

**Balcones Canyonlands Preserve
Karst Monitoring and Management
FY 2014 Annual Report**



Tooth Cave pseudoscorpion (*Tartarocreagris texana*) detected while conducting a faunal survey in Jester Estates Cave, Travis County.
Photo by Mark Sanders

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



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1.0 REGIONAL PERMIT

There are six species of endangered karst invertebrates (ES) and 25 karst species of concern (SOC) 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 2014 (FY14), 30,540 acres have been acquired for the Balcones Canyonlands Preserve (BCP). Forty-seven of the 62 BCCP karst features have some form of formal protection within these BCP tracts, which include properties owned and managed by COA, TC, and BCCP partners, as well as private mitigation lands.

The six species of endangered karst invertebrates in Travis County are:

Tooth Cave pseudoscorpion	<i>Tartarocreagris texana</i>	Kretschmarr Cave mold beetle	<i>Texamaurops reddelli</i>
Tooth Cave spider	<i>Neoleptoneta myopica</i>	Bee Creek Cave harvestman	<i>Texella reddelli</i>
Tooth Cave ground beetle	<i>Rhadine persephone</i>	Bone Cave harvestman	<i>Texella reyesi</i>

The 25 additional karst species of concern to be protected by the regional permit are:

FLATWORMS	<i>Sphalloplana mohri</i>	PSEUDOSCORPIONS	<i>Aphrastochthonius</i> N. S.
OSTRACODS	<i>Candona</i> sp. Nr. <i>Stagnalis</i>		<i>Tartarocreagris comanche</i>
SPIDERS	<i>Cicurina bandida</i>		<i>Tartarocreagris reddelli</i>
	<i>Cicurina cueva</i>		<i>Tartarocreagris intermedia</i>
	<i>Cicurina ellioti</i>		<i>Tartarocreagris</i> N. S. 3
	<i>Cicurina reddelli</i>	HARVESTMEN	<i>Texella spinoperca</i>
	<i>Cicurina reyesi</i>	GROUND BEETLES	<i>Rhadine s. subterranea</i>
	<i>Cicurina travisae</i>		<i>Rhadine s. mitchelli</i>
	<i>Cicurina wartoni</i>		<i>Rhadine austinica</i>
	<i>Neoleptoneta concinna</i>	ISOPODS	<i>Caecidotea reddelli</i>
	<i>Neoleptoneta devia</i>		<i>Trichoniscinae</i> N. S.
	<i>Eidmannella reclusa</i>		<i>Miktoniscus</i> N. S.
MILLIPEDES	<i>Speodesmus</i> N. S.		

2.0 CAVE MANAGEMENT SUMMARY

This annual report covers the fiscal year 10/01/13-9/30/14 (FY14). In FY14, 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 1 and 3 for species localities).

A total of 47 of the BCCP caves are “protected” in some way, with 15 “unprotected”. The 47 “protected” BCCP caves are currently managed as follows: 21 caves protected as part of the BCP on COA land; one cave protected on The Nature Conservancy (TNC) land; 12 caves protected as part of the BCP on TC land; two caves protected on Texas Cave Management Association (TCMA) land; seven 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 5 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 2 and 4). 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 FY14, 12 endangered species karst features which were not listed on the BCCP permit are being protected on BCP lands (six features on TC BCP; six features on COA BCP; Table 2). 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 4).

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 1. 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 <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Neoleptoneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Amber Cave	BCP Jollyville/TC	Jollyville Plateau	X 1996		X 2010 (Reddell)	X 1996		
Bandit Cave	Private	Rollingwood					P 1996	
Beard Ranch Cave	BCP Ivanhoe/COA	Jollyville Plateau						X 1996
Bee Creek Cave	Private	Rollingwood					X 1996	
Beer Bottle Cave	Not one of the 62 BCCP caves	McNeil/Round Rock						X 1996
Broken Arrow Cave	BCP Lime Cr. Prs./COA	Cedar Park			X 1996			
Cave Y	BCP Barton Creek Grblt/COA	Rollingwood					P 1996 delete P (Reddell 2004)	
Cold Cave	Private	McNeil/Round Rock						X 1996
Cotterell Cave	BCP Spicewood Spgs. Pk./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 Pk./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

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Neoleptoneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Hole-in-the-Road	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	
Jester Estates Cave	BCP Forest Ridge/COA	Jollyville Plateau	X 2008 (Cokendolpher)	X 2010 (Ledford)			X 1996	
Jollyville Plateau Cv.	BCP Private 10(a)	Jollyville			X 1996			X 1996
Kretschmarr Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996	X 1996		
Kretschmarr Dble. Pit	BCP Jollyville/TC	Jollyville Plateau	P 1996 X 2005		P 1996 X 2005		P 1996	
Lamm Cave	Private Section 7	Jollyville Plateau			X 1996			
Little Bee Cr. 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
Millipede Cave	Not one of the 62 BCCP caves	McNeil/Round Rock						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 Tr. Cave	BCP Lake Travis/TC	Jollyville Plateau		X 1996				X 1996
No Rent Cave	Private	McNeil/Round Rock						X 1996

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Neoleptoneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
North Root Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996			
Puzzle Pits Cave	Not one of the 62 BCCP caves	Jollyville			X 1996			
Rolling Rock Cave	BCP Lime Cr.Pr./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)	P 1996 delete P 2004 (Reddell)
Stark's North Mine Cave	BCP Stark's/TC						X 2009 (USFWS)	
Stovepipe Cave	BCP Canyon Creek/ COA	Jollyville Plateau	P 1996 delete P 2005 (Reddell) *	P 1996 delete P 2010 (Ledford)	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
West Rim Cave	Not one of the 62 BCCP caves	Central Austin						X 1996

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

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 2005 = was listed as confirmed in the HNTB summary of James Reddell's data, 2005 report for USFWS

Tentative 2005 = was listed as tentative in the HNTB summary of Reddell's data, 2005 report for USFWS

Delete P 2004 (Reddell) = this species is no longer thought to occur in this cave (personal communication Reddell 2004)

* Reddell (pers com 2005) reported that *Tartarocreagris texana* does NOT occur in Stovepipe Cave. The species there is *Tartarocreagris altimana*, known only from that cave.

X 2008 = Cokendolpher (pers com 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 com 2010)

Delete P 2010 (Ledford) = *Neoleptoneta* for stovepipe was confirmed as *N devia* (personal communication J. Ledford 2010)

X 2010 (Reddell) = confirmed by J. Reddell (pers com 2010)

Table 2. 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 <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Neoleptoneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
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
Merkin Hole	COA	Jollyville Plateau					X 2010	
Pond Party Pit	COA	Jollyville Plateau						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: USFWS 2008, Zara Environmental 2007a, 2007b, 2008, and 2010.

Key

X = confirmed occurrence based on collected specimen.

Table 3. Karst Invertebrate SOC within BCCP Caves, Travis County, Texas^{1,2}

Key and footnotes follow table

Cave Name	<i>Aphrastochitonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> ³	<i>Cicurina travisae</i> ⁴	<i>Cicurina</i> sp. ⁵	<i>Eidmannella reclusa</i>	<i>Miktoniscus</i> N.S.	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. ³	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> 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														

Cave Name	<i>Aphrastochithonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> ³	<i>Cicurina travisae</i> ⁴	<i>Cicurina</i> sp. ⁵	<i>Eidmannella reclusa</i>	<i>Miltoniscus</i> N.S.	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> 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															

Cave Name	<i>Aphrastochthonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> ³	<i>Cicurina travisae</i> ⁴	<i>Cicurina</i> sp. ⁵	<i>Eidmannella reclusa</i>	<i>Miltoniscus</i> N.S.	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spinoperca</i>	<i>Trichoniscinae</i> 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	<i>Aphrastochthonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. <i>stagnalis</i>	<i>Cicurina bandida</i> ³	<i>Cicurina travisae</i> ⁴	<i>Cicurina</i> sp. ⁵	<i>Eidmannella reclusa</i>	<i>Miltoniscus</i> N.S.	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> 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 2014.

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 trivisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. trivisae* (Hedin 2014).

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

Table 4. Non-BCCP Caves/Karst Features with Karst SOC Protected on BCP^{1,2}

Key and footnotes follow table

Cave Name	BCP Owner	<i>Aphrastochitonius</i> N.S.	<i>Caecidotea reddelli</i>	<i>Candona</i> sp. nr. stagnalis	<i>Cicurina bandida</i> ³	<i>Cicurina trivisae</i> ⁴	<i>Cicurina</i> sp. ⁵	<i>Eidmannella reclusa</i>	<i>Miktoniscus</i> N.S.	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine s. subterranea</i>	<i>Rhadine s. mitchelli</i>	<i>Speodesmus</i> N.S.	<i>Sphalloplana mohri</i>	<i>Tartarocreagris comanche</i>	<i>Tartarocreagris intermedia</i>	<i>Tartarocreagris</i> N.S. 3	<i>Texella spiniperca</i>	<i>Trichoniscinae</i> 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														
RI-1	TC						X														
RI-3	TC						X														
Siebert Sink	COA				X					X											X
Two Trunks Cave	TC					X															

Sources: Bayless pers com 2013, Paquin and Hedin 2005, Sanders pers com 2013, TMM 2007, Zara Environmental 2008, 2010, Hedin 2014.

Key and Footnotes

X = confirmed location based on collected specimen.

¹ *Cicurina elliotti* 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 trivisae* include localities formerly listed as *Cicurina reddelli* and *Cicurina wartoni*, which have been formally grouped together into the single species *C. trivisae* (Hedin 2014).

⁵ Localities of possible SOC; 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, and septic 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.

In order to meet the terms and conditions of the BCCP Permit, Permit holders in FY14 determined a need to provide a procedure for the BCCP Coordinating Committee to implement conditions in the Permit that allow BCCP-listed caves to be substituted with suitable other caves in a process that is transparent, science-based, and consistent with the vision and intent established for the BCCP. The first of several workshops commenced in August 2014, attended by members of TC, COA, USFWS, and other karst experts and stakeholders, which set up a strategy to define roles, responsibilities, and evaluation criteria for a final BCCP Karst Substitution Process Policy to be completed in FY15.

Table 5. FY14 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 twice 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; 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; 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 cave cricket exit counts WPD (Watershed Protection Division) is currently negotiating with property owner to increase monitoring and management of the cave 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; 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; RIFA control	none
Disbelievers Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
District Park Cave	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	1 st room open, past 1 st room protected by gate, access by permit*
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; 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	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	Private/COA Protection Agreement	Gated and fenced	Protected with Protection Agreement - Inadequate setback from development.		none
Goat Cave	SOC	BCP/COA	Fenced	Protected on preserve	COA weekly surface monitoring; annual species monitoring; 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

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Jack's Joint	SOC	Private		Private - Unknown		none
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; 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 Cr. 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 – Unknown (new owner); may be development near cave entrance		none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Lost Oasis Cave	SOC	Private/ TCMA	Gated and fenced	Protected by TCMA	Sporadic species and surface monitoring by TCMA	controlled 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 weekly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	access by permit*
McDonald Cave	ES	BCP Jollyville/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; 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; 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 and add a cave gate, as well as adding a 300 ft buffer around the cave.	Zara Environmental species monitoring	none
Pickle Pit	SOC	BCP/Private Sec. 7	Gated	TC staff in early negotiations worked with property owner on a possible MOU or management agreement.	TC/COA occasional species monitoring Monthly surface inspections by concerned neighbor	none
Pipeline Cave	SOC	Private	Gated	WPD have 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; 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; RIFA control	none
Spanish Wells Cave	SOC	Private		Private- Unknown	TC/COA occasional 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; RIFA control	none
Stark's North Mine	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

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Stovepipe Cave	ES	BCP/ COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Talus Springs Cave ²	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 to assess tawny crazy ant impacts	controlled access**

¹Cave 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 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

The *Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management* (2007) describes the need for public education as follows:

- “Public education is essential for the continued existence and recovery of karst invertebrates.”
- “Public Education includes literature, curriculum, guided surface and subsurface tours that can be made available for the general public, agencies, and individuals interested in learning more about karst areas and their inhabitants.”
- “A higher public awareness is an important step for the recovery of the endangered cave invertebrates and preservation of species of concern.”
- “Need to control public access (cave gates) and monitor for impacts to species.”

Public education on caves and cave ecosystems is recognized as vital for karst species preservation in the Karst Land Management Plan. Currently, most opportunities for children to enter caves and learn about cave ecosystems is through programs provided by COA 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 2,034 person trips in FY14. 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 BS/EACD 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 1,502 visitors in FY14. Wildflower Cave has been used for education by COA Earth Camp since 1997 after it was restored by cleaning out trash fill on December 4, 1993, March 6, 1994, and April 22, 1995. 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 to be used 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 FY14, considerable progress was made in developing non-BCCP caves to use for education:

- La Crosse Cave (owned by the University of Texas Lady Bird Johnson Wildflower Center) and Wade Sink in the Goat Cave Karst Preserve (owned by Austin Parks and Recreation Department) were gated by Charlie Savas under contract by COA WPD, so that removal of sediment and ranch fill can continue in 2015.
- 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 FY14, progress with restoration plans continued (revegetation and fire ant 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 Mark Sanders and Todd Bayless (TC BCP).. To

help fund this restoration project, Tina Vick received \$1,000 from the Partners in Education Grant. On October 8th, and December 2nd, 2013, presentations on karst biology and geology were provided by Todd Bayless and Mark Sanders to the McNeil High School Green club and AP Environmental Science classes as the students were introduced to the courtyard caves.

FY14 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). FY14 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 FY14, Earth Camp guided 1,444 students into Wildflower Cave. An additional 5,476 fifth-graders in AISD and Eanes ISD received Earth School, a hands-on classroom presentation using an Aquifer Model (Table 6). The BS/EACD and Lady Bird Johnson Wildflower Center are partnered with Earth Camp. More details on these programs can be found online at: www.austintexas.gov/EarthCamp and www.austintexas.gov/department/earth-school. The LBJ Wildflower Center, in partnership with COA WPD, also offered a family cave adventure at Wildflower Cave in March 2014 for 8 participants.

In summer 2014, **Parent/Child Clean Creek Camp** brought 50 children and parents into Wildflower Cave and Whirlpool Cave (Table 6). 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 FY14, 15 middle school students were guided through Lost Oasis Cave and 98 middle school students and approximately 100 high school students were guided through Whirlpool Cave (Table 6). (www.austintexas.gov/department/watershed-detectives and www.austintexas.gov/department/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. During the 2014 Institute, 50 teachers were reached (Table 6; www.keeptaustinbeautiful.org/GroundwatertoGulf)

Table 6. Summary of FY14 COA WPD education programs providing cave field trips and aquifer outreach

Program	Grade	Number reached
Earth Camp	5 th	1444
Earth School	5 th	5,476 (presentation does not include cave immersion)
Watershed Detectives	6 th -8 th	113
Hydrofiles	9 th -12 th	100
Clean Creek Camp	Adults and 4 th -8 th	50
Groundwater to the Gulf	teachers	50
Total reached:		7,233

Annual BCCP Infrastructure Workshop

COA , LCRA, and TC staff organized the annual BCCP Infrastructure workshop on October 10, 2013. This workshop is primarily intended to help project managers and field supervisors involved in infrastructure projects avoid impacts to the BCP. COA WPD staff presented on the challenges of developing the COA Water Treatment #4 plant over endangered species habitat. TC BCP staff provided a field trip to Kretschmarr Cave and presented on karst environments, biology, and impacts to karst ecosystems.

USFWS Karst Conservation Initiative Conference

In September 2014, Nico Hauwert of COA WPD presented on new study results that show that recharge from rainfall over the Edwards Aquifer is much higher than is commonly cited in environmental assessments. Understanding of recharge sources is critical for assessing water source areas for preserving cave ecosystems. An associated paper was published in the Journal of Water Resource and Protection (<http://dx.doi.org/10.4236/jwarp.2014.69081>).

Master Naturalist Annual Geology Training

Annual master naturalist training was held in February 2014 at UT's Lady Bird Johnson Wildflower center in Geology and Soils, which included a wild cave tour of Wildflower Cave and training on cave development, cave ecosystems, common and rare cave fauna, and the interaction of surface and subsurface systems, particularly nutrients and water.

Cave Guide training

Cave skills trainings were provided by COA WPD hydrogeologist Nico Hauwert in Whirlpool Cave for camp counselors, mentors, and trip leaders of the ANSC, Austin PARD rangers, and Explore Austin. The trainings included cave ecosystems, surface and subsurface exchange of nutrients and water, groundwater hydrogeology, cave safety, and physical challenges in these specific caves. The trained tour leaders provide education for a large number children to assist in stewardship of the BCCP caves.

Austin Parks and Recreation

ANSC offers summer camps and other programs year-round that educate children ages 3-16 on bats, reptiles, salamanders and other wildlife. The Nature Center offers cave tours through their camps as well as for families on special events. ANSC took about 438 participants (students and adults) on educational caving trips from Oct 1, 2013 through September 20, 2014 into four BCCP Caves: Whirlpool Cave (360), Lost Oasis Cave (33), Goat Cave (15), and District Park Cave (30).

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>)

In 2013, COA PARD rangers initiated a cave education program, utilizing Maple Run, District Park, and Goat caves primarily for adults and families. In FY14, they led roughly 200 participants on cave tours.

The Camacho Activity Center began providing child cave tours in 2014.

Texas Cave Management Association Cave Education

In FY14, Whirlpool Cave was managed by Matt Turner while Lost Oasis Cave was managed by Chris Vreeland, both volunteers for TCMA. Whirlpool Cave supports the BCP as the most suitable cave currently available for lengthy recreation/education trips.

Access was up this year to both TCMA owned caves. 2,034 individuals accessed Whirlpool cave and a total of 133 individuals accessed Lost Oasis Cave.

FY14 Access Status

In FY14, 402 visitors were issued access permits by COA BCP staff to COA BCCP caves for educational/recreational/rescue training including: Airmen's cave (134), District Park Cave (97), Goat Cave (127), Maple Run Cave (28), and Midnight Cave (16). See Table 3 for access and gating status of all of the BCCP caves. This total includes the numbers listed above issued to COA PARD for education 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 Heather Tucek, Justin Shaw, landscape architect Vivian Loftin, Don Broussard, Guin McDaid, David Comer, Yaz Avila, Drew

Thompson, Lee Jay Graves Jeff Nichols, and Fernando Hernandez. In FY14, the team primarily worked restoring five project caves (Brownlee, Sinky Dinky, Winter Woods, Wyoka, and Sink-in-the-Woods/Williams Well) on Blowing Sink Research Management Unit. Restoration efforts for these caves are described below.

Blowing Sink Research Management Unit restoration

In FY13, COA WPD, in cooperation with COA BCP and PARD conducted sinkhole and cave restoration on five project sinkholes (Sink in the Woods/Williams Well, Brownlee, Winter Woods, Wyoka, and Sinky Dinky) on the Blowing Sink Preserve. After a rescue of two 18-year old students from Blowing Sink Cave in February 1991, volunteer cavers under leadership of William Russell installed wooden structures in these five sinks to keep people out. After 20 years the temporary emergency structures are failing, allowing the collapse of unstable sediment slopes that contribute to obstructing recharge as the caves plug. Since the plugged caves can no longer accept recharge, floodwaters pummel a BCCP cave: Blowing Sink Cave. In addition, several of the sinks are once again gaping open as a public safety hazard. These caves are in the subsurface catchment area and are known to contribute recharge to Blowing Sink Cave. COA WPD dedicated Capital Improvements funds to restore the five sinkholes with project management by Nico Hauwert.

Prior to initiation of a Zara Environmental, LLC contract to begin restoring the five project caves, flood flows caused extensive collapse and unstable filling of the drain in Kirschberg Hall in Blowing Sink Cave, effectively cutting off access to the lower portions of the cave including the water table. Attempts by COA WPD and BCP staff were unsuccessful in reopening the collapsed section. During the 1990s, this section was sealed by a similar flood and remained inaccessible for about five years, although the current collapse appears more unstable and may be permanent without difficult mitigation.

In FY14, Zara Environmental completed construction of concrete chimneys and gates for Sinky Dinky, Winter Woods, Wyoka, and Sink-in-the-Woods/Williams Well caves. The COA WPD cave team also manually excavated the five project caves of plugging sediment and debris, as well as installed surface sedimentation/erosion controls and tree protection. COA PARD preserve managers, rangers and foresters assisted by removing sediment and retaining venomous snakes from the project caves, providing mulch for tree protection and sediment/erosion controls, and removing approved trees, and assisting with site security. COA BCP also supported the restoration project with backhoe work for rimming Brownlee Cave with on-site boulders to help prevent future erosion.



Sinky Dinky Cave in 2002, with cave explorer William Russell and COA biologist Carlo Abbruzzese.



Sinky Dinky Cave in 2012. As the wooden chimney decomposes, unstable sediment collapses into the 20 ft-deep cave floor, plugging the cave and exposing public safety and cave ecosystem threats. Brian Cowan, geologist for Zara Environmental, is documenting the collapse.



Sinky Dink Cave in October 2014 with completed concrete chimney, gate, and filter media, but prior to landscape revegetation.

Brownlee Cave was restored from its plugged condition in 2012 by manual excavation from the COA WPD cave team. Manual restoration without a natural chimney was deemed necessary since the Kinder Morgan petroleum pipeline runs within 15 feet of the cave entrance, presenting a risk for the type of restoration used at the other four project caves. Upgradient rock berms effectively removed sediment such that a chimney was not necessary and more natural appearance could be attained.



Brownlee Cave is plugged under three feet deep lake following a storm on Feb. 18, 2012. Photo by Nico Hauwert.



Brownlee Cave was restored manually by the COA WPD cave team, in part to avoid impacting an adjacent petroleum pipeline. This cave was plugged on several occasions prior to 2014 but now recharges relatively clear runoff. Cave team members, Yazmin Avila (right) and Fernando Hernandez (left) are shown in photo by Don Broussard.

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 with 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 will focus 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.

In FY14, COA and TC BCP staff facilitated and monitored protection efforts within karst zones and near karst features for LCRA’s T-160 power line upgrade. Staff worked with Zara Environmental on studies to delineate drainage basins for several BCCP caves and identify karst features within infrastructure development areas (see section 7.0 for details), as well as overseeing implementation of mitigation measures at impacted sites (Zara Environmental 2014a, 2014b, 2014c).

Also in FY14, 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 been confirmed. Implementation of these BMPs will be critical to minimizing the potential of introducing new populations of this destructive non-native ant species to other parts of Austin and elsewhere. Completion of these BMPs will occur in early

FY15, where they will be 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 (USFWS 2014a).

Beyond USFWS recommendations, survey methodology also follows guidelines described in the *2007 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 2 hours starting 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.

FY14 TC/COA Collaborative Monitoring Projects

In FY 13, USFWS contracted with Marshal Hedin at San Diego State University in an effort to confirm the species of blind Cicurina found in Pickle Pit Cave, which is known as the type locality for *Cicurina wartoni*, a candidate species for listing under the ESA. In 2009, Paquin and Duperre redescribed *C. wartoni* and provided morphological and geographical evidence to suggest that this taxon is a member of the *C. buwata* species complex (including *C. wartoni*, *C. reddelli*, *C. buwata*, and *C. trivisae*; Paquin and Duperre 2009). Therefore, there was a need to verify the validity of this taxon. COA and TC BCP staff collaborated on this project by providing *Cicurina* specimens collected from all of the type localities listed for northern Travis County, including Pickle Pit Cave. Marshal Hedin's final report was released in March 2014, and results of genetic analyses indicated that there are only two distinct species complexes in the study area: *C. buwata* in the northern range and *C. trivisae* in the southern range. Based on these findings, *C. reddelli*, *C. wartoni*, and *C. trivisae* should now be treated as a single species: *C. trivisae*. Thus, confirmed localities previously identified as *C. reddelli* and *C. wartoni* are now considered as localities for *C. trivisae* (Hedin 2014; APPENDIX P12). Following the completion of Hedin's report, USFWS completed a status review of *Cicurina wartoni* and concluded that this species does not warrant protection under the Endangered Species Act (ESA) (USFWS 2014b).

In FY14, TC and COA BCP staff updated a monitoring and collection protocol and reporting procedures for the tawny crazy ant (TCA), a newly discovered non-native species which could potentially adversely affect forest and karst ecosystems on the BCP. Since FY12, BCP staff have included monitoring for presence of TCAs at all visits to cave sites. In FY13, at

least one BCCP cave (Whirlpool Cave) has been confirmed to be infested by TCAs, which was observed >100 ft into the cave. 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 <200 m from these caves. In addition, COA and TC BCP staff are collaborating with local TCA specialist Ed LeBrun of UT's Brackenridge Field Lab to study impacts to karst invertebrate assemblages and design control methods for use within sensitive karst environments.

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 FY14 to gather baseline data for the McNeil High School courtyard restoration project, scheduled to commence in FY15 (EXHIBIT A). Cave cricket exit counts and management activities such as vegetation planting and RIFA control are being 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.

City of Austin FY14 Biological Monitoring

During FY14, COA BCP staff conducted bi-annual monitoring on the following 16 pre-selected caves: Airmen's Cave, Broken Arrow Cave, Cave Y, Cortana Cave (non-BCCP cave), Cotterell Cave, District Park Cave, Flint Ridge 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). In addition, COA BCP staff conducted three surveys at Barker Ranch Cave # 1 (non-BCCP cave), and initiated quarterly surveys at Flint Ridge Cave (EXHIBIT A). Faunal surveys in these caves were conducted by permitted COA biologists in either Fall 2013/ Spring 2014 or Winter 2014/ Summer 2014. Annual faunal surveys were also conducted in Arrow Cave, Beard Ranch Cave, Blowing Sink, Goat Cave, Rolling Rock Cave, and Slaughter Creek Cave (EXHIBIT A).

Testudo Tube was added to TC/COA's collective bi-annual monitoring efforts in FY14, when Zara Environmental's long term monitoring contract to comply with the Lakeline Mall Habitat Conservation Plan expired. To maintain consistency with Zara Environmental's monitoring efforts of Testudo Tube since 1991, COA BCP staff are committed to continue data collection utilizing the same survey transects, and have also expanded the lower level survey to include *Eurycea tonkawae* monitoring.

In an effort to determine the validity of a possible listed species (*Texella reyesi*) that could be negatively impacted by the proposed SH SW 45, COA BCP staff as well as TXDOT contractors conducted faunal surveys at Barker Ranch Cave #1 in an effort to collect an adult specimen for species verification. On one visit COA BCP staff collected an immature specimen that was then sent to taxonomist Darrell Ubick. Due to the fact that an adult specimen was not collected, Dr. Ubick could not positively determine the specimen to species level; however, he did make the determination that the original identification of *T. reyesi* was most likely a mistake based on the fact that no *T. reyesi* are known to occur south of the Colorado River (D. Ubick pers com, 2014). Therefore, the immature specimen is most likely the non-listed species, *Texella mulaiki*.

Also in FY 14, COA BCP staff increased the frequency of faunal surveys for Flint Ridge Cave to collect baseline data for determining potential negative impacts from a newly proposed SH SW 45 being considered nearby (EXHIBIT A).

In FY14, COA BCP staff with the help of volunteers conducted bi-annual cave cricket exit counts (quarterly at Flint Ridge Cave) at the same 16 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 FY14 Biological Monitoring

TC's BCP staff conducted bi-annual monitoring on the following nine pre-selected caves: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave (non-BCCP cave), McDonald Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Faunal surveys in these nine caves, with permitted TC biologists, were conducted in either Fall 2013/ Spring 2014 or Winter 2014/ Summer 2014 (EXHIBIT A). Annual faunal surveys were also conducted in five other TC-owned BCCP caves with federally listed species: Kretschmarr Cave, Kretschmarr Double Pit, New Comanche Trail Cave, North 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 two additional TC-owned BCP caves with listed ES: Two Trunks Cave and Tight Pit Cave (EXHIBIT A).

In FY14, TC conducted bi-annual cave cricket exit counts at the same nine caves pre-selected for faunal surveys: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave,

Geode Cave, McDonald Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Exit counts were conducted in either Fall 2013/ Spring 2014 or Winter 2014/ Summer 2014 (EXHIBIT B).

Also in FY 14, TC staff facilitated and assisted with a cave cricket foraging study performed by Zara Environmental, in association with plans to extend COA PARD's Walnut Creek Trail in the vicinity of Stark's North Mine. Zara Environmental staff conducted several cave cricket exit counts as part of this project; results can be found in EXHIBIT B as well as in their report entitled "Cave Cricket Foraging Study from Stark's North Mine to Proposed North Walnut Creek Trail, Austin, Travis County, Texas (Zara Environmental 2014d; APPENDIX P23).

RIFA surveys were performed in Fall 2013 and Spring 2014 on all eleven TC-owned BCCP caves with federally listed species, as well as all other TC-owned caves with ES (Geode Cave, Tight Pit Cave, and Two Trunks Cave). RIFA surveys were also conducted at two additional TC-owned BCCP caves (Ireland's Cave and Talus Spring Cave). RIFA mounds were surveyed within a 80 m radius around cave entrances, and all mounds found during surveys were treated with boiling water as recommended by USFWS (2014c). In Fall of 2013, a total of 243 RIFA mounds were treated within these 80 m cave survey areas, with an additional 21 RIFA mounds treated in the vicinity of caves but outside of survey areas. In Spring of FY14, a total of 258 RIFA mounds were treated within these 80 m cave survey areas, with an additional 59 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 FY14, including Cactus Pit, Brew Pot Cave, Kretschmarr Sink, Kretschmarr Salamander Cave and karst features RI-1, LU-11 and LU-12. Also in FY14, TC staff photographed, tree-tagged, and verified locations for 27 Travis County BCP karst features following standardized methods for improving protection efforts.

Other Biological Monitoring Efforts

Zara Environmental conducted biological monitoring at Pennie's Cave in FY14 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 in FY14, with plans for additional monitoring/management in FY15 including RIFA surveys/control and creation of a cave map (Zara Environmental 2014e; APPENDIX P24).

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 FY14, 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

COA WPD hydrogeologists Scott Hiers, David Johns, and Nico Hauwert utilized new LIDAR surface topography coverages and performed a GPS field survey of debris lines after heavy flooding in mid-October 2013 to re-examine the surface catchment area for Flint Ridge Cave along its western edge. As a result of this work, the surface catchment to the cave has been refined from previous efforts.

In April 2014, Nico Hauwert and the COA WPD cave team initiated a hydrogeologic study of Flint Ridge Cave. A quality assurance project plan was prepared for the study on May 15, 2014. In April and May, 2014, COA preserves near Flint Ridge Cave were surveyed for karst features, crossing the area between Lost Oasis Drive and Bliss Spillar Road in 50 to 100 feet wide transects. A number of new caves were discovered, and previously known features were found to be caves, including Tabor Crevice Cave (700 feet long), Root Cave (20 feet long), and others. Drips in the newly discovered caves were evaluated, and some drips were incorporated in monitoring for the hydrogeologic study. All drips found in Flint Ridge Cave were mapped. Monitoring stations, including ISCO autosamplers, HOBO drip gauges, and continuous Hydrosonde monitoring, were established in Flint Ridge Cave at the Drip Pit and lower Culvert Crawl and in Tabor Crevice cave at Zeus Finger drip. Background sampling was conducted from the monitoring stations and other identified drips in Flint Ridge and Tabor Crevice caves from September into November 2014. Tracing from 7 surface sites will be initiated in early FY15. Roger Glick's team of hydrogeologists continued to measure flow and water quality entering the cave from three drainages. It is anticipated that three phases of tracing and a hydrogeologic study report will be completed by June 2015.

Goat Cave, Maple Run, and Blowing Sink Caves

A hydrogeologic study of water source areas for Goat Cave, Maple Run, and Blowing Sink caves was conducted in FY14 by the COA WPD cave team with Brian Cowan and other staff of Zara Environmental. The study completion was delayed so that a mandated addendum to the quality assurance plan could be prepared to describe the final trace in greater detail. An addendum to the QAPP was completed April 15, 2014 to allow the final trace, intended to verify the flow path traced from Goat Cave karst preserve to Balcony Drip in Blowing Sink Cave. The third phase injection was conducted on May 13, 2014 in Hideout Cave. Unfortunately, after the October 31, 2013 flood, access to the lower level of Blowing Sink Cave was blocked, and attempts to re-excavate the passage were unsuccessful, so that most monitoring sites in Blowing Sink Cave could not be monitored for the final tracing phase. A breakthrough of the tracers at the Balcony Room of Blowing Sink Cave was not measured in the phase 3 trace of the study, as was measured in a similar trace conducted on February 4, 2012. Consequently the original trace could not be verified, but the original results cannot be discounted as well. The hydrogeologic study is expected to be completed by September 2015.

Spanish Wells Cave

A hydrologic study of Spanish Wells cave was completed in December 2013 by Nico Hauwert of COA WPD. The report includes surface and sub-surface catchment areas as well as an updated cave map (Hauwert 2013).

Stark's North Mine

A COA WPD hydrogeologic study of Stark's North Mine, involving mapping of the cave, identifying cave drips and pools, and projecting cave pool elevations on the surface to overestimate potential subsurface catchment areas, was initiated in FY14, with a final hydrogeologic report expected in early FY15.

District Park Cave

Rain events on October 12 and October 31, 2013 and backwater behind a downstream flood control dam caused the cave to be inundated. The lower Aggie Room appeared to have been filled to the ceiling with floodwater. The COA WPD cave team re-excavated the cave access crawl on Nov. 12, 2013. The cave drips were not monitored in FY14.

LCRA T-160 Line Upgrade Project Hydrogeologic Studies

LCRA contracted Zara Environmental to perform hydrogeologic studies at New Comanche Cave, Geode Cave (non-BCCP cave), Eluvial Cave, Japygid Cave, Jollyville Plateau Cave, and M.W.A. Cave (Zara Environmental 2014a, 2014b). These hydrogeologic studies were needed to determine if the proposed LCRA line upgrade would negatively impact these BCCP caves, all of which were located within ¼ mile of the LCRA power line upgrade work. Results from these studies concluded that none of the caves would be negatively impacted due to the fact that the proposed work was outside of the caves' surface and subsurface drainage basins.

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 FY15, and prioritize efforts accordingly.

In order to meet the terms and conditions of the BCCP Permit, Permit holders in FY14 determined a need to provide a procedure for the BCCP Coordinating Committee to implement conditions in the Permit that allow BCCP-listed caves to be substituted with suitable other caves in a process that is transparent, science-based, and consistent with the vision and intent established for the BCCP. The first of several workshops commenced in August 2014, attended by members of TC, COA, USFWS, and other karst experts and stakeholders, which set up a strategy to define roles, responsibilities, and evaluation criteria for a final BCCP Karst Substitution Process Policy to be completed in FY15.

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.

9.0 KARST MANAGEMENT ACTIVITIES

The BCP Karst Land Management Plan (2007) outlines planned activities concerning the 62 BCCP karst features. Table 7 below includes a summary of monitoring and management activities for these features completed in FY14.

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.
<p><u>Adobe Springs Cave</u> The Nature Conservancy</p> <ol style="list-style-type: none"> 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).
<p><u>Airmen's Cave</u> City of Austin</p> <ol style="list-style-type: none"> 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 twice weekly, and have helped COA staff make cave gate and sign repairs. Volunteers noted a major breach attempt as the gate was cut at four places, though cave still could not be accessed. COA staff contracted out repair work, and gate was repaired within days of breach attempt.
<p><u>Amber Cave</u> Travis County</p> <ol style="list-style-type: none"> 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. Treated 21 mounds in Fall 2013 and 21 mounds in Spring 2014. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
<p><u>Armadillo Ranch Sink</u> Private</p>
<p><u>Arrow Cave</u> City of Austin</p> <ol style="list-style-type: none"> 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 BCP staff met on site with COA PARD Rangers in an effort to address these ongoing problems, and the Rangers will start monitoring the site monthly in FY15. 3. Inspected site for RIFA infestations. On all visits RIFA were observed within close proximity of the cave (but not inside the cave).
<p><u>Bandit Cave</u> Private</p>

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

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 semi-monthly, installed 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. The site had a dramatic increase in trespass, theft, and vandalism until the perpetrators were eventually caught.
2. Treated site for RIFA with boiling water.
3. Completed cave faunal survey (See EXHIBIT A).
4. Continued work on an in-depth hydrogeologic study to determine the potential impacts of a new road extension and realignment of Davis Lane (completed).
5. A 26 acre parcel is immediately south of Blowing Sink Cave, and includes a new cave and well which was deeded to the Blowing Sink tract. Upon transfer to COA, the property owner installed a 6’ chain link fence along the perimeter of the property, thus greatly improving security to the property.
6. COA staff removed invasive non-native vegetation from the preserve.
7. WPD staff initiated efforts to stabilize and secure several sinkholes located on the tract. Currently these features contribute large amounts of sediment into the aquifer and are also a potential safety liability. In FY14, 3 of the 5 features have been restored.
8. The lower passageways to Blowing Sink were blocked after the major flood event on October 31, 2013, and COA WPD staff subsequently opened up these blocked passageways. However, another flood in September, 2014 further blocked access, making the lower passageway (and water table) inaccessible for monitoring until material can be removed.

Broken Arrow Cave

City of Austin

1. Inspected quarterly with no sign of human visitation or vandalism.
2. Treated site for RIFA with boiling water.
3. Completed bi-annual faunal surveys (See EXHIBIT A).
4. 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.
3. COA BCP staff commented on the COA Shoal Creek Greenbelt Master Plan for improved trail work enhancement and determined that the proposed work will not negatively impact the spring.

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

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

to do the above mentioned work, and they performed bi-monthly cave cricket exit counts in FY14; faunal surveys were not conducted due to high CO2 levels (SWCA 2014). COA WPD and BCP staff are continuing to try to work with the applicant to fulfil their agreement.

Cave Y

City of Austin

1. Visited this cave 6 times and noticed no signs of vandalism to the cave or cave gate.
2. Treated site for RIFA with boiling water.
3. Completed bi-annual cave faunal survey(See EXHIBIT A).
4. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).

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 were treated once with boiling water; most of the ants were located at the parking lot, approximately 300 feet from the cave.
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. Treated site for RIFA with boiling water.
7. 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

1. WPD mapped relocated features on site and mapped new CEF's to see how close they are to the new proposed development to make certain that the applicant is in compliance with City code.
2. LCRA contracted a hydrological study for this cave in order to determine if work on an adjacent power line might negatively impact the cave. The study, conducted by Zara Environmental, showed that the surface and subsurface drainage basins are outside of the work site and so therefore will not negatively impact the cave.
3. COA WPD staff investigated encroachment issues with the adjacent Four Points development and worked with the developer to mitigate the damage, which included the construction of a permanent perimeter fence to prevent future encroachment issues.

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

<p><u>Flint Ridge Cave</u> City of Austin</p> <ol style="list-style-type: none"> 1. Conducted six site visits and noted no signs of illegal trespass. 2. Treated site for RIFA with boiling water; staff treated numerous active mounds due to favorable habitat (open and disturbed). 3. Conducted quarterly cave faunal surveys (See EXHIBIT A). 4. BCP staff and volunteers conducted bi-annual cave cricket exit counts (See EXHIBIT B). 5. COA WPD continued monitoring the storm water catchment area of Flint Ridge cave. 6. COA WPD and BCP staff reviewed TXDOT proposal to build SH45 that is proposed to be built over the surface catchment area as well as the cave footprint. 7. COA WPD initiated a new hydrogeologic study that will delineate the subsurface catchment area to determine potential negative impacts from a newly proposed roadway.
<p><u>Fossil Cave</u> City of Austin</p> <ol style="list-style-type: none"> 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 3. COA BCP staff initiated meetings with PARD staff to iron out a cave management agreement, which will provide future protection for this and other karst features located on the property.
<p><u>Fossil Garden Cave</u> Private</p>
<p><u>Gallifer Cave</u> Travis County</p> <ol style="list-style-type: none"> 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. Treated 20 mounds in Spring 2014. 4. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
<p><u>Get Down Cave</u> TCMA</p> <ol style="list-style-type: none"> 1. COA WPD is currently in negotiations with the neighborhood association to take over ownership and management of this cave and property (includes several other significant karst features). 2. Commented on COA WPD proposal to experiment with different non-toxic ways to eradicate unwanted weeds on the hiking trail.
<p><u>Goat Cave</u> City of Austin</p> <ol style="list-style-type: none"> 1. Completed annual faunal survey (See EXHIBIT A). 2. Treated RIFA annually with boiling water. 3. With the help of volunteer stewards, conducted twice monthly site inspections, removed trash from preserve area and reported on anything out of the ordinary. 4. Allowed permitted access to this cave . 5. 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. 6. COA WPD staff continued work on an in-depth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane (completed).
<p><u>Hole-in-the-Road Cave</u> Private</p>

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

<p><u>Ireland's Cave</u> Travis County</p> <ol style="list-style-type: none">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. Surveyed site bi-annually for RIFA. Treated 36 mounds in Spring 2014.3. TC conducted an annual cave faunal survey (see EXHIBIT A).
<p><u>Jack's Joint Cave</u> Private</p>
<p><u>Japygid Cave</u> Private 10a Permit: PRT-808694</p> <ol style="list-style-type: none">1. WPD mapped relocated features on site and mapped new CEFs to ensure that proposed new development is in compliance with City code.2. LCRA contracted a hydrological study for this cave in order to determine if work on an adjacent power line might negatively impact the cave. The study, conducted by Zara Environmental, showed that the surface and subsurface drainage basins are outside of the work site and so therefore will not negatively impact the cave.3. COA WPD staff investigated encroachment issues with the adjacent Four Points development and worked with the developer to mitigate the damage, which included the construction of a permanent perimeter fence to prevent future encroachment issues.
<p><u>Jest John Cave</u> City of Austin</p> <ol style="list-style-type: none">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).
<p><u>Jester Estates Cave</u> City of Austin</p> <ol style="list-style-type: none">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. WPD staff and a volunteer continued work on a hydrological study of this cave which included: remapping the cave interior, determining the surface drainage, and taking water samples in an effort to determine if the cave is being negatively impacted by adjacent development. It appears that the cave subsurface drainage area is much larger than the 3.2 acre preserve (completed).3. Treated site twice for RIFA with boiling water.4. Conducted bi-annual cave faunal surveys (See EXHIBIT A).5. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B).6. BCP staff removed non-native invasive vegetation.
<p><u>Jollyville Plateau Cave</u> Private 10a Permit: PRT-808694</p> <ol style="list-style-type: none">1. WPD mapped relocated features on site and mapped new CEFs to ensure that proposed new development is in compliance with City code.2. LCRA contracted a hydrological study for this cave in order to determine if work on an adjacent power line might negatively impact the cave. The study, conducted by Zara Environmental, showed that the surface and subsurface drainage basins are outside of the work site and so therefore will not negatively impact the cave.3. COA WPD staff investigated encroachment issues with the adjacent Four Points development and worked with the developer to mitigate the damage, which included the construction of a permanent perimeter fence to prevent future encroachment issues.
<p><u>Kretschmarr Cave</u> Travis County</p> <ol style="list-style-type: none">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.

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

3. Maintained fencing and signage to protect this area from unauthorized access and dumping.
4. Surveyed site bi-annually for RIFA. Treated 53 mounds in Spring 2014.
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 bi-annually for RIFA. Treated 24 mounds in Fall 2013 and 24 mounds in Spring 2014.
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. COA and TC staff met on site after a news report stated that adjacent residents were fearful of rattlesnakes and wanted the features/caves filled in. Staff met with the property owner (Walmart) and were granted permission to secure the access gates to the adjacent CEF fenced area (not including Lamm cave), and removed trash from site. 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

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 weekly site inspections, removed trash from preserve area and reported on anything out of the ordinary.
4. Permitted access to this cave is allowed.
5. Treated site for RIFA with boiling water.
6. COA WPD staff continued work on an in-depth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane (completed).
7. COA WPD staff also looked at potentially retrofitting the existing storm water/ filtration pond located directly over the footprint of the cave. In an effort to determine the precise location of the cave in relationship to the existing storm water pond, COA WPD staff used a cave radio to verify the location. (ongoing)

McDonald Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Surveyed site bi-annually for RIFA. Treated 12 mounds in Fall 2013.
4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).
5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).

McNeil Bat Cave

Private

Midnight Cave

City of Austin

1. Conducted quarterly site inspections (observed fence and sign vandalism, made repairs and met on site with COA PARD Rangers in an effort to increase on site patrols..
2. Conducted bi-annual cave faunal surveys. (See EXHIBIT A).
3. Treated site for RIFA with boiling water and trained COA PARD staff on RIFA treatment methods.
4. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).
5. Volunteers initiated a new detailed survey map of the cave (on going).
6. Permitted access to this cave is allowed, though no access permits were granted this fiscal year.
7. Volunteers removed old trash recently exposed from the October 2013 flood.

M.W.A. Cave

Private 10a Permit: PRT-808694

(see FWS files for status)

1. WPD mapped relocated features on site and mapped new CEFs to ensure that proposed new development is in compliance with City code.
2. LCRA contracted a hydrological study for this cave in order to determine if work on an adjacent power line might negatively impact the cave. The study, conducted by Zara Environmental, showed that the surface and subsurface drainage basins are outside of the work site and so therefore will not negatively impact the cave.
3. COA WPD staff investigated encroachment issues with the adjacent Four Points development and worked with the developer to mitigate the damage, which included the construction of a permanent perimeter fence to prevent future encroachment issues.

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 bi-annually for RIFA. Treated 64 mounds in Fall 2013 and 55 mounds in Spring 2014.
4. Conducted annual cave faunal survey (see EXHIBIT A).
5. LCRA contracted a hydrogeologic study for this cave in order to determine if work on an adjacent power line might negatively impact the cave. The study, conducted by Zara Environmental, showed that the surface and subsurface drainage basins are outside of the work site and so therefore will not negatively impact the cave.

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 began 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).

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

<p><u>North Root Cave</u> Travis County</p> <ol style="list-style-type: none">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. Treated 44 mounds in Fall 2013 and 11 mounds in Spring 2014.4. Conducted annual cave faunal survey (see EXHIBIT A).
<p><u>Pennie's Cave</u> Private</p> <ol style="list-style-type: none">1 The entrance was re-excavated in 2012, providing access to the cave.2. A new development plan is seeking approval for the site containing the cave.3.The site plan calls for the cave entrance to be gated and boulders placed around the cave at the edge of a 300-ft buffer.4. 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.
<p><u>Pickle Pit Cave</u> Section 7 Permit 2-15-93-F-075</p> <ol style="list-style-type: none">1. Staff from Loomis, USFWS, and COA BCP and COA WPD staff met on site and conducted one cave faunal survey (collected blind <i>Cicurina</i> to help with future species identification. (See EXHIBIT A).2. USFWS contracted with Marshal Hedin to verify the validity of the species <i>Cicurina wartoni</i>, which has been petitioned to be listed. Hedin's work determined that the species does not warrant listing due to the fact that <i>C. wartoni</i> is not a distinct species.3. A volunteer neighbor monitors the cave entrance/ gate monthly.
<p><u>Pipeline Cave</u> Private</p> <ol style="list-style-type: none">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.
<p><u>Rolling Rock Cave</u> City of Austin</p> <ol style="list-style-type: none">1. Inspected quarterly and no sign of human visitation or vandalism was found.2. RIFA control.3. Conducted one cave faunal survey. (See EXHIBIT A).
<p><u>Root Cave</u> Travis County</p> <ol style="list-style-type: none">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. Treated 44 mounds in Fall 2013 and 11 mounds in Spring 2014.4. Conducted annual cave faunal survey (see EXHIBIT A).
<p><u>Slaughter Creek Cave</u> City of Austin</p> <ol style="list-style-type: none">1. Conducted quarterly site inspections, observed signs of attempted vandalism (digging tools, fire, and trash), and met on site with COA PARD Rangers in an effort to increase onsite patrols..2. Conducted one cave faunal survey. (See EXHIBIT A)

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

<p><u>Spanish Wells Cave</u> Private</p> <ol style="list-style-type: none">1. TC/COA verified a precise location of cave using Trimble GPS unit in FY13.2. COA WPD completed a hydrogeologic study to delineate surface and sub-surface catchment areas and create a cave map.
<p><u>Spider Cave</u> City of Austin</p> <ol style="list-style-type: none">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.5. Installed a new perimeter fence along the FM 2222 ROW.
<p><u>Stark's North Mine</u> Travis County</p> <ol style="list-style-type: none">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. TC facilitated installation of a cave gate by Zara Environmental.4. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave.5. Conducted bi-annual cave faunal surveys (See EXHIBIT A).6. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).7. Zara Environmental performed a cave cricket foraging study in association with plans to extend COA PARD's nearby Walnut Creek Trail.
<p><u>Stovepipe Cave</u></p> <ol style="list-style-type: none">1. Conducted 6 site inspections, and continued to remove 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).
<p><u>Talus Spring Cave</u> Private</p> <ol style="list-style-type: none">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. No mounds found within 80 m of cave.4. Conducted annual cave faunal survey (see EXHIBIT A).
<p><u>Tardus Hole Cave</u> Travis County</p> <ol style="list-style-type: none">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. Treated 21 mounds in Fall 2013 and 18 mounds in Spring 2014.4. Conducted annual cave faunal survey (see EXHIBIT A).
<p><u>Tooth Cave</u> Travis County</p> <ol style="list-style-type: none">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. Conducted a trash clean-up around the cave site and surrounding area.4. Surveyed site bi-annually for RIFA. Treated 22 mounds in Spring 2014.

Table 7. FY14 BCCP Karst Feature Monitoring and Management Activities.

5. Conducted bi-annual cave faunal surveys (see EXHIBIT A).
6. 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 began 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).

Whirlpool Cave

TCMA

1. In response to the discovery of invasive TCAs inside this cave, TC/COA BCP continued conducting cave faunal surveys quarterly in an effort to determine what impacts this invasive species will have on cave fauna (see EXHIBIT A).
2. 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.

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EXHIBIT A:
KARST FAUNAL SURVEY REPORTS

FY14 City of Austin/Travis County Karst Faunal Surveys^{1,2}

Cave	Survey Date	Monitoring Agency	Endangered Species							Species of Concern							Other Significant Troglobites					Other notable species detected					
			<i>Neoleptoneta myopica</i>	<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Texamaurops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Cocciodea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina travisae</i>	<i>Eidmannella reclusa</i>	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinnica</i>	<i>Rhadine subterranea</i>	<i>Speodesmus NS</i>	<i>Sphallopilana mohri</i>	<i>Texella spinopera</i>	<i>Cicurina sp. (blind)</i>	<i>Eidmannella rostrata</i>		<i>Eidmannella sp.</i>	<i>Speodesmus bicornourus</i>	<i>Speodesmus sp.</i>	<i>Tartarocreagris infernalis</i>	<i>Texoreddella texensis</i>
Adobe Springs Cave	11/19/2013	TC																								Trichoniscidae (2)	
Adobe Springs Cave	5/28/2014	TC																									
Airmen's Cave	1/28/2014	COA								18									3	7		7				<i>Perimyotis subflavus</i> (12)	
Airmen's Cave	8/20/2014	COA								27									18	26		2					
Amber Cave	11/19/2013	TC		1		1					3											31					
Amber Cave	5/27/2014	TC				1					4											8				Trichoniscidae (1)	
Arrow Cave	9/16/2014	COA								14				1								1				<i>Texella mulaiki</i> (2)	
Barker Ranch Cave #1	5/1/2014	COA								1				5								23				<i>Batrisesodes sp.</i> (1) <i>Myotis velifer</i> (1)	
Barker Ranch Cave #1	7/22/2014	COA								11				6								54				<i>Batrisesodes sp.</i> (1)	
Barker Ranch Cave #1	8/22/2014	COA								12				1								76				<i>Tartarocreagris sp.</i> (1)	
Beard Ranch Cave	1/21/2014	COA																				2					
Blowing Sink Cave	9/29/2014	COA									2									1				1			
Broken Arrow Cave	11/27/2013	COA							20																	<i>Batrisesodes sp.</i> (1) <i>Cicurina buwata</i> (1) <i>Stygobromus russelli</i> (4)	
Broken Arrow Cave	5/31/2014	COA		4					27													1				<i>Cicurina buwata</i> (2) <i>Stygobromus russelli</i> (1)	
Cave Y	1/28/2014	COA								1																<i>Perimyotis subflavus</i> (4) <i>Texella grubbsi</i> (3)	
Cave Y	8/20/2014	COA								10												7				<i>Texella grubbsi</i> (12)	
Cold Cave	2/4/2014	TC						3										4				15				<i>Batrisesodes sp.</i> (2)	
Cold Cave	8/13/2014	TC						9										2				5				<i>Batrisesodes sp.</i> (2)	
Cortana Cave	1/20/2014	COA	16								2																
Cortana Cave	8/14/2014	COA	24					4			8									4		4					
Cotterell Cave	1/21/2014	COA						5			37											5	2				
Cotterell Cave	8/14/2014	COA						28			65											25	5				

Cave	Survey Date	Monitoring Agency	Endangered Species						Species of Concern										Other Significant Troglobites						Other notable species detected
			<i>Neoleptoneta myopica</i>	<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Texamauraps reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina trivisae</i>	<i>Eidmannella reclusa</i>	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinea</i>	<i>Rhadine sabieranea</i>	<i>Speodesmus NS</i>	<i>Sphallopilana mohri</i>	<i>Texella spiniperca</i>	<i>Cicurina sp. (blind)</i>	<i>Eidmannella rostrata</i>	<i>Eidmannella sp.</i>	<i>Speodesmus bicornoturus</i>	<i>Speodesmus sp.</i>	
District Park Cave	11/18/2013	COA							2													2			
District Park Cave	5/15/2014	COA							18					1											
Flint Ridge Cave	11/18/2013	COA							3													1			<i>Perimyotis subflavus</i> (1)
Flint Ridge Cave	5/15/2014	COA							10															1	
Flint Ridge Cave	8/22/2014	COA							9												2	18			<i>Batrisesodes sp.</i> (2)
Gallifer Cave	2/11/2014	TC	18	3						57												2		1	<i>Perimyotis subflavus</i> (5)
Gallifer Cave	8/7/2014	TC	6	8						33												3		1	
Geode Cave	1/16/2014	TC	6							3	2											1			
Geode Cave	8/19/2014	TC	10	3						11	7											7			
Goat Cave	9/16/2014	COA							4								1								<i>Texella mulaiki</i> (2) Trichoniscidae (5)
Ireland's Cave	1/23/2014	TC							2					24					1		1			1	<i>Batrisesodes sp.</i> (2)
Jester Estates Cave	11/27/2013	COA	19		1		13			15												5			<i>Anapistula sp.</i> (2)
Jester Estates Cave	5/31/2014	COA	4		2		8			8															
Kretschmarr Cave	12/12/2013	TC		1						8											2				
Kretschmarr Double Pit	12/12/2013	TC								1												1			<i>Perimyotis subflavus</i> (5)
Little Bee Creek Cave	11/30/2013	COA					7															3			
Little Bee Creek Cave	5/15/2014	COA					3															1			
Maple Run Cave	1/23/2014	COA							3													1			<i>Anapistula sp.</i> (3)
Maple Run Cave	8/26/2014	COA							10													2			<i>Anapistula sp.</i> (5) <i>Texella mulaiki</i> (3)
McDonald Cave	1/30/2014	TC						1		28				17					29		12				
McDonald Cave	8/14/2014	TC					7			43				9					19		13			1	
Midnight Cave	1/23/2014	COA							17					3							22				
Midnight Cave	8/26/2014	COA							52												33	3			<i>Batrisesodes sp.</i> (4)

Cave	Survey Date	Monitoring Agency	Endangered Species					Species of Concern										Other Significant Troglobites					Other notable species detected			
			<i>Neoleptoneta myopica</i>	<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Texanauraps reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina trivisae</i>	<i>Eidmannella reclusa</i>	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinea</i>	<i>Rhadine sabieranea</i>	<i>Speodesmus NS</i>	<i>Sphallopilana mohri</i>	<i>Texella spiniperca</i>	<i>Cicurina sp. (blind)</i>	<i>Eidmannella rostrata</i>	<i>Eidmannella sp.</i>		<i>Speodesmus bicornotarius</i>	<i>Speodesmus sp.</i>	<i>Tartarocreagris infernalis</i>
Millipede Annex Cave	12/2/2013	TC/COA	9				1												4							
Millipede Annex Cave	5/19/2014	TC/COA	3				15												9							Trichoniscidae (3)
Millipede Cave	12/2/2013	TC/COA					1												1			1				<i>Anapistula sp.</i> (1)
Millipede Cave	5/19/2014	TC/COA					3			2									10							<i>Neoleptoneta sp.</i> (1)
New Comanche Trail Cave	8/22/2014	TC	2				1			1																
No Rent Cave	10/3/2013	TC/COA																								<i>Cicurina buwata</i> (9)
No Rent Cave	12/2/2013	TC/COA																			3					<i>Cicurina buwata</i> (20) <i>Perimyotis subflavus</i> (1)
No Rent Cave	2/4/2014	TC/COA																								<i>Cicurina buwata</i> (9) <i>Perimyotis subflavus</i> (1)
No Rent Cave	5/19/2014	TC/COA					2							1							1	1		2		<i>Cicurina buwata</i> (38)
No Rent Cave	8/13/2014	TC					2																			<i>Cicurina buwata</i> (32)
North Root Cave	5/29/2014	TC								1											1					
Pond Party Pit	1/21/2014	COA					7														7	21	1			
Pond Party Pit	8/13/2014	COA					19														8	7	7			<i>Rhadine sp.</i> (3)
Rolling Rock Cave	11/27/2013	COA																				1				<i>Perimyotis subflavus</i> (5)
Seibert Sink	1/23/2014	COA									2											4				
Seibert Sink	8/26/2014	COA							4		2											2	6			
Slaughter Creek Cave	9/16/2014	COA							30													1	145			<i>Batrissodes sp.</i> (1) <i>Texella mulaiki</i> (1)
Spider Cave	11/27/2013	COA	1			2				20												8				
Spider Cave	5/31/2014	COA	1			3				11												8	6			
Stark's North Mine	11/19/2013	TC									8															<i>Perimyotis subflavus</i> (5)
Stark's North Mine	5/16/2014	TC									1											2				<i>Perimyotis subflavus</i> (1) <i>Tartarocreagris sp.</i> (1)
Stovepipe Cave	1/21/2014	COA	3		11	40				9		1										8	34			Trichoniscidae (1)
Stovepipe Cave	8/13/2014	COA	8	1	5	21				10												2	28			

Cave	Survey Date	Monitoring Agency	Endangered Species						Species of Concern										Other Significant Troglobites						Other notable species detected		
			<i>Neoleptoneta myopica</i>	<i>Rhadine persephone</i>	<i>Tartarocreagrís texana</i>	<i>Texamaurorops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina travisae</i>	<i>Eidmannella reclusa</i>	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinea</i>	<i>Rhadine sabieranea</i>	<i>Speodesmus NS</i>	<i>Sphallopilana mohri</i>	<i>Texella spiniperca</i>	<i>Cicurina sp. (blind)</i>	<i>Eidmannella rostrata</i>	<i>Eidmannella sp.</i>	<i>Speodesmus bicornoturus</i>	<i>Speodesmus sp.</i>		<i>Tartarocreagrís infernalis</i>	<i>Texoredellia texensis</i>
Talus Spring Cave	8/28/2014	TC																									<i>Stygobromus sp.</i> (12)
Tardus Hole	12/10/2013	TC																									
Testudo Tube Cave	8/28/2014	COA		1												18					31		14				<i>Cicurina buwata</i> (25) <i>Eurycea sp.</i> (18) <i>Stygobromus russelli</i> (21) Trichoniscidae (4)
Tight Pit Cave	1/30/2014	TC																									
Tooth Cave	11/7/2013	TC	7	1		1		15							16							5					<i>Perimyotis subflavus</i> (7)
Tooth Cave	5/14/2014	TC	6	4	1			33						40	4							7					
Two Trunks Cave	1/30/2014	TC																									
Weldon Cave	12/2/2013	TC/COA																			4	6					<i>Cicurina buwata</i> (4) <i>Perimyotis subflavus</i> (1)
Weldon Cave	2/4/2014	TC/COA						1														6					<i>Cicurina buwata</i> (3)
Weldon Cave	5/19/2014	TC/COA						4														4					<i>Cicurina buwata</i> (9) <i>Perimyotis subflavus</i> (1)
Weldon Cave	8/13/2014	TC						1																			<i>Cicurina buwata</i> (1)
Whirlpool Cave	12/4/2013	TC/COA																			11		1				<i>Nylanderia fulva</i> (278)
Whirlpool Cave	2/13/2014	TC/COA																					2				<i>Nylanderia fulva</i> (~604) <i>Tayshaneta sandersi</i> (1)
Whirlpool Cave	5/21/2014	TC/COA																			10		1				
Whirlpool Cave	8/26/2014	TC																					1				<i>Nylanderia fulva</i> (~3890)

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

² Surveyors in FY14 include Todd Bayless, John Chenowith, Travis Clark, Erin Cord, Renee Fields, Devin Grobert, Paul Fushille, Linda Laack, Mark Sanders, Jonny Scalise, and William Simper.

EXHIBIT B:
CAVE CRICKET EXIT COUNT DATA REPORTS

FY 14 COA/TC CAVE CRICKET EXIT COUNT DATA REPORTS

Surveyed Caves	Fall 2013 (November)				Winter 2014 (January/February)				Spring 2014 (May/June)				Summer 2014 (August/ September)			
	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:
Adobe Springs Cave	5	1	9	15					3	140	581	724				
Airmen's Cave					11	15	20	46					480	159	32	671
Amber Cave	51	35	35	121					197	91	15	303				
Broken Arrow Cave	646	25	19	108					183	111	172	466				
Cave Y					431	328	86	845					267	548	85	900
Cold Cave					231	8	0	239					822	200	187	1209
Cortana Cave					47	21	10	78					98	42	49	189
Cotterell Cave					115	22	3	140					1564	327	54	1945
District Park Cave	1879	571	125	2575					2150	1557	1001	4708				
Flint Ridge Cave	171	71	99	341					689	226	177	1092	56	15	30	101
Gallifer Cave					0	0	0	0					18	43	527	588
Geode Cave					15	10	6	31					20	142	126	288
Jest John Cave													238	346	216	800
Jester Estates Cave	40	13	4	57					506	215	50	771				
Little Bee Creek Cave	3	2	1	6					0	0	3	3				
Maple Run Cave					34	2	0	36					149	93	25	267
McDonald Cave					11	1	0	12					0	0	6	6
Midnight Cave					3657	6956	2371	12984					9304	9560	2127	20991
No Rent Cave	231	156	175	562	160	55	0	215	714	226	390	1330	157	123	105	385
Pond Party Pit					120	66	47	233					188	71	567	826
Seibert Sink					356	520	340	1216					178	364	137	679
Spider Cave	9	0	0	9					15	9	5	29				
Stark's North Mine	1	0	2	3					0 3 0 0 1	0 3 0 5 9	20 18 0 16 13 7	20 24 0 21 18 17				
Stovepipe Cave					313	208	27	548					252	41	69	362

Surveyed Caves	Fall 2013 (November)				Winter 2014 (January/February)				Spring 2014 (May/June)				Summer 2014 (August/ September)			
Testudo Tube					237	363	32	632					169	102	261	532
Tooth Cave	4	12	12	28					5	1	0	6				
Weldon Cave	661	1065	788	2514	459	122	5	586	747	476	989	2212	538	141	254	933

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