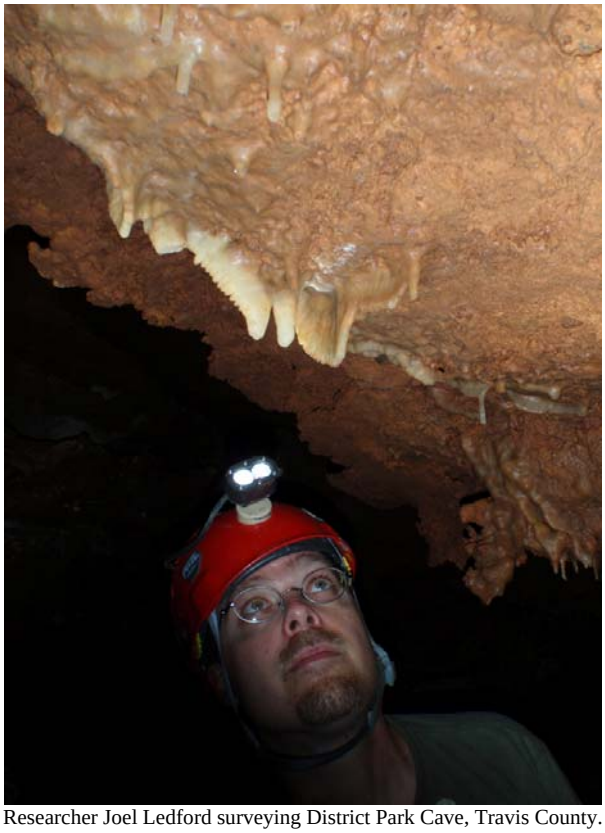
Balcones Canyonlands Preserve
Karst Monitoring and Management
FY 2010 Annual Report



Researcher Joel Ledford surveying District Park 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)

October 1, 2009 – September 30, 2010

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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 as the Jollyville, McNeil, and Northwood cave clusters. Currently, 28,996 acres have been acquired for the Balcones Canyonlands Preserve (BCP). 45 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	*Tartarocreagris texana*	Kretschmarr Cave mold beetle	*Texamaurops reddelli*
Tooth Cave spider	*Neoleptoneta myopica*	Bee Creek Cave harvestman	*Texella reddelli*
Tooth Cave ground beetle	*Rhadine persephone*	Bone Cave harvestman	*Texella reyesi*

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

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

2.0 CAVE MANAGEMENT SUMMARY

This annual report covers the fiscal year 10/01/09-9/30/10 (FY10). In FY10, 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 (Tables 1 and 2).

A total of 45 of the BCCP caves are "protected" in some way, with 17 "unprotected". The 45 "protected" BCCP caves are currently managed as follows: 21 caves protected as part of the BCP on COA land plus one additional private cave (Lamm Cave) managed by the Austin Water Utility Deptartment-BCP office; one protected on The Nature Conservancy (TNC) land; ten protected on TC land and one 10(a) private cave informally protected by TC (Talus Springs Cave); three caves are protected on Texas Cave Management Association (TCMA) land; seven caves are protected as part of private Section 10(a) or Section 7 agreements with USFWS; and one cave is protected by a private landowner (Bandit Cave). Some of these "protected" caves only have protected entrances, but are threatened by surrounding development or planned development. With the exception of the Four Points East Cluster, which is protected by a private 10(a) agreement, and some of the caves in the Four Points West Cluster, all other caves in the three cave clusters required to be protected by the permit are threatened by potential development near the caves (Tables 2 and 3).

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 develop 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 in Travis County, Texas. This table was originally in the BCCP permit in 1996 and was revised in 2005, 2008, and 2009 to show new species location information from James Reddell (2004, 2005), HNTB (2005), Cokendolpher (pers com, 2008), Sanders (pers com, 2009), USFWS (2009a,2009b), and Ledford (2010).

Cave Name	**Current Preserve Status**	**Karst Fauna Region**	**Tooth Cave Pseudoscorpion** *Tartarocreagris texana*	**ToothCave Spider** *Neoleptoneta myopica*	**Tooth Cave Ground Beetle** *Rhadine persephone*	**Kretschmarr Cave Mold Beetle** *Texamaurops reddelli*	**Bee Creek Cave Harvestman** *Texella reddelli*	**Bone Cave Harvestman** *Texella reyesi*
Amber Cave	BCP Jollyville/ TC	Jollyville Plateau	X 1996		P 2009***	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 required to be protected under BCCP	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 *Tartarocreagris texana*	ToothCave Spider *Neoleptoneta myopica*	Tooth Cave Ground Beetle *Rhadine persephone*	Kretschmarr Cave Mold Beetle *Texamaurops reddelli*	Bee Creek Cave Harvestman *Texella reddelli*	Bone Cave Harvestman *Texella reyesi*
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 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 1996
Millipede Cave	Not Protected under BCCP	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 *Tartarocreagris texana*	ToothCave Spider *Neoleptoneta myopica*	Tooth Cave Ground Beetle *Rhadine persephone*	Kretschmarr Cave Mold Beetle *Texamaurops reddelli*	Bee Creek Cave Harvestman *Texella reddelli*	Bone Cave Harvestman *Texella reyesi*
North Root Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996			
Puzzle Pits Cave	Not required to be protected under BCCP	Jollyville			X 1996			
Rolling Rock Cave	BCP Lime Cr. Prs./COA, Sec.10(a)	Cedar Park			X 1996			
Root Cave	BCP Jollyville/TC	Jollyville Plateau		X 2010 (Ledford)	X 1996 Tentative 2005			X 1996
Spider Cave	BCP Park West/COA	Jollyville Plateau			X 2004		X 2004 (Reddell)	P 1996 delete P 2004 (Reddell)
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 Protected under BCCP	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*
P 2009*** = Visual field verification by M. Sanders. Speciman not collected and thus not confirmed by species expert.
X 2009 = USFWS - according to the 2009 5 year review on *Texella reyesi* the report lists *T. reyesi* as confirmed for Stovepipe Cave.
X 2009 (Chandler) = confirmed by D. Chandler, as reported in USFWS 5-year review (2009b).
X 2010 = confirmed by J. Ledford (pers com 2010)
Delete P 2010 (Ledford) = *Neoleptoneta* for stovepipe was confirmed as *N devia* (personal communication J. Ledford 2010)

3.0 OWNERSHIP AND PROTECTION STATUS

Table 2 lists the status of the 62 caves/karst features listed in the BCCP permit with information on ownership, species status, cave cluster.

Table 2. FY10 Ownership Status of the 62 BCCP caves/karst features (35 with ES and 27 caves with SOC).

Cave Name	ES or SOC	Current tract/owner. On BCP Land or private	Cave Cluster
Adobe Springs Cave	SOC	BCP Lehmann/TNC	
Airman's Cave	SOC	BCP Barton Creek/COA	
Amber Cave	ES	BCP Jollyville/TC	4 Points (West)
Armadillo Ranch Sink	SOC	Private	
Arrow Cave	SOC	BCP Slaughter Cr. Pk./COA	
Bandit Cave	ES	Private	
Beard Ranch Cave (Featherman's Cave)	ES	BCP Ivanhoe/COA	
Bee Creek Cave	ES	Private	
Blowing Sink Cave	SOC	BCP COA	
Broken Arrow Cave	ES	BCP Lime Crk Pres/COA	
Buda Boulder Spg.	SOC	BCP Shoal Creek Grblt./COA	
Cave X	SOC	Private/COA Protection Agreement	
Cave Y[1]	SOC	BCP Barton Creek Grblt/COA	
Ceiling Slot Cave	SOC	Private	
Cold Cave	ES	Private	Northwood
Cotterell Cave	ES	BCP Stillhouse Hollow Preserve./COA	
Disbelievers Cave	ES	BCP Private 10(a)	4 Points (East)
District Park Cave	SOC	BCP D.Nickols Pk./COA	
Eluvial Cave	ES	BCP Private 10(a)	4 Points (East)
Flint Ridge Cave	SOC	Prop 2 Tabor tract /COA	
Fossil Cave	ES	BCP Schroeter Pk./COA	
Fossil Garden Cave	ES	Private	McNeil
Gallifer Cave	ES	BCP Jollyville/TC	4 Points (West)
Get Down Cave	SOC	Private/COA Protection Agreement with TCMA	
Goat Cave	SOC	BCP Goat Cave Karst Preserve/COA	
Hole-in-the-Road Cave	ES	Private	Northwood
Ireland's Cave	SOC	Private Circle C	
Jack's Joint	SOC	Private	
Japygid Cave	ES	BCP Private 10(a)	4 Points (East)
Jest John Cave	ES	BCP Forest Ridge/COA	
Jester Estates Cave	ES	BCP Forest Ridge/COA	

Cave Name	ES or SOC	Current tract/owner. On BCP Land or private	Cave Cluster
Jollyville Plateau Cave.	ES	BCP Private 10(a)	4 Points (East)
Kretschmarr Cave	ES	BCP Jollyville/TC	4 Points (West)
Kretschmarr Double Pit	ES	BCP Jollyville/TC	4 Points (West)
Lamm Cave	ES	BCP Private Section 7	
Little Bee Cr. Cave	ES	BCP Ullrich WTP/COA	
Lost Gold Cave	SOC	Private	
Lost Oasis Cave	SOC	Private TCMA	
M.W.A. Cave	ES	BCP Private 10(a)	4 Points (East)
Maple Run Cave	SOC	BCP Goat Cave Karst Preserve/COA	
McDonald Cave	ES	BCP Jollyville/TC	
McNeil Bat Cave	ES	Private	McNeil
Midnight Cave	SOC	BCP Slaughter Cr. Pk./COA	
Moss Pit	SOC	Private	
New Comanche Trail Cave	ES	BCP Lake Travis/TC	
No Rent Cave	ES	Private	McNeil
North Root Cave	ES	BCP Jollyville/TC	4 Points (West)
Pennie's Cave	SOC	Private	
Pickle Pit	SOC	BCP Private Sec. 7	
Pipeline Cave	SOC	Private	
Rolling Rock Cave	ES	BCP Lime Cr. Prs./COA	
Root Cave	ES	BCP Jollyville/TC	4 Points (West)
Slaughter Creek Cave	SOC	BCP Slaughter Cr.Pk./COA	
Spanish Wells Cave	SOC	Private	
Spider Cave	ES	BCP Park West/COA	
Stark's North Mine	SOC	Private	
Stovepipe Cave	ES	BCP Canyon Creek/ COA	
Talus Springs Cave	SOC	Private/ 10(a) permit, TC checks entrance	
Tardus Hole	ES	BCP Jollyville/TC	4 Points (West)
Tooth Cave	ES	BCP Jollyville/TC	4 Points (West)
Weldon Cave	ES	Private	McNeil
Whirlpool Cave	SOC	Private TCMA	

[1]Cave Y was considered an ES cave *(Texella reddelli*) in the 1996 BCCP Permit, but since was determined not to contain *Texella reddelli* (Reddell 2004).

Many caves within the BCP have adequate protection, based on the protection criteria outlined in the *U.S. Fish and Wildlife Service's Bexar County Karst Invertebrates Draft Recovery Plan Appendix B - Preserve Design* (USFWS 2008). However, some caves listed in Table 3 as "protected" under individual USFWS Section 10(a) or Section 7 permits may not be adequately protected by these individuals as defined in USFWS, 2008. Efforts will be made by the BCCP Permit Holders to contact these individuals to assess their protection

efforts and to assist them with protection where possible. Though not a requirement of the BCCP permit, newer USFWS preserve design recommendations direct that the protected area surrounding the cave should be 60-90 acres in size to capture the majority of plant and animal community elements needed to support the karst ecosystem (USFWS, 2008). BCCP Permit Holders will continue efforts to acquire and protect the karst features listed in the BCCP permit.

Table 3. FY10 protection, monitoring and access status of the 62 BCCP karst features.

Cave Name	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Adobe Springs Cave		Protected on preserve	Occasional surface and species monitoring by COA	none
Airman's Cave	Gate has been Breached by vandals	Protected on parkland	COA species and surface monitoring	Open to sign, beyond requires permit. However, since there's no gate, it's voluntary**
Amber Cave	Gated, fenced	Protected on preserve (very close to road and sewer line)	TC bi-annual surface monitoring; quarterly cricket exit counts; red-imported fireant (RIFA) survey/control; quarterly species monitoring	none
Armadillo Ranch Sink		Private - Unknown		none
Arrow Cave	Gated	Protected in parkland .(There are nearby homes immediately south of the cave entrance).	COA species and surface monitoring	none
Bandit Cave	Gated	Protected by private ecologically concerned landowner		none
Beard Ranch Cave		Protected on preserve	COA quarterly surface monitoring plus annual faunal survey	none
Bee Creek Cave		Private- Unknown		none
Blowing Sink Cave	Gated	Protected on preserve	COA bi-monthly surface and annual species monitoring	none
Broken Arrow Cave	Tract is fenced (8' game fence)	Protected on preserve	COA quarterly surface and Annual species monitoring	none
Buda Boulder Spg.		Protected in parkland (close proximity to a hike and bike trail)	COA annual surface monitoring	none
Cave X	Gated, fenced	Protected by landowner with 4.5 acre setback to protect cave footprint. Protected to some extent (not actively managed and the set back is inadequate).	Occasional species and surface monitoring by COA	1 day/ year COA guided access to first room to educate children

Cave Name	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Cave Y	Gated	Protected in parkland	COA quarterly surface and annual species monitoring	none
Ceiling Slot Cave		Private - Unknown		none
Cold Cave		Private - Unknown		none
Cotterell Cave	Fenced and gated	Protected in parkland. (There are nearby homes immediately east of the cave entrance)	COA quarterly species and surface monitoring; quarterly cricket exit counts	none
Disbelievers Cave		Protected by 10a permit, hired ACI Consulting		none
District Park Cave	Gated after the 1st room.	Protected in parkland	COA quarterly species and surface monitoring; quarterly cricket exit counts	1st room open, past the 1st room protected by gate, access by permit*
Eluvial Cave		Protected by 10a permit, hired ACI Consulting		none
Flint Ridge Cave	Gated	Protected on Water Quality Protection Land (drainage basin will be negatively impacted by the construction of a new highway).	COA quarterly species and surface monitoring; quarterly cricket exit counts, Watershed Protection and Development Review Dept.(WPDRD) monitors quantity and quality at surface	none
Fossil Cave	Access to features on site are protected by large rocks	Protected in parkland	Exact location of cave is unknown. COA quarterly surface monitoring	None
Fossil Garden Cave		Private - Unknown		none
Gallifer Cave	Gated, fenced	Protected on preserve	TC bi-annual surface monitoring; quarterly cricket exit counts; RIFA survey/control; annual species monitoring	none
Get Down Cave	Gated	Protected with Protection Agreement Inadequate setback from development.	TCMA species and surface monitoring	none
Goat Cave	Fenced	Protected on preserve	COA annual faunal survey, monthly surface monitoring	access by permit*

Cave Name	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Hole-in-the-Road		Private –Unknown. (very close to a major roadway)		none
Ireland's Cave	Fenced	Protected by landowner with 4.8 ac. setback, watershed problems with golf course, setback inadequate		none
Jack's Joint		Private - Unknown		none
Japygid Cave		Protected by 10a permit, hired ACI consulting		none
Jest John Cave		Protected on preserve	COA cricket exit count, bi-annual surface monitoring	none
Jester Estates Cave	Gated and fenced	Protected on preserve (3.2 acre preserve surrounded by homes).	COA annual species and quarterly surface monitoring	none
Jollyville Plateau Cave	Gated [1]	Protected by 10a permit, hired ACI Consulting		none
Kretschmarr Cave	Gated, Fenced	Protected on preserve. Close to roadway and in powerline ROW.	TC bi-annual surface monitoring; quarterly cricket exit counts; RIFA survey/control; annual species monitoring	none
Kretschmarr Dble. Pit	Fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cricket exit counts; RIFA survey/control;quarterly species monitoring	none
Lamm Cave	Gated and fenced	COA negotiated setback (approximately 150')	Occasional surface and species monitoring by COA	none
Little Bee Cr. Cave	Gated	Protected by COA AWU Dept	COA annual faunal survey and ser annual surface monitoring	none
Lost Gold Cave	Gated	Private - Unknown, new owner, may be development near cave entrance		none
Lost Oasis Cave	Gated and Fenced	Protected by TCMA	TCMA species and surface monitoring	controlled access**
M.W.A. Cave		Protected by 10a permit, hired ACI Consulting		

Cave Name	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Maple Run Cave	Gated	Protected on preserve	COA annual faunal survey and Monthly surface monitoring	access by permit*
McDonald Cave		Protected on preserve	TC bi-annual surface monitoring; bi-annual cricket exit counts; RIFA survey/control; quarterly species monitoring	None
McNeil Bat Cave		Private – Unknown (close proximity to high school)		none
Midnight Cave	Fenced	Protected on parkland (close proximity to soccer fields)	COA quarterly surface and annual species monitoring	access by permit*
Moss Pit		Private - Unknown		none
New Comanche Tr. Cave		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; anuual species monitoring	none
No Rent Cave		Private - Unknown		none
North Root Cave		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Pennie's Cave		Land owner closed entrance with fill Material. WPDRD are potentially negotiating a setback including possible excavation of entrance		none
Pickle Pit	Gated	Private- Unknown		none
Pipeline Cave	Metal frame [1]	WPDRD have negotiated a small setback from future platted development		none
Rolling Rock Cave	tract is fenced with a 8' game fence	Protected on preserve	COA quarterly surface and Annual species monitoring	none
Root Cave		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Slaughter Creek Cave	Gated	Protected on parkland. (There are nearby homes immediately south of the cave entrance)	COA quarterly surface and annual species monitoring	none

Cave Name	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Spanish Wells		Private- Unknown		none
Spider Cave	Fenced (ranch fence)	Protected on preserve	COA quarterly species and surface monitoring; quarterly cricket exit counts	none
Stark's North Mine		Private - Unknown		none
Stovepipe Cave	Fenced (ranch Fence) preserve boundary	Protected on preserve	COA annual faunal and quarterly surface monitoring	none
Talus Springs Cave	Gated	Protected by Homeowners Association and TC, only has 50' setback from houses and is probably effected by uphill development.	TC bi-annual surface monitoring; RIFA survey/control	none
Tardus Hole	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual Species monitoring	none
Tooth Cave	Gated	Protected on preserve	TC bi-annual surface monitoring; quarterly cricket exit counts; RIFA survey/control; quarterly species monitoring	none
Weldon Cave		Private - Unknown		None
Whirlpool Cave	Gated	Protected by TCMA	TCMA species and surface monitoring	controlled access**

[1] Needs gate repairs/improved gate

* Access by Permit - Permit may be issued by COA – Austin Water Utility or PARD staff.

** Controlled Access - Private cave owners control the access

*** Access by Permit- Permit may be issued by TCMA

4.0 ACCESS STATUS AND KARST EDUCATION

The BCP Karst Land Management Plan (2007) recognizes the importance of public education for the long-term preservation of karst species. In addition, cave tours are typically the highlight of educational programs and are heavily requested. Currently, there are limited educational cave resources and efforts are underway to expand the number of suitable caves for education.

In FY10, 350 visitors were issued access permits to COA BCP caves for educational/recreational/rescue training: District Park Cave (26), Maple Run Cave (123), Goat Cave (75), Midnight Cave (71),and Flint Ridge Cave (55). See Table 3 for access and gating status of all of the BCCP caves.

The City of Austin Watershed Protection and Development Review Department (WPDRD) conducts cave education through Earth Camp (a fifth grade water quality program), Clean Creek Camp (a summer parent/child water quality program) and Hydrofiles (a high school water quality program). Earth Camp involves a week long day camp available to Title I Austin Independent School District (AISD) schools where students learn in the field about watersheds, the Edwards Aquifer, caves, and cave biota through cave tours on the Wildflower Center and interactions with professional biologists and hydrogeologists. Earth Camp is coordinated by Susan Wall, a former classroom (certified) teacher with an MS in science education. In FY10, Earth Camp guided 1,350 students into Wildflower Cave. Additionally, every fifth-grader in the AISD is offered aquifer education through an Earth School hands-on classroom presentation.

In summer 2010 Parent/Child Clean Creek Camp brought 31 students and parents into Wildflower Cave. Clean Creek Camp is a partnership between the City of Austin WPDRD 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 9-12.

Hydrofiles reaches aquatic science, earth science and environmental science classes with a hands-on inquiry based investigation 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 cave tours. In FY09 WPDRD stopped offering cave tours due to the lack of access to a suitable cave.

The City of Austin WPDRD produces cave posters and a companion aquifer brochure which are distributed through other agencies and at public events. In 2011, WPDRD educators will

produce a virtual caving field trip with hydrogeologist David Johns. The video will be marketed with curriculum for high school in recognition of Groundwater Week.

The Tabor WQPL tract and Flint Ridge Cave were used for a series of repeated educational field trips by WPDRD and Texas Natural Resources Conservation Commission about recharge and surface-subsurface connections. The field trips summarized research findings of recharge research, soil tracing, geophysical surveys, highway spill tracing, and surface-subsurface interaction of cave fauna. The fieldtrips on Sept 18, 2009, October 28, 2009, and Feb 18, 2010 invited the USFWS Karst Conservation Initiative Group and included 108 attendants. Each trip offered an optional underground experience through portions of Flint Ridge Cave for attendants directly involved in protection of the cave, and 55 visitors participated over four cave trips. A summary guidebook was subsequently produced and can be downloaded from: http://drop.io/TaborFTGuide20100417#

COA shared a BCP booth with TC at the annual "Cave Day Festival" held at the Village of Western Oaks Karst Preserve in March 2010. The BCP was able to educate large numbers of citizens about the BCP and its role in protecting the unique biology of karst ecosystems.

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 this data to determine current status and compliance with the regional permit and determine future needs of the listed species. In 2009, Rob Clayton with WPDRD developed the Karst Database that houses all faunal survey data from BCCP caves and provides much of the information needed for this karst analysis. This database is now available for use by all 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 and contribution to recovery.

6.0 BIOLOGICAL MONITORING

City of Austin

During FY10, COA BCP staff performed species surveys of the following BCCP caves: Adobe Springs Cave, Airman's Cave, Arrow Cave, Beard Ranch Cave, Blowing Sink (7 times), Broken

arrow Cave (3 times), Buda Boulder Spring, Cave Y, Cotterell Cave (quarterly), District Park Cave (quarterly), Flintridge Cave (quarterly), Goat Cave, Jester Estates Cave, Lamm Cave (twice), Little Bee Creek Cave, Maple Run Cave, Midnight Cave, Rolling Rock Cave, Slaughter Creek Cave, Spider Cave (5 times), and Stovepipe Cave Survey methodology followed the guidelines in the *2007 Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management*. In addition, COA BCP staff surveyed Cortana Cave, Pond Party Pit, and Seibert Sink. While these three caves are not listed on the BCCP permit, Seibert Sink has species of concern, and Cortana Cave and Pond Party Pit have endangered species. The results of these surveys are presented in EXHIBIT A.

Zara Environmental Inc. staff conducted faunal surveys of Broken Arrow, Cold Cave, Fossil Garden Cave, Hole in the Road Cave, Jester Estates Cave, No Rent Cave, and Weldon Cave. In addition, they surveyed Down Dip Sink, Garden Hoe Cave, Millipede Cave, Millipede Annex Cave, and Pond Party Pit. The survey data are presented in EXHIBIT A, included in the COA reports.

COA, with the help of volunteers, conducted quarterly cave cricket exit counts at: Cotterell, District Park, Flintridge, and Spider Caves, plus an annual cricket exit count at Jest John Cave (EXHIBIT B). Survey methodology followed guidelines in the *2007 Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management*.

In an effort to analyze existing cave faunal data for both the COA and TC, the City contracted with Dr Weckerly, Texas State University to accomplish this goal. Dr. Weckerly looked at both cave faunal and cave cricket exit count survey protocol and determined that both survey methods are valid. He looked at the number and frequency of existing cave faunal surveys and made recommendations for future survey efforts. He also looked at existing trends of selected endangered and species of concern karst invertebrates. (APPENDIX O10).

COA re-issued a Scientific Research permit for calendar year 2010 to Joel Ledford (doctoral student at the University of California Berkeley). His research will reevaluate the species limits for the spider genus *Neoleptoneta* using a combination of molecular, morphological, and geological data. The molecular component of this work requires fresh specimens collected from sites within the BCP.

A USFWS Section 6 grant was awarded to Paul Chippindale, Andy Gluesenkamp, and Nate Bendik to conduct molecular work with salamanders found in Blowing Sink and other sites. The focus of the research is to examine the status of newly discovered salamander populations in the

Barton Springs Segment of the Edwards Aquifer using mitochondrial and nuclear DNA sequences, microsatellite markers, and allozymes and assess their relationships to the federally protected species *Eurycea sosorum* and *E. nana* over two years. To date, enough material has been collected, and analyses are underway (Appendix O1).

COA contracted with Weston Solutions, Inc., which in turn subcontracted with Zara Environmental, Inc. for biological survey work within the BCP (Appendix O12). The objective of the project is to update the scientific knowledge base of karst invertebrates and the species data contained in *The Caves of the Balcones Canyonlands Conservation Plan, Travis County, 1997* in accordance with the Karst Species Management Plan contained in the BCCP Permit. The project is focusing on endangered species identification and mapping in caves and karst features managed under the BCCP, with particular emphasis on *Neoleptoneta myopica*, *Tartarocreagris texana*, and *Texamaurops reddelli*. The updates generated during this effort are intended to increase knowledge about the occurrence and distribution of these endangered karst invertebrates, and to assess the recovery of these fauna as part of a status review of Travis County karst species. To date several new endangered species localities were discovered on City BCP properties. *Neoleptoneta myopica* was confirmed from Cortana Cave. Newly excavated features also yielded probable listed species. *Texella reddelli* has been tentatively confirmed at Merkin Hole, and *Texella reyesi* was tentatively confirmed at IV-3. This contract is expected to be completed in FY2011, at which time a final report will be submitted and results included in the 2011 annual report.

Brian Cowan, MS completed a thesis in 2010 that involved air monitoring in a number of BCCP permit caves, including Whirlpool, Maple Run, and District Park Caves (Appendix O13). This work was done in cooperation with University of Texas Dept of Geological Sciences, the City of Austin WPDRD, Austin Parks and Recreation Dept. (PARD), and Austin Water Utility BCP program. Cowan's study shows relatively dynamic airflow through caves and connecting mesocaverns, and that carbon dioxide varied seasonally due to temperature effects on airflow circulation. After completing his MS, Brian joined Zara Environmental Inc. as a hydrogeologist.

<u>Flint Ridge Cave</u>

Flow monitoring of runoff into Flint Ridge Cave from its surface catchment area was continually monitored by flow stations maintained under Roger Glick, PE.

Soil tracing conducted in 2007 was temporarily stopped after a drought dried the drips. As the study is incomplete, additional work is necessary before the results can be completely analyzed

and a report completed. Additional funding sources are needed so the study can continue. No soil tracing was conducted in FY10, although it is hoped that the study can continue in 2011.

Goat/Maple Run/Blowing Sink Caves

In May 2010 a wastewater line near Mopac Expressway and La Crosse Ave was sabotaged and overflowed into a tributary of Slaughter Creek across LBJ Wildflower Center property. The spill was followed with a dye injection in Wildflower Cave, near the downstream extent of the spill, in order to determine sites that potentially may be affected by the wastewater release. The injected dye was detected in lower cave stream passages of Blowing Sink Cave, located about one mile east of the spill site. A report on the 2010 Wildflower trace results and 2007 spill simulations was drafted and is expected to be released in December 2010 as a cooperative report with City of Austin and Barton Springs/Edwards Aquifer District.

A proposed expansion/diversion of Deer Lane into Davis Lane was delayed so that a hydrogeological study of the surface and subsurface catchments to Goat, Maple Run, and Blowing Sink can be prepared by WPDRD. Zara Environmental is being contracted to conduct soil tracing necessary to define subsurface catchments divides and to evaluate hydrologic connections with the roadway and its drainages. The report is anticipated to be completed by March 2011.

McNeil Cave cluster (Fossil Garden, No Rent, Weldon, and McNeil Bat Caves)

A hydrogeological study of the surface and subsurface catchments for four McNeil cluster caves was conducted in 2010. The study included surface geological mapping, drilling of three deep boreholes, mapping the four caves and their drips, surveying the entrance of the caves, and field mapping of surface catchments with GPS. The report shows detailed cave locations and is not intended for general public release in order to protect the caves and local water supplies.

Travis County

TC's BCP staff conducted quarterly monitoring on the following four pre-selected caves: Amber Cave, Kretschmarr Double Pit, McDonald Cave, and Tooth Cave. Faunal surveys in these four caves, with permitted TC biologists, were conducted in late Fall 2009, and Winter, Spring, and Summer 2010 (EXHIBIT A). Annual faunal surveys were conducted in Fall 2009 (FY10) in all other TC-owned BCCP caves with federally listed species: Gallifer Cave, Kretschmarr Cave, New Comanche Trail Cave, North Root Cave, Root Cave, and Tardus Hole (EXHIBIT A). Faunal survey methodology followed guidelines in the *2007 Balcones Canyonlands Preserve*

Land Management Plan: Tier II-A Chapter IX Karst Species Management. A summary of federally listed endangered karst invertebrates detected during faunal surveys of TC managed caves by fiscal year is reported below (Table 4).

TC staff also issued a Scientific Research Permit to Zara Environmental Inc. staff to conduct faunal surveys and cave excavations through a COA contract (APPENDIX O12). In FY10, TC coordinated with Zara staff to conduct faunal surveys at Gallier Cave, Kretschmarr Cave, New Comanche Trail Cave, North Root Cave, and Tardus Hole Cave. In addition, several caves not listed in the BCCP permit were also surveyed including Brewpot Sink, Cactus Pit, Cherry Cave, Oxalis Cave, Paul's Cave, SAS Salamander Cave, Two Trunks, and Tight Pit. Feature excavations and subsequent faunal surveys were also conducted at BCP-01, Kickback Cave, Lonnie Moore Cave, Pilfer Cave, and features RI-1, RI-3, RI-6, and RI-8. Significant findings at faunal surveys of newly excavated features include collection and subsequent confirmation by taxonomic experts of a *Texella reddelli* in RI-1 and a *Neolepteneta myopica* in Tight Pit . These confirmations represent new localities for these listed species (Zara Environmental 2010; APPENDIX O12).

In FY10, TC conducted quarterly cave cricket exit counts at Amber Cave, Gallifer Cave, Kretschmarr Cave, and Tooth Cave. TC staff also conducted bi-annual cricket counts in Fall 2009 and Winter 2010 at Kretschmarr Double Pit and McDonald Cave (EXHIBIT B). Survey methodology followed guidelines in the *2007 Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management*.

Red-imported fire ant (RIFA) surveys were performed in Spring 2010 on all ten TC-owned BCCP caves with federally listed species, as well as at Geode Cave. RIFA mounds were surveyed within a 50 m radius around cave entrances, and all mounds found during surveys were treated with boiling water as recommended by USFWS (2001). A total of 58 mounds were treated in cave survey areas. TC staff plans to perform RIFA surveys and control on these caves bi-annually, continuing in Fall 2010.

In addition to managing the karst features required in the BCCP permit, TC voluntarily managed other karst features located on BCP land in 2010, including Geode Cave, Two Trunks Cave, Cactus Pit, Brew Pot Cave, and karst features F11 and F12, as well as all karst features surveyed by Zara Environmental (mentioned above). Also in 2010, TC created a Karst Feature Excavation Policy to provide guidance on determining the need and procedures for excavating karst features on Travis County managed properties.

TC's BCP staff verified, photographed, and tree tagged all 10 TC-owned BCCP cave locations, following standardized methods to meet the BCCP Karst Completion goals. All other TC features with federally-listed species (Geode Cave, Two Trunks Cave, F11, and F12) were also verified using the above methods.

Table 4. Listed Endangered Species karst invertebrates found in TC managed caves by fiscal year.

Cave Name	2005	2007	2008	2009	2010
Amber Cave	No listed species observed	No listed species observed	*Texamaurops reddelli* *T. texana*	***R. persephone* *Texamaurops reddelli*	*Texamaurops reddelli*
Feature F11**	Not yet owned by TC	Not yet owned by TC	**N. myopica*	No survey done	No listed species observed
Feature F12**	Not yet owned by TC	Not yet owned by TC	**T. reyesi*	No survey done	No listed species observed
Gallifer Cave	**N. myopica* *T. reyesi* ***Texamaurops reddelli* *R. persephone*	*N. myopica* *T. reyesi* *Texamaurops reddelli* *R. persephone*	*N. myopica* *T. reyesi* *Texamaurops reddelli* *R. persephone*	No survey done	*N. myopica* *T. reyesi* *R. persephone*
Geode Cave**	Not yet owned by TC	Not yet owned by TC	**N. myopica* **T. reyesi* **R. persephone*	No survey done	*T. reyesi* *R. persephone*
Kretschmarr Cave	No listed species observed	*Texamaurops reddelli*	No listed species observed	No survey done	No listed species observed
Kretschmarr Double Pit	No survey done	*T. texana*	No listed species observed	*T. texana*	No listed species observed
McDonald Cave	*T. reyesi*	*T. reyesi*	*T. reyesi*	*T. reyesi*	*T. reyesi*
New Comanche Trail Cave	Not yet owned by TC	Not yet owned by TC	*N. myopica*	No survey done	*T. reyesi*

North Root Cave	No survey done	No listed species observed	No listed species observed	No survey done	No listed species observed
Feature RI-1**	Feature unknown	Feature unknown	Feature unknown	Feature unknown	**Texella reddelli*
Root Cave	No survey done	*******N. myopica*	No listed species observed	No survey done	No listed species observed
Tardus Hole Cave	No survey done	****T****examaurops reddelli*	No listed species observed	No survey done	No listed species observed
Tight Pit**	No survey done	No survey done	No survey done	No survey done	**N. myopica*
Tooth Cave	*T. reyesi* *Texamaurops reddelli*	*N. myopica* *T. reyesi* *Texamaurops reddelli* *R.. persephone*	*N. myopica* *T. reyesi* *R. persephone*	*N. myopica* *T. reyesi* *Texamaurops reddelli* *T. texana*	*N. myopica* *T. reyesi* *Texamaurops reddelli* *T. texana* *R. persephone*
Two Trunks Cave**	No survey done	No listed species observed	No survey done	No survey done	No listed species observed

** new record (not previously observed in this location and not listed in BCCP EIS-HCP and 10a Permit, if BCCP cave)*

*** Karst features not listed in BCCP EIS-HCP and 10a Permit*

7.0 RECOMMENDATIONS

COA and TC should 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, so therefore, the COA and TC should attempt to locate these caves in order to make a meaningful assessment. Additionally, there may be a need to substitute some of the privately owned caves listed on the BCCP permit for caves known to have listed species that have been found on COA, TC, or other BCCP partner lands since the permit was issued. During FY2011, COA and TC will continue evaluating the adequacy of protection of all of the 62 BCCP caves. If protection is not possible for one or more BCCP caves, USFWS will be consulted to evaluate whether any caves could potentially serve as a replacement.

Based on recommendations made in Dr. Weckerly's analyses of karst survey efforts on the BCP (APPENDIX O10), COA and TC have determined a need to modify and expand the BCPs cave monitoring program. In FY2011, COA and TC will identify 25 caves within Travis County managed through BCP partners that provide a more evenly distributed data set across cave clusters and karst faunal regions (KFRs). This new monitoring plan will begin in FY2011, and the number and frequency of karst faunal surveys and cricket counts will be synchronized among managing partners to better accommodate comparisons and determine 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.

Future research needs for the BCP should include an effort to determine what species of blind *Cicurina* occur in BCP caves north of the Colorado River. Currently there are several species listed for this area, in one case two blind species from the same cave. It is recommended that COA, TC, and USFWS initiate efforts to answer this question.

8.0 KARST MANAGEMENT ACTIVITIES

The BCP Land Management Plan outlined planned activities concerning the 62 BCCP karst features. Table 5 below includes a summary of activities completed in 2010.

Table 5. 2010 BCCP Karst Monitoring and Management Activities.

Adobe Springs Cave The Nature Conservancy 1. Completed annual cave faunal survey (See EXHIBIT A). 2. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Airman's Cave City of Austin 1. Completed annual cave faunal survey (See EXHIBIT A). 2. The City of Austin BCP, Austin PARD, Austin EMS, and Austin Fire Department are currently in discussion on methods to better handle future rescue incidents. 3. Discussed the need to re-install the chain gate at Cruxifiction rock, PARD purchased the chain, however, to date the gate has not been installed. 4. The UT Spelological Society takes beginner cavers into this cave, teaching beginners the proper caving etiquette to safely access caves with minimal impacts. 5. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 6. COA staff removed trash and graffiti from the cave.
Amber Cave Travis County 1. Conducted quarterly cricket exit surveys. (See EXHIBIT B). 2 .Performed frequent surface inspections with no signs of vandalism to the cave entrance or in the cave.

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
3. Maintained fencing and signage to protect this area from unauthorized access and dumping. 4. Inspected site for RIFA. Treated eight mounds with boiling water, including one mound within 10 m of cave entrance. 5. Conducted quarterly cave faunal surveys (see EXHIBIT A). 6. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Armadillo Ranch Sink Private
Arrow Cave City of Austin 1. Completed annual cave faunal survey (See EXHIBIT A). 2. Conducted quarterly site inspections. City staff continue to deal with ongoing dumping problems from the adjacent neighborhood. 3. Inspected site for RIFA infestations. On all visits though fire ants were observed within close proximity of the cave (but not inside the cave). 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Bandit Cave Private
Beard Ranch Cave (Featherman's Cave), City of Austin 1. Completed annual cave faunal survey (See EXHIBIT A). 2. Conducted quarterly site inspections. 3. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 4. No red imported fire ants were found. A healthy population of native fire ants was found in close proximity to the cave.
Bee Creek Cave Private
Blowing Sink Cave City of Austin 1. Inspected monthly and no signs of vandalism were found in the cave or to the cave entrance. 2. Treated site for fire ants with boiling water. 3. Completed 4 cave faunal surveys (See EXHIBIT A). 4. Completed "stabilization project", was tested on the September 8, 2010 flood, and now allows safe access to the lower portion of the cave for needed hydrological and biological studies. This was a major project, very complicated in many ways and was completed almost entirely by local caver volunteers. 5. In response to a nearby sewer line leak, the City WPDRD initiated a hydrological study including a dye trace study. The dye injected near the site of the sewer leak was detected in the cave. 6. Permitted UT grad student to conduct CO2 monitoring research project. Research was completed. (See Appendicx O13). 7. Initiated a new indepth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane. 8. Met with Pard and WPDRD staff regarding land currently owned by AISD that may be deeded to Pard. The 26 acre parcel is immediately south of blowing sink cave, and includes a new cave and well. If the property is transferred, we will also request that the current owner install a 6' chainlink fence with 3 strands of barbed wire along the perimeter of the property, thus greatly improving security to the property. 9. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 10. COA staff removed invasive non-native vegetation from the preserve.
Broken Arrow Cave City of Austin

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
1. Inspected quarterly with no sign of human visitation or vandalism. 2. Treated site for fire ants with boiling water. 3. Completed two cave faunal surveys (See EXHIBIT A). 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
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 took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Cave X Private 1. The City of Austin entered into a Private Landowner Agreement "Cave X, Management and Monitoring Plan, Covenants and Restrictions, (see attachment)", with the property owners (Regent's School) in Oct. 1999. The agreement sets aside a 4.5 acre area to protect the cave footprint. The USFWS was involved in the discussions on protection. 2. The cave entrance is gated and also has a fence for added protection. 3. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 4. Regents staff conduct periodic surface inspections of the cave including gate and lock maintenance. 5. The City of Austin's WPDRD and BCP staff reviewed Regents School's proposal to "thin vegetation" within the setback area. After researching their proposal the work was approved since it was in compliance with FWS guidelines (GCWA bird clearance) and their karst management plan. The School followed through with the clearing, now most understory vegetation has been removed, leaving the site in a "parked up" state. It's not known how this may impact cave cricket foraging, in this un-natural state.
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 fire ants with boiling water. 3. Completed annual cave faunal survey(See EXHIBIT A). 4. Permitted UT grad student to conduct CO2 monitoring research, project was completed. (See Appendices for reference to this study) 5. COA took GPS coordinates using a trimble unit in an attempt to get the precise location which will enhance our ability to determine the current level of protection via GIS analysis.
Ceiling Slot Cave Private
Cold Cave 1. TC is currently exploring the possibility of ownership and management of this 8 acre tract. 2. Zara Environmental Inc. conducted one cave faunal survey as part of a contract with the City of Austin (an attempt to get a better understanding of the true distribution of our listed karst invertebrates) (See EXHIBIT A). 3. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 4. Excavated blocked entrance to allow access for cave faunal survey.
Cotterell Cave City of Austin 1. Conducted quarterly site inspections, and found no RIFA at or near the cave. 2. RIFA were treated twice with boiling water, most of the ants were located at the parking lot, approximately 300 feet from the cave. 3. Conducted 4 cave faunal surveys and 4 cricket exit counts (See EXHIBIT A and B). 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 5. Conducted a follow-up vegetation transect (50% within the fence exclosure) with the helf of FWS staff.

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
Disbelievers Cave Private 10a Permit: PRT-808694
District Park Cave City of Austin 1.BCP staff conducted four cave faunal surveys (See EXHIBIT A). 2. BCP staff and volunteers conducted 4 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. Permitted UT grad student CO2 monitoring research project, completed study. (See Appendices for reference to this study) 7. Treated site for fire ants with boiling water. 8. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 9. Collected a new undescribed speices of Leptonetid spider, (waiting for Joel Ledford to describe this new species).
Eluvial Cave Private 10a Permit: PRT-808694
Flint Ridge Cave City of Austin 1. Conducted 6 site visits and noted no signs of illegal trespass. 2. In Sept 2006, UT Geological Sciences (Brian Cowan) installed new drip monitoring equipment and continued to maintain the monitoring with WPDRD support. Brian installed a drip monitoring station for the Balcony Room in 2007. Several research trips were made in 2009 for this study. 3. Treated site for fire ants with boiling water, as usual, staff treated numerous active mounds due to favorable habitat (opened up and disturbed). 4. Conducted four cave faunal surveys (See EXHIBIT A). 5. BCP staff and volunteers conducted 4 cave cricket exit counts (See EXHIBIT B). 6. Nico Hauwert with the COA WPDRD passed his monitoring work onto Roger Glick (storm water monitoring specialist at WPDRD) on the surface catchment area of Flint Ridge cave. In 2009, the flow station was upgraded as described in the appendices for ongoing, long term monitoring. 7. Nico Hauwert (WPDRD hydrogeologist) led a field trip to the site regarding how to determine the level of sensitivity and needed protection for karst features, targeted audience was regulators. Part of the field trip included access to Flintridge cave. 8. On September 8, 2010 heavy rains allowed for a large volume of water to enter the cave, minimal damage was noted and it appears that the flood may have “opened up” the lower portion of the cave due to the lack of any sign that water backed up (clean, scoured bedrock). 9. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Fossil Cave City of Austin 1. Inspected quarterly and there was no new signs of vandalism 2. Inspected for RIFA infestations. On all visits though fire ants were observed within close proximity of the “suspected” cave (but not inside the cave). 3. COA took GPS coordinates using a trimble unit in an attempt to get the precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Fossil Garden Cave Private 1. COA took GPS coordinates using a trimble unit in an attempt to get the precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
2. Zara Environmental Inc. conducted two cave faunal surveys as part of a contract with the City of Austin (an attempt to get a better understanding of the true distribution of our listed karst invertebrates) (See EXHIBIT A). 3. BCP staff removed old trash from the cave. 4. WPDRD initiated a hydrological study in an attempt to determine potential negative impacts from a proposed new water line.
Gallifer Cave Travis County 1. Performed 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. Inspected site for RIFA. Treated twelve mounds with boiling water, including two mounds within 10 m of cave entrance. 4. Conducted quarterly cricket exit surveys (See EXHIBIT B). 5. Conducted annual faunal survey (See EXHIBIT A). 6. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Get Down Cave TCMA 1. The annual Village of Western Oaks Karst Day was held in March 2010, providing a great opportunity to educate the public about the importance of karst ecosystems. 2. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Goat Cave Karst Preserve City of Austin 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 including a channel 6 filming of the Nature Center taking kids into the cave as part of publicity for the Austin Nature Center. 5. Repaired vandalized gate and fence and noticed new vandalism in the cave, (smashed speleothems). 6. Continued to periodically repair the perimeter fence cuts by vandals, many of the repairs were reported by our volunteer land steward and in some cases the volunteer made the needed repairs. 7. No bats observed. There seems to be a consistent concern regarding the lack of bat populations in this and in other local Austin caves, such as Barker Bat and County Line Bat caves. These caves have historically had bat activity. Possible explanations for some historic bat colony locations is encroaching urbanization and changes in land usage. 8. Initiated a new indepth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane. 9. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 10. COA staff removed invasive non-native vegetation from the preserve.
Hole-in-the-Road Cave Private 1. Zara Environmental Inc. conducted one cave faunal survey as part of a contract with the City of Austin (an attempt to get a better understanding of the true distribution of our listed karst invertebrates) (See EXHIBIT A). 2. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 3. WPDRD initiated a hydrological study in an attempt to determine potential negative impacts from a proposed new water line.
Ireland's Cave Private 1. A new subdivision; Somerset Estates has been built around the cave.

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
2. City of Austin WPDRD obtained 4. 819 acres critical environmental feature setback surrounding the cave. About 99% of the cave's natural catchment area is preserved. The entire 4.819 acres setback will be fenced with a combination of 6-ft wood and wrought fencing. Currently the cave entrance is blocked with large rocks. 3. More info is needed on who will manage the cave; need to ask about possible landowner agreement with BCP. 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Jack's Joint Cave Private
Japygid Cave Private 10a Permit: PRT-808694
Jest John Cave City of Austin 1. Conducted 2 site visits found and no signs of vandalism or human visitation. 2. Inspected site for RIFA infestations. On all visits though fire ants were observed within close proximity of the cave. 3. Conducted one cave cricket exist count. (See EXHIBIT B). 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 5. Installed a game camera near the entrance of the cave in an attempt to determine if feral hogs were foraging on cave crickets, the camera did indeed pick up activity (gray fox and ringtails appeared to actively forage on cave crickets exiting and entering the cave, however, no feral hog activity was noted).
Jester Estates Cave City of Austin 1. BCP staff conducted 6 site visits and noted increased signs of illegally dumped brush and trash from neighbors. Also noted that some neighbors appear to be spraying herbicide (strips of dead and dying vegetation) and possibly insect poison baits (dead RIFA mounds) within the preserve. This is a classic example of a poorly designed preserve with woefully inadequate setbacks. 2. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 3. Treated site twice for fire ants with boiling water. 4. Conducted one cave faunal survey (See EXHIBIT A).
Jollyville Plateau Cave Private 10a Permit: PRT-808694
Kretschmarr Cave Travis County 1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. Treated twelve mounds with boiling water, including one mound within 10 m of cave entrance. 3. Conducted quarterly cricket exit surveys (See EXHIBIT B). 4. Conducted annual faunal survey (See EXHIBIT A). 5. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Kretschmarr Double Pit Travis County 1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. Treated one mound with boiling water - no mounds found within 10 m of cave entrance. 3. Conducted bi-annual cricket exit surveys (See EXHIBIT B). 4. Conducted quarterly cave faunal surveys (See EXHIBIT A). 5. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Lamm Cave Section 7 Permit 2-15-93-F-075 (see USFWS files)

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
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 WPDRD and BCP staff recommendations and design. Once the cave gate was completed, BCP staff reviewed work, requested additional measures and eventually signed off on the completed gate. 3. No application of fertilizers, pesticides or herbicides will be allowed in the CEF area. 4. COA staff noted that the locks on the gates had been removed, so staff installed new locks on all gates. 5. Conducted one cave faunal survey (See EXHIBIT A). 6. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Little Bee Creek Cave City of Austin 1. Conducted 2 site visits. 2. Conducted one cave faunal survey (See EXHIBIT A). 3. COA took GPS coordinates using a garmin unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Lost Oasis Cave TCMA 1. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Lost Gold Cave Private
Maple Run Cave City of Austin 1. Conducted one cave faunal survey (See EXHIBIT A). 2. With the help of volunteer stewards, conducted bi-monthly site inspections, removed trash from preserve area and reported on anything out of the ordinary. 3. Permitted UT grad student CO2 monitoring research project which was completed. (See Appendices for reference to this study) 4. Permitted access to this cave is allowed. 5. Treated site for RIFA with boiling water. 6. Initiated a new indepth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane. 7. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
McDonald Cave Travis County 1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. No mounds found within 50 m of cave. 3. Conducted bi-annual cricket exit surveys (See EXHIBIT B). 4. Conducted quarterly cave faunal surveys (See EXHIBIT A). 5. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
McNeil Bat Cave Private 1. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 2. Conducted one bat flight exit count (*Myotis velifer*) coordinated by BCI with help from Travis County and City staff. 3. WPDRD initiated a hydrological study in an attempt to determine potential negative impacts from a proposed new water line.
Midnight Cave City of Austin 1. Conducted quarterly site inspections.

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
2. Conducted one cave faunal survey, collected new species of Batrisodes. (See EXHIBIT A). 3. Treated site for RIFA with boiling water. 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 5. AFD staged 3 cave resuce scenarios for on site training, COA BCP staff issued permits and made certain that AFD followed the stated guidelines to protect the cave.
M.W.A. Cave Private 10a Permit: PRT-808694 (see FWS files for status)
Moss Pit Cave Private
New Comanche Trail Cave Travis County 1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. Treated three mounds with boiling water - no mounds found within 10 m of cave entrance. 3. Conducted annual faunal survey (See EXHIBIT A). 4. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
No Rent Cave Private 1. Zara Environmental Inc. conducted one cave faunal survey as part of a contract with the City of Austin (an attempt to get a better understanding of the true distribution of our listed karst invertebrates) (See EXHIBIT A). Staff noted very high CO2 readings during a visit on July 22, 2010. 2. WPDRD initiated a hydrological study in an attempt to determine potential negative impacts from a proposed new water line. 3. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 4. BCP staff removed old trash from the cave.
North Root Cave Travis County 1. Perfomed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. Treated eight mounds with boiling water- no mounds found within 10 m of cave entrance. 3. Conducted annual faunal survey (See EXHIBIT A). 4. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Pennie's Cave Private 1 The entrance has been GPS located and dug-out to a depth of about five feet in 2008. 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.Additional excavation is needed to completely uncover the entrance and open the passage into cave, WPDRD is working with the land owner to protect the cave and re-establish the cave habitat. 5. The proposed Commerical Developed has not started construction. The developer filed for an extension to their development permit November 2010 and construction on a turn lane into the start should be permitted within 180 days. Once construction activities start on Commerical Development, the cave enterance will be gated.
Pickle Pit Cave Section 7 Permit 2-15-93-F-075 (see USFWS files)
Pipeline Cave Private 1. A 2004 agreement between COA and Stratus set aside a fenced buffer around Pipeline cave that varies from 100 feet to the east and up to 300 feet west of the cave and an additional setback of 300 feet to the north and

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
west; 150 ft to east and south for the adjacent feature known as Confusion Sink. As of November 2010, construction has yet to start. Developer filled a correction to approved site plan changed building layout - Feature is still protected with 300-ft and cave gate. Cave gate to be intstalled once the construction activites commence. 2. Met on site with PARD staff and SWCA consultants and had multiple email correspondence with these parties regarding a proposed new water line and trail that would be built in close proximity to the cave. Due to the potential for damage to this cave BCP and WPDRD staff recommended an alternative route that was accepted by the applicant and has been approved. WPDRD staff will monitor progress once construction starts to make certain all rules are followed and to minimize negative impacts to the cave. The project was completed. 3. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Rolling Rock Cave City of Austin 1. Inspected quarterly, and no sign of human visitation or vandalism was found. 2. Inspected site for RIFA infestations. On all visits though fire ants were observed within close proximity of the cave (including a few just inside the cave entrance). 3. Conducted one cave faunal survey. (See EXHIBIT A). 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Root Cave Travis County 1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. Treated eight mounds with boiling water- no mounds found within 10 m of cave entrance. 3. Conducted annual faunal survey (See EXHIBIT A). 4. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Slaughter Creek Cave City of Austin 1. Conducted quarterly site inspections. 2. Conducted one cave faunal survey. Staff noticed an apparent sick raccoon that followed staff during the survey. (See EXHIBIT A) 3. Treated site for RIFA with boiling water. 4. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 5. COA BCP staff met on site with WPDRD, SWCA, and Murphy Engineering to make certain that the nearby waterline construction would not negatively impact the cave.
Spanish Wells Cave Private (location unknown)
Spider Cave City of Austin 1. Conducted four site visits, and no sign of human access or vandalism was found. 2. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 3.Conducted four cave faunal surveys (See EXHIBIT A). 4. BCP staff with the help of volunteers conducted 4 cave cricket exit counts. (See EXHIBIT B). 5. Treated site for RIFA with boiling water.
Stark's North Mine Private 1. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Stovepipe Cave 1. Conducted 6 site inspections, and continued to remove old trash from the preserve. 2. Repaired perimeter fence.

Table 5. 2010 BCCP Karst Monitoring and Management Activities.
3. Surveyed the site for RIFA infestations and determined that no treatment wsa necessary. 4. Conducted one cave faunal survey (See EXHIBIT A). 5. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.
Talus Springs Cave Private 1. The USFWS 10a permit PRT 815447 mitigation requirement intended this cave to go to TC, however, the cave is located on private land just outside of the mitigation area. TC has continued requesting that the homeowners association donate the land to TC; Coordinated management with them. 2. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 3. Inspected site for RIFA. No mounds found within 50 m of cave. 4. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Tardus Hole Cave (Kretschmarr Fluted Sink) Travis County 1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. Treated three mounds with boiling water - no mounds were found within 10 m of cave entrance. 3. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Tooth Cave Travis County 1. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Inspected site for RIFA. Treated seven mounds with boiling water, including 1 mound found within 10 m of cave entrance. 3. Conducted quarterly cricket exit surveys (See EXHIBIT B). 4. Conducted quarterly cave faunal surveys (See EXHIBIT A). 5. Verified cave location with Trimble GPS unit; also photographed and tree-tagged cave entrance.
Weldon Cave Private 1. Zara Environmental Inc. conducted one cave faunal survey as part of a contract with the City of Austin (an attempt to get a better understanding of the true distribution of our listed karst invertebrates) (See EXHIBIT A). On each visit staff noticed that a wild goat is living in the cave, droppings are covering most of the upper portion of the cave. 2. WPDRD initiated a hydrological study in an attempt to determine potential negative impacts from a proposed new water line. 3. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS. 4. BCP staff removed old trash from the cave.
Whirlpool Cave TCMA 1. COA took GPS coordinates using a trimble unit in an attempt to get a precise location which will enhance our ability to accurately assess the level of protection defined by multiple parameters assessed through GIS.

9.0 LITERATURE CITED

Balcones Canyonlands Preserve Land Management Plan. 2007. Karst Species Management. Chapter IX. In Tier II-A. Balcones Canyonlands Management Handbook. Unpublished document. Travis County, TX.

Cokendolpher, James, Natural Science Research Laboratory, Museum of Texas Tech University, personal communication, 2008.

Elliot, William R. 1992. Endangered and Rare Karst Species in Travis County, Texas: Options for the Balcones Canyonlands Conservation Plan.

Elliott, William R. 1997. The Caves of the Balcones Canyonlands Conservation Plan, Travis County Texas, Travis County Natural Resources Program.

Hauwert, Nico M., Hiers, Scott, and Beatty, Heather. 2009. Field Trip guidebook: Understanding upland recharge for geologic assessments: printed by City of Austin Watershed Protection and Development Review Department. 84 p.

HNTB. 2005. Summary of Information for Assessing the Status of the Tooth Cave ground beetle (*Rhadine Persephone*,), a report for USFWS by Casey Berkhouse.

Ledford, Joel, Department of Entomology, California Acadamy of Sciences, personal communication, 2010.

Paquin, Pierre, SWCA Environmental Consultants, personal communication, 2009.

Reddell, James, Texas System of Natural Laboratories (TSNL), Texas Cave Management Association (TCMA), personal communication, 2004.

Reddell, James, Texas System of Natural Laboratories (TSNL), Texas Cave Management Association (TCMA), personal communication, 2005.

Russell, William, Texas Cave Management Association (TCMA), personal communication, 2005.

Sanders, Mark, City of Austin, personal communication, 2009.

U.S. Fish and Wildlife Service. 1994. Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas. Albuquerque, NM.

U.S. Fish and Wildlife Service. 1996a. Federal Fish and Wildlife Permit No. PRT-788841.

U.S. Fish and Wildlife Service. 1996b. (Final EIS-HCP) Final Environmental Impact Statement/Habitat Conservation Plan for Proposed Issuance of a Permit to Allow Incidental Take of the Golden-cheeked Warbler, Black-capped Vireo, and Six Karst Invertebrates in Travis County, Texas. U. S. Fish and Wildlife Service, Albuquerque, NM.

U.S. Fish and Wildlife Service. 2001. Draft Recommendations for Karst Preserve Design, March 6, 2001 Version, USFWS, Austin, TX.

U.S. Fish and Wildlife Service. 2008. Bexar County Karst Invertebrates Draft Recovery Plan. U.S. Fish and Wildlife Service, Albequerque, NM.

U.S. Fish and Wildlife Service. 2009. Bone Cave Harvestman (*Texella reyesi*) 5-Year Review: Summary and Evaluation. Austin Ecological Services Field Office, Austin, TX.

U.S. Fish and Wildlife Service. 2009. Tooth Cave Spider (*Neoleptoneta myopica*), Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*), and Tooth Cave Pseudoscorpion (*Tartarocreagris texana*) 5-Year Review: Summary and Evaluation. Austin Ecological Services Field Office, Austin, TX.

Zara Environmental LLC. 2010. Population Status of Karst Invertebrates in the Balcones Canyonlands Preserve. Report for Weston Solutions, Inc., Austin TX.

EXHIBIT A:

KARST FAUNAL REPORTS
TRAVIS COUNTY (23 REPORTS)
CITY OF AUSTIN (46 REPORTS)

FY2010 Travis County Karst Faunal Surveys[1, 2]

		Endangered Species					Species of Concern					Other Significant Troglobytes		
Cave	Survey Date	Neoleptoneta myopica	Rhadine persephone	Tartarocrea gris texana	Texamaurops reddelli	Texella reyesi	Cicurina elliotti	Cicurina travisae	Neoleptoneta devia	Tartarocreagris reddelli	Eidmannella reclusa	Speodesmus bicornourus	Speodesmus sp.	Eidmannella sp.
Amber Cave	12/14/2009							10					46	
Amber Cave	2/16/2010							4					33	
Amber Cave	6/9/2010				1								7	2
Amber Cave	9/14/2010							1					8	3
Gallifer Cave	12/8/2009	3	5			25	21						3	2
Geode Cave	12/15/2009		7			2								5
Kretschmarr Cave	12/14/2009							3			5	1		
Kretschmarr Double Pit	12/3/2009							2						1
Kretschmarr Double Pit	2/25/2010													
Kretschmarr Double Pit	6/8/2010													3
Kretschmarr Double Pit	9/2/2010													1
McDonald Cave	12/3/2009					3		15				5		24
McDonald Cave	2/16/2010					2		33		1		2		9
McDonald Cave	6/3/2010					1		14	2					22
McDonald Cave	9/14/2010					2		18	2	4		17		8
New Comanche Trail Cave	12/15/2009					1								
North Root Cave	11/12/2009													
Root Cave	12/15/2009													
Tardus Hole	12/8/2009													1
Tooth Cave	12/8/2009	1				46		45			1	1		
Tooth Cave	2/25/2010		1			51		14			4	1		
Tooth Cave	6/8/2010			1	1	26		19		1	6	3		
Tooth Cave	9/9/2010	1				71		22			5	4		

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

[2] Surveyors in FY2010 include Rachel Barlow, Todd Bayless, Paul Fushille, Bill Larsen, Jeanette Larsen, Kathleen O'Connor, and William Simper.

FY2010 City of Austin Karst Faunal Surveys[1, 2]

		Endangered Species				Species of Concern						Other Significant Troglobytes									
Cave	Survey Date	Neoleptoneta myopica	Rhadine persephone	Texella reddelli	Texella reyesi	Caecidotea reddelli	Cicurina bandida	Neoleptoneta devia	Rhadine austinica	Rhadine subterranea	Texella spinoperca	Texella mulaiki	Speodesmus bicornourus	Speodesmus sp.	Eurycea sp.	Batrisodes sp.	Brackenridgia sp.	Tartarocreagris infernalis	Texella grubbsi	blind Cicurina	Neoleptoneta sp.	Eidmannella sp.
Adobe Springs Cave	12/18/2009																7					
Airman's Cave	4/25/2010						12															20
Arrow Cave	9/23/2010						12		1					9								
Beard Ranch Cave	1/14/2010																			2		
Blowing Sink Cave	12/19/2009						8		1			1		16	5							
Blowing Sink Cave	1/18/2010						2		1					11								
Blowing Sink Cave	2/20/2010						2							5	4							
Blowing Sink Cave	3/28/2010						4		1					2	1							
Blowing Sink Cave	4/25/2010						1							1								
Blowing Sink Cave	5/26/2010						1		1					11	6							
Blowing Sink Cave	7/17/2010						2							1								
Broken Arrow Cave	11/5/2009													1						2		
Broken Arrow Cave	1/28/2010					22								2		1				4		
Broken Arrow Cave	6/30/2010		1			5							2							3		
Cave Y	9/16/2010						10		1				2						4			
Cortana Cave	10/14/2009	2																		4		5
Cotterell Cave	11/13/2009				20								5							58		
Cotterell Cave	1/28/2010				6								6					2		38		
Cotterell Cave	5/13/2010				11								1					4		60		
Cotterell Cave	9/1/2010				10								5					4		67		
District Park Cave	11/19/2009						16					4										
District Park Cave	2/3/2010						12															
District Park Cave	5/10/2010						3					2									1	

		Endangered Species				Species of Concern						Other Significant Troglobytes										
Cave	Survey Date	Neoleptoneta myopica	Rhadine persephone	Texella reddelli	Texella reyesi	Caecidotea reddelli	Cicurina bandida	Neoleptoneta devia	Rhadine austinica	Rhadine subterranea	Texella spinoperca	Texella mulaiki	Speodesmus bicornourus	Speodesmus sp.	Eurycea sp.	Batrisodes sp.	Brackenridgia sp.	Tartarocreagris infernalis	Texella grubbsi	blind Cicurina	Neoleptoneta sp.	Eidmannella sp.
District Park Cave	9/3/2010						19														2	
Flintridge Cave	11/13/2009						23							147								
Flintridge Cave	2/2/2010						21		1					139								
Flintridge Cave	5/13/2010						27					3		114								
Flintridge Cave	9/3/2010						33							71								1
Goat Cave	9/24/2010						1					1										
Jester Estates Cave	8/12/2010	18			7															4		
Lamm Cave	10/14/2009																			7		
Lamm Cave	1/14/2010																			2		
Little Bee Creek Cave	5/14/2010													1								
Maple Run Cave	1/10/2010						1															
Midnight Cave	9/20/2010						15															9
Pond Party Pit	12/18/2009				12												3					2
Pond Party Pit	8/12/2010				10					2			7					5		2		2
Rolling Rock Cave	11/5/2009																			4		
Seibert Sink	9/14/2010						3				4			4			1				4	1
Slaughter Creek Cave	9/23/2010						14					1		11								
Spider Cave	10/21/2009		1																	10		1
Spider Cave	11/13/2009			2																22		2
Spider Cave	1/28/2010																			24		1
Spider Cave	5/13/2010		3																	28		
Spider Cave	9/1/2010			9										4						23		7
Stovepipe Cave	9/28/2010				12			1						20			6			7		5

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

[2] Surveyors in FY2010 include Rachel Barlow, John Chenoweth , Joel Ledford, Krista McDermid, Kelly Nesvacil, Kathleen O'Connor, and Mark Sanders.

EXHIBIT B:

CRICKET COUNT DATA REPORTS
CITY OF AUSTIN (5 CAVES)
TRAVIS COUNTY (6 CAVES)

CRICKET COUNT DATA REPORTS

City of Austin Caves:

Surveyed Caves	November 2009				February 2010				May 2010				July/ August/ September 2010			
	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:
Cotterell Cave	184	20	2	206	55	21	0	76	347	80	17	444	397	71	7	475
District Park Cave	117	20	33	170	635	109	2	746	373	223	322	918	343	60	270	673
Flintridge Cave	15	3	2	20	284	135	39	458	214	159	187	560	186	30	402	618
Jester Estates Cave	--	--	--	n/a	--	--	--	n/a	--	--	--	n/a	13	90	1017	1120
Spider Cave	22	0	0	22	276	22	1	299	46	17	28	91	38	23	45	106

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

Travis County Caves:

Surveyed Caves	November 2009				February 2010				May 2010				August 2010			
	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:
Amber Cave	2	7	12	21	190	41	5	236	25	22	32	79	24	47	27	98
Gallifer Cave	0	0	1	1	7	0	0	7	32	29	36	97	7	8	14	29
Kretschmarr Cave	0	1	0	1	21	9	0	30	8	12	6	26	10	3	0	13
Kretschmarr Double Pit Cave	0	0	0	0	0	0	0	0	--	--	--	n/a	--	--	--	n/a
McDonald Cave	0	0	0	0	0	0	0	0	--	--	--	n/a	--	--	--	n/a
Tooth Cave	12	5	8	25	24	10	0	34	4	2	18	24	15	7	39	61

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