694

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Jest John Cave City of Austin 1. Conducted 2 site visits found and no signs of vandalism or human visitation. 2. Inspected site for RIFA infestations, no RIFA were observed near the cave. 3. Conducted one cave cricket exist count. (See EXHIBIT B).
Jester Estates Cave City of Austin 1. BCP staff conducted 6 site visits looking for signs of illegally discharged pools, dumped brush and trash from neighbors. It appears that past educational efforts have paid off, no illegal activities were observed. 2. Treated site for RIFA with boiling water. 3. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 4. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B). 5. BCP staff removed non-native invasive vegetation.
Jollyville Plateau Cave Private 10a Permit: PRT-808694
Kretschmarr Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Conducted a trash clean-up around the cave site and surrounding area. 3. Maintained fencing and signage to protect this area from unauthorized access and dumping. 4. Surveyed site bi-annually for RIFA. Treated 21 mounds in Fall 2015 and 38 mounds in Spring 2016. 5. Conducted annual cave faunal survey (see EXHIBIT A).
Kretschmarr Double Pit Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 17 mounds in Spring 2016. 4. Conducted annual cave faunal survey (see EXHIBIT A).
Lamm Cave Section 7 Permit 2-15-93-F-075 (see USFWS files) 1. The City of Austin negotiated protective measures for this cave including a Land Management Plan for this cave. The cave has a setback size of approximately 4.13 acres. The radius of the setback varies from a minimum of 123 feet south of the cave to a maximum of 340 feet north of the cave. 2. The cave was gated and the preserve area was fenced following COA WPD and BCP staff recommendations and design. 3. No application of fertilizers, pesticides or herbicides will be allowed in the CEF area. 4. TC staff continue to periodically monitor the site to make certain that the gates and fences are secure.
Little Bee Creek Cave City of Austin 1. Conducted two site visits. 2. Conducted bi-annual cave faunal survey (See EXHIBIT A). 3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).
Lost Oasis Cave TCMA 1. Conducted five site visits. 2. COA WPD led four cave education trips into cave.

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Lost Gold Cave Private
Maple Run Cave City of Austin 1. Conducted bi-annual cave faunal survey (See EXHIBIT A). 2. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). 3. With the help of volunteer stewards: conducted monthly site inspections, removed trash from preserve area and reported on anything out of the ordinary. 4. Permitted access to this cave is allowed.
McDonald Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site bi-annually for RIFA. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).
McNeil Bat Cave Private
Midnight Cave City of Austin 1. Conducted quarterly site inspections 2. Conducted bi-annual cave faunal surveys. (See EXHIBIT A). 3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). 4. Permitted access to this cave is allowed, though no access permits were granted this fiscal year.
M.W.A. Cave Private 10a Permit: PRT-808694
Moss Pit Cave Private
New Comanche Trail Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 60 mounds in Fall 2015. 4. Conducted annual cave faunal survey (see EXHIBIT A).
No Rent Cave Private 1. TC gained permission from landowner to perform quarterly faunal surveys and cave cricket exit counts. 2. TC performed surface inspections with no current signs of vandalism to the cave entrance or in the cave. 3. TC/COA continued increased monitoring efforts and incorporated new methods to document the arrival and impacts of a nearby TCA population. 4. TC/COA conducted quarterly cave faunal surveys (see EXHIBIT A). 5. TC/COA conducted quarterly cave cricket exit surveys. (See EXHIBIT B).
North Root Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 23 mounds in Spring 2016. 4. Conducted annual cave faunal survey (see EXHIBIT A).

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Pennie's Cave Private 1 The entrance was re-excavated in 2012, providing access to the cave. 2.The cave entrance has been gated and boulders placed around the cave at the edge of a 300-ft buffer to better define the protected area. 3. Zara Environmental has secured a one year contract to conduct quarterly cave faunal surveys, map the interior of the cave and treat the site for RIFA. Although only a one year contract, it is hoped that the owner will extend the contract for multiple years.
Pickle Pit Cave Private USFWS Section 7 Permit 2-15-93-F-075 1. A volunteer neighbor monitors the cave entrance/ gate monthly; no problems noted.
Pipeline Cave Private 1. A 2004 agreement between COA and Stratus set aside a fenced buffer around Pipeline Cave that varies from 100 feet to the east and up to 300 feet west of the cave and an additional setback of 300 feet to the north and west; 150 ft to east and south for the adjacent feature known as Confusion Sink. 2. Developer installed cave gate (including a gate on the nearby "confusion cave", silt fences were in place but no permanent fences delineating the preserve area was in place. COA BCP staff reported findings to WPD staff.
Rolling Rock Cave City of Austin 1. Inspected quarterly and no sign of human visitation or vandalism was found. 2. Conducted one cave faunal survey. (See EXHIBIT A).
Root Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 23 mounds in Spring 2016. 4. Conducted annual cave faunal survey (see EXHIBIT A).
Slaughter Creek Cave City of Austin 1. Conducted quarterly site inspections,. 2. Conducted one cave faunal survey. (See EXHIBIT A)
Spanish Wells Cave Travis County 1. TC acquired Spanish Wells Cave and surrounding land that protects the cave cricket foraging area and surface/subsurface drainage basins in FY15. 2. Performed surface inspections with no signs of trespass or vandalism to the cave entrance or in the cave. 3. Surveyed site bi-annually for RIFA. Treated 31 mounds in Fall 2015 and 40 mounds in Spring 2016. 4. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 5. Conducted summer cave cricket exit count. (See EXHIBIT B).
Spider Cave City of Austin 1. Conducted four site visits, and no sign of human access or vandalism was found. 2.Conducted bi-annual cave faunal surveys (See EXHIBIT A). 3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B). 4. Treated site for RIFA with boiling water.

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.
Stark's North Mine Travis County 1. TC acquired this cave and 0.8 acres surrounding it in FY12. The area surrounding the cave is all previously developed. 2. Performed surface inspections and detected signs of vandalism to the cave entrance and inside the cave. 3. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave. 4. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 5. Conducted bi-annual cave cricket exit counts (See EXHIBIT B). 6. Documented complete flooding of cave during Memorial day flood event. 7. Performed non-native plant removal project on tract to increase native plant diversity.
Stovepipe Cave 1. Conducted 6 site inspections, and continued to remove new and old trash from the preserve. 2. Repaired perimeter fence. 3. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 4. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).
Talus Spring Cave Private 1. The USFWS 10a permit PRT 815447 mitigation requirement intended this cave to go to TC, however, the cave is located on private land just outside of the mitigation area. TC has continued requesting that the homeowners association donate the land to TC; coordinated management with them. 2. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 3. Surveyed site bi-annually for RIFA. 4. Conducted annual cave faunal survey (see EXHIBIT A).
Tardus Hole Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 16 mounds in Spring 2016. 4. Conducted annual cave faunal survey (see EXHIBIT A).
Tooth Cave Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping. 3. Surveyed site for RIFA. Treated 27 mounds in Spring 2016. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
Weldon Cave Private 1. TC gained continued permission from landowner to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program. 2. TC performed surface inspections with no current signs of vandalism to the cave entrance or in the cave. 3. TC/COA continued increased monitoring efforts and incorporated new methods to document the arrival and impacts of a nearby TCA population. 4. TC conducted quarterly cave faunal surveys (see EXHIBIT A). 5. TC conducted quarterly cave cricket exit surveys. (See EXHIBIT B).

Table 10. FY16 BCCP Karst Feature Monitoring and Management Activities.

Whirlpool Cave TCMA 1. TC/COA continued increased monitoring efforts and incorporated new methods to document the arrival and impacts of a nearby TCA population. 2. TC/COA conducted quarterly cave faunal surveys (see EXHIBIT A). 3. TC/COA conducted quarterly cave cricket exit surveys. (See EXHIBIT B). 4. TCMA continued to allow permitted access to the cave; however, in an effort to limit access and to raise funds for cave management, they are now charging a fee for access. 5. Replaced old cave gate with a cupola-style bat friendly cave gate that is also safer for visitor access.

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EXHIBIT A:

KARST FAUNAL SURVEY REPORTS

FY16 City of Austin/Travis County Karst Faunal Surveys[1, 2]

			Endangered Species						Species of Concern									Other Significant Troglobites									
Cave	**Survey Date**	**Monitoring Agency**	***Rhadine persephone***	***Tartarocreagris texana***	***Tayshaneta myopica***	***Texamaurops reddelli***	***Texella reddelli***	***Texella reyesi***	***Caecidotea reddelli***	***Cicurina bandida***	***Cicurina travisae***	***Eidmannella reclusa***	***Rhadine austinica***	***Rhadine subterranea***	***Sphalloplana mohri***	***Tayshaneta devia***	***Texella spinoperca***	***Cicurina buwata***	***Eidmannella rostrata***	***Eidmannella* sp.**	***Rhadine* sp.**	***Speodesmus* sp.**	***Speodesmus bicornourus***	***Tartarocreagris infernalis***	***Tayshaneta* sp.**	***Texoreddellia texensis***	**Other notable species detected**
Adobe Springs Cave	11/16/2015	TC																									
Adobe Springs Cave	6/20/2016	TC																									
Airman's Cave	1/8/2016	COA								23			1							63		3				1	
Airman's Cave	8/25/2016	COA								1											1						
Amber Cave	6/1/2016	TC				3					9									3		8	5				*Batrisodes* sp. (1)
Arrow Cave	9/20/2016	COA								8												8					
Beard Ranch Cave	1/15/2016	COA						3																			
Blowing Sink Cave	9/23/2016	COA								6										4	1	1					
Bomb Shelter Cave	5/20/2016	TC																									
Broken Arrow Cave	11/16/2015	COA							9									2				2					
Broken Arrow Cave	5/25/2016	TC/COA	2						11					2								4					*Stygobromus* sp.(4) Trichoniscidae (1)
Cave X	1/25/2016	COA																				1					
Cave Y	1/8/2016	COA								9										3		13					*Perimyotis subflavus* (8) *Texella grubbsi* (15)
Cave Y	8/25/2016	COA								29												62				3	
Cold Cave	2/2/2016	TC						3						1								100					*Batrisodes* sp. (2) *Cicurina sp.* (blind) (8)
Cold Cave	8/3/2016	TC						16														20					*Batrisodes* sp. (15) *Cicurina sp.* (blind) (4) Pseudoscorpionida (1)
Cortana Cave	1/22/2016	COA			66			2			5									9		4					
Cortana Cave	8/5/2016	COA			38			14			4									14		14					
Cotterell Cave	1/15/2016	COA						33			63												21	2			
Cotterell Cave	8/9/2016	COA						20			35									2			35	1			Trichoniscidae (1)
District Park Cave	11/18/2015	COA								20																	*Texella mulaiki* (1)
District Park Cave	5/31/2016	TC/COA								50												2				1	

			Endangered Species						Species of Concern									Other Significant Troglobites									
Cave	**Survey Date**	**Monitoring Agency**	***Rhadine persephone***	***Tartarocreagris texana***	***Tayshaneta myopica***	***Texamaurops reddelli***	***Texella reddelli***	***Texella reyesi***	***Caecidotea reddelli***	***Cicurina bandida***	***Cicurina travisae***	***Eidmannella reclusa***	***Rhadine austinica***	***Rhadine subterranea***	***Sphalloplana mohri***	***Tayshaneta devia***	***Texella spinoperca***	***Cicurina buwata***	***Eidmannella rostrata***	***Eidmannella* sp.**	***Rhadine* sp.**	***Speodesmus* sp.**	***Speodesmus bicornourus***	***Tartarocreagris infernalis***	***Tayshaneta* sp.**	***Texoreddellia texensis***	**Other notable species detected**
Elbowbush Cave	10/10/2015	COA																									
Flint Ridge Cave	11/18/2015	COA								7										4		28				3	*Batrisodes* sp. (4)
Flint Ridge Cave	5/31/2016	TC/COA								11										5		23				1	
Flint Ridge Cave	8/24/2016	COA								7										1		28				5	*Texella mulaiki* (1)
Gallifer Cave	1/21/2016	TC	6		23			49			70									1		7					*Perimyotis subflavus* (2)
Gallifer Cave	8/23/2016	TC	20		21			66			92									5		48				6	*Batrisodes* sp. (1)
Geode Cave	2/11/2016	TC	2		94			2			13	9										8					*Tartarocreagris* sp. (1)
Geode Cave	8/2/2016	TC	5		28			6			22	12								2		7	2			1	
Goat Cave	9/20/2016	COA								3																	
Ireland's Cave	2/9/2016	TC								3			10						1				2				*Batrisodes unicornis* (2)
Jester Estates Cave	11/16/2015	COA		2	12		22				12									2		5					*Anapistula* sp. (8) Trichoniscidae (10)
Jester Estates Cave	5/25/2016	TC/COA		6	1		16				5											6					Trichoniscidae (3)
Kretschmarr Cave	12/2/2015	TC				1					7			1						5							
Kretschmarr Double Pit	12/2/2015	TC	1								1									2		3					*Perimyotis subflavus* (2) *Texella* sp. (1)
Leopard Cave	10/10/2015	COA																									*Cicurina sp.* (blind) (1)
Little Bee Creek Cave	11/30/2015	COA					7			1										1		3					
Little Bee Creek Cave	5/31/2016	TC/COA					1			1												1					
Maple Run Cave	1/11/2016	COA								2																	*Anapistula* sp. (7)
Maple Run Cave	8/23/2016	COA								6																	
McDonald Cave	2/4/2016	TC						7			52					1			37				40				
McDonald Cave	8/19/2016	TC						7			19					3			12				24	1		1	
Midnight Cave	1/11/2016	COA								18			2							17		23					*Batrisodes* sp. (5) Trichoniscidae (3)
Midnight Cave	8/23/2016	COA								24			1							4		2				4	*Batrisodes* sp. (1)

			Endangered Species						Species of Concern									Other Significant Troglobites									
Cave	**Survey Date**	**Monitoring Agency**	***Rhadine persephone***	***Tartarocreagris texana***	***Tayshaneta myopica***	***Texamaurops reddelli***	***Texella reddelli***	***Texella reyesi***	***Caecidotea reddelli***	***Cicurina bandida***	***Cicurina travisae***	***Eidmannella reclusa***	***Rhadine austinica***	***Rhadine subterranea***	***Sphalloplana mohri***	***Tayshaneta devia***	***Texella spinoperca***	***Cicurina buwata***	***Eidmannella rostrata***	***Eidmannella* sp.**	***Rhadine* sp.**	***Speodesmus* sp.**	***Speodesmus bicornourus***	***Tartarocreagris infernalis***	***Tayshaneta* sp.**	***Texoreddellia texensis***	**Other notable species detected**
Millipede Annex Cave	11/10/2015	COA						8										5		2					10	1	*Anapistula* sp. (7)
Millipede Annex Cave	5/24/2016	TC/COA						29										15							1	2	
Millipede Cave	11/10/2015	COA																3		1					7		*Anapistula* sp. (4) Pseudoscorpionida (1)
Millipede Cave	5/24/2016	TC/COA																8							4	1	
New Comanche Trail Cave	8/2/2016	TC			6			18				2										25				2	*Cicurina sp.* (blind) (9)
No Rent Cave	11/17/2015	TC																13		1		2				6	*Nylanderia fulva* (345) *Perimyotis subflavus* (1)
No Rent Cave	1/27/2016	TC																10									*Nylanderia fulva* (146)
No Rent Cave	5/24/2016	TC						2						1				31				5				8	*Batrisodes* sp. (2)
No Rent Cave	8/10/2016	TC/COA						6										32				24			1		*Batrisodes* sp. (1)
North Root Cave	6/1/2016	TC									1																
Pond Party Pit	1/15/2016	COA						12												3		14		13			
Pond Party Pit	8/9/2016	COA	2					11			2			2						3		11		8			Trichoniscidae (1)
Rolling Rock Cave	11/16/2015	COA																									*Perimyotis subflavus* (1) Trichoniscidae (1)
Root Cave	2/11/2016	TC									9									1		38					
Seibert Sink	1/11/2016	COA															7			9		1					
Seibert Sink	8/23/2016	COA								6							5					8					
Slaughter Creek Cave	9/20/2016	COA								19												31					
Spanish Wells	11/19/2015	TC													86												*Stygobromus russelli* (305)
Spanish Wells	8/26/2016	TC							1						79												*Stygobromus russelli* (270)
Spider Cave	5/25/2016	TC/COA					5				15									1			2				
Stark's North Mine Cave	11/10/2015	TC																									*Perimyotis subflavus* (20)
Stark's North Mine Cave	5/27/2016	TC																				3					
Stovepipe Cave	1/15/2016	COA	3			18		22			4	6										21					*Tartarocreagris attenuata* (3) Trichoniscidae (6)

			Endangered Species						Species of Concern									Other Significant Troglobites									
Cave	**Survey Date**	**Monitoring Agency**	***Rhadine persephone***	***Tartarocreagris texana***	***Tayshaneta myopica***	***Texamaurops reddelli***	***Texella reddelli***	***Texella reyesi***	***Caecidotea reddelli***	***Cicurina bandida***	***Cicurina travisae***	***Eidmannella reclusa***	***Rhadine austinica***	***Rhadine subterranea***	***Sphalloplana mohri***	***Tayshaneta devia***	***Texella spinoperca***	***Cicurina buwata***	***Eidmannella rostrata***	***Eidmannella* sp.**	***Rhadine* sp.**	***Speodesmus* sp.**	***Speodesmus bicornourus***	***Tartarocreagris infernalis***	***Tayshaneta* sp.**	***Texoreddellia texensis***	**Other notable species detected**
Stovepipe Cave	8/9/2016	COA	1					17			5											41					*Tartarocreagris attenuata* (2) Trichoniscidae (21)
Talus Spring Cave	8/23/2016	TC																									*Stygobromus* sp.(3) *Texella* sp. (2)
Tardus Hole	11/9/2015	TC																									
Testudo Tube Cave	1/22/2016	COA	1												12			17		8	1	12					*Batrisodes* sp. (7) *Eurycea tonkawae* (12) *Stygobromus* sp. (55) Trichoniscidae (2)
Testudo Tube Cave	8/5/2016	TC/COA												1	100			13				9					*Eurycea tonkawae* (17) *Stygobromus* sp. (200) Trichoniscidae (1)
Tooth Cave	11/5/2015	TC	3		5			71			31	5											11			1	*Batrisodes* sp. (2) *Perimyotis subflavus* (6)
Tooth Cave	5/17/2016	TC	3		6			34			30	7											11			4	
Two Trunks Cave	2/11/2016	TC	1								2														2		
Weldon Cave	11/17/2015	TC												13				2					1				
Weldon Cave	1/27/2016	TC						1						7				6					1				
Weldon Cave	5/24/2016	TC						5						11				8		1			2				
Weldon Cave	8/10/2016	TC/COA						3						3				31					8				*Perimyotis subflavus* (2)
Whirlpool Cave	11/23/2015	TC/COA								4										17							*Nylanderia fulva* (153)
Whirlpool Cave	1/19/2016	TC/COA								1										1		1					
Whirlpool Cave	5/16/2016	TC								2												1					*Batrisodes* sp. (1) *Nylanderia fulva* (8) *Texella mulaiki* (1)
Whirlpool Cave	8/30/2016	TC/COA								7												1					*Batrisodes* sp. (2) *Texella mulaiki* (2)

[1] All survey data and full species lists available by request through COA and TC.

[2] Surveyors in FY16 include Todd Bayless, Christina Campbell, Travis Clark, Devin Grobert, Paul Fushille, Jessica Gordon, Linda Laack, Julie Murray, Krista McDermid, Mark Sanders, Jonny Scalise, and Blake Sissel.

EXHIBIT B:

CAVE CRICKET EXIT COUNT DATA REPORTS

FY 16 COA/TC CAVE CRICKET EXIT COUNT DATA REPORTS

Surveyed Caves	Fall 2015 (November)				Winter 2016 (January/February)				Spring 2016 (May)				Summer 2016 (August)			
	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:
Adobe Springs Cave	8	44	114	166					3	106	401	510				
Airman's Cave					110	15	10	125					63	40	0	103
Amber Cave	37	19	5	61					153	196	795	1144				
Broken Arrow Cave	89	68	211	368					366	201	573	1140				
Cave Y					640	522	108	1270					163	255	324	742
Cold Cave					778	98	0	876					180	85	235	500
Cortana Cave					27	23	51	101					13	47	75	135
Cotterell Cave					383	146	65	594					1142	129	40	1311
District Park Cave	701	73	1	775					253	584	464	1301				
Flint Ridge Cave	8	1		9	160	30	4	194	76	20	6	102	26	22	30	78
Gallifer Cave					9	17	0	26					6	9	462	477
Geode Cave					28	20	6	54					5	32	38	75
Jest John Cave													90	163	69	322
Jester Estates Cave	87	88	108	283					482	58	33	573				
Little Bee Creek Cave	13	5	0	18					0	0	20	20				
Maple Run Cave					788	177	15	980					994	66	42	1102
Midnight Cave					5979	7533	1521	15033					4385	2577	882	7844
No Rent Cave	349	235	7	591	42	17	0	59	495	294	711	1500	169	127	164	460
Pond Party Pit					60	17	35	112					94	78	172	344
Seibert Sink					75	114	41	230					255	122	155	532
Spanish Wells Cave													172	114	299	585
Spider Cave	11	11	24	46					45	25	43	113				
Stark's North Mine	3	5	3	11					0	12	10	22				

Surveyed Caves	Fall 2015 (November/December)				Winter 2016 (January/February)				Spring 2016 (May/ June)				Summer 2016 (August/ September)			
Stovepipe Cave					122	78	38	238					448	203	28	679
Testudo Tube					123	88	19	230					18	12	26	56
Tooth Cave	44	10	46	100					9	37	7	53				
Weldon Cave	220	167	96	483	349	173	0	522	556	363	587	1506	200	58	140	398
Whirlpool Cave	973	615	1593	3181	3383	799	35	4217	9025	2283	102	11410	2514	2136	415	5065

N= nymphs; J= juveniles; A= adults; TI= total individuals.