2021 SUMMARY OF CITY OF AUSTIN SPRING MANAGEMENT ACTIVITIES ON THE BALCONES CANYONLANDS PRESERVE



Crystal Datri in a cave found while searching for springs.

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Abstract

This report details the Balcones Canyonlands Conservation Plan (BCCP) springs management activities performed during the 2021 fiscal year. On-going management activities for FY 2021 include mapping and characterizing newly documented springs, monitoring previously documented springs, survey for stygofauna, and maintaining a database of springs. Biologists documented 28 new spring locations in FY2021. Invertebrates were sampled at 7 springs, all of which are new occurrence records, including BCCP species of concern and state species of greatest conservation need. Multiple specimens await further taxonomic scrutiny.

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Introduction

The Balcones Canyonlands Preserve (BCP) is a regional system of preserve tracts created for the protection of federally listed species and species of concern as specified by the Balcones Canyonlands Conservation Plan (BCCP). The BCCP is a regional 10(a)(1)(B) permit jointly issued to the City of Austin and Travis County by the U.S. Fish and Wildlife Service (USFWS) under the endangered species act. The regional permit addresses the stewardship of habitat for the permanent protection of eight federally listed endangered species (two songbirds and six invertebrates) and twenty-seven species of concern (two plants and twenty-five invertebrates). Should the species of concern become federally listed, no additional mitigation would be required by the permittees with the full implementation of all BCCP protections (BCP 2007a, USFWS 1996).

The permit area, or Balcones Canyonlands Preserve, is located in Western Travis County on the eastern edge of the Edwards Plateau ecoregion. This area comprises part of the Balcones Canyonlands, characterized by steep streams and canyons deeply dissecting the Balcones Escarpment. The karstic limestone found here is highly fractured and pocked with numerous solution cavities and springs. These subterranean features and spring-fed drainages support unique ecological niches and a high degree of endemism (BCP 2007a).

Balcones Canyonland Conservation Plan (BCCP) spring management obligations include: identifying spring locations (BCP 2007e, 2007g, 2007j), monitoring springs for water quality and seasonal discharge (BCP 2007b, 2007g, 2007h, 2007j), protecting springs (BCP 2007b, 2007d, 2007h, 2007i, 2007j), controlling invasive species (BCP 2007g, 2007h, 2007i, 2007j), and monitoring for populations of aquatic target species (BCP 2007b, 2007c, 2007h, 2007j). These management obligations include research goals that specify improving understanding of the ecology of preserve species and aquatic and subterranean environments (BCP 2007b). Those topics that contribute to management practices and permanent protection for listed species and species of concern are emphasized. The BCCP cites a lack of information regarding karst species and karst habitat management and specifically encourages research regarding aquatic life within the aquifer (BCP 2007c).

The animals that occur in subsurface water are referred to as stygofauna. This report addresses the two categories of stygofauna found on the Balcones Canyonlands Preserve: the stygophiles that exploit aquatic subsurface environments for some

portion of their life cycle, and the stygobites that complete their entire life cycle in subsurface waters (Malard *et al.* 2002).

Among the twenty-seven species of concern protected under the BCCP, three are stygobitic: the flatworm *Sphalloplana mohri*, the ostracod *Candona sp. nr. stagnalis*, and the isopod *Caecidotea reddelli*. Further, the BCCP identifies additional species of concern (BCP 2007a). Of these are two stygobitic invertebrates: the amphipods *Stygobromus russelli* and *Stygobromus bifurcatus*. Both amphipods have a conservation status of vulnerable (Hutchins 2017). The stygophilic Jollyville Plateau salamander (*Eurycea tonkawae*) and the undescribed "Pedernales River springs" salamander are not listed as a species of concern by the 1996-issued BCCP permit; however, the BCCP does list these species as additional species of concern and indicates that *Eurycea* salamanders may deserve further scrutiny throughout the term of the permit (BCP 2007a). The "Pedernales River springs" salamander is an undescribed neotenic *Eurycea* species (*Eurycea* sp. 1) occurring in springs along the lower Pedernales River in Blanco, Travis, and Hays Counties (Devitt *et al*. 2019) that was recently petitioned for federal listing (Datri et al. 2021). NatureServe rankings indicate this salamander will be listed as critically imperiled once described (NatureServe 2020). The Jollyville Plateau salamander has since been federally listed as threatened and is a vulnerable-imperiled state species of greatest conservation need (USFWS 2013, TPWD 2012). Numerous populations are found on the BCP and monitoring Jollyville Plateau salamanders is specifically prescribed in the management objectives (BCP 2007f, 2007h). The BCP does possess a USFWS 10(a)(1)(A) permit for research and recovery purposes for *E. tonkawae*. Table 1 and Table 2 summarize the conservation status of the stygofauna of the BCCP.

Table 1. The stygofauna protected under the BCCP along with their most recently assessed conservation status[1]. These species may merit federal listing if the BCP does not adequately protect their habitat[2].

Common name	Scientific Name	Conservation Status	Federal Status	State Species of Greatest Conservation Need
Flatworm	*Sphalloplana mohri*	Vulnerable		
Ostracod	*Candona sp. nr. stagnalis*			
Isopod	*Caecidotea reddelli*	Apparently secure		

[1] Hutchins 2017
[2] BCP 2007a.

Table 2. The stygofauna the BCCP names as additional species of concern along with their most recently assessed conservation status[1,2].

Common name	Scientific Name	Conservation Status	Federal Status	State Species of Greatest Conservation Need
Jollyville Plateau salamander	*Eurycea tonkawae*		threatened	Imperiled
"Pedernales springs" salamander	*Eurycea sp. 1*			
Bifurcated cave amphipod	*Stygobromus bifurcatus*	Vulnerable		
amphipod	*Stygobromus russelli*	Vulnerable		Critically Imperiled

[1] Hutchins 2017.
[2] Texas Parks and Wildlife Department 2020.

There is insufficient data on the taxonomy, distribution, and ecology of stygofauna. Spring outflows provide access points or "windows" into aquatic subterranean ecosystems (Malard 2002). The City of Austin (COA) wishes to establish baseline physical condition data for all COA BCP springs and assess these springs for aquatic target species, with the long-term goal of monitoring sites for changes that could be in response to the surrounding growing urban population, climate change, or invasive species.

BCP staff initiated mapping and characterizing springs in FY 2017. In FY 2018, BCP staff continued to map and characterize spring locations, began monitoring springs, and established a geospatial springs database. These activities were expanded to include increased survey for stygofauna with the initiation of a contract agreement with permitted biologist, Crystal Datri, owner, Wren Daytree LLC. Management activities in FY 2019 included mapping and characterizing newly documented springs, monitoring previously documented springs, survey for stygofauna, prioritizing sites for protection from feral hogs, updating the springs database, refining methods, and establishing a system of curation for collections. Management activities for FY 2020 included mapping and characterizing newly documented springs (expanded to include the Pedernales and South Lake Austin macrosites), monitoring previously documented springs, survey for stygofauna, site protection from feral hogs, updating the springs database, and refining methods. This annual report details ongoing activities for FY 2021 including mapping and characterizing newly documented springs (expanded to include the West Austin macrosite), monitoring previously documented springs, survey for stygofauna, updating the springs database, and refining methods.

Methods

Here we define springs following Springer and Lawrence (2009): ecosystems where groundwater reaches the Earth's surface either at or near the land-atmosphere interface or the land-water interface. Seeps are small springs where discharge is immeasurably diffuse (Stevens *et al.* 2016). The source of the spring or its point of emergence is referred to as the orifice (Springer and Lawrence 2009).

Identifying Undocumented Springs

Biologists selected locations to search for springs by identifying canyons and ravines within City of Austin (COA)-owned tracts of the Balcones Canyonlands Preserve (BCP) using topographic maps. Previous fiscal years have included spring survey on Travis County and LCRA BCP tracts. Previously documented spring locations were considered to identify gaps in COA springs data. Biologists traversed streams, canyons, ravines, and their tributaries, searching for signs of springs (e.g. spring-associated vegetation, sounds of water flowing, temperature gradients). Spring locations were documented when water issuing from an orifice was observed. Seeps were documented where there was not an obvious orifice of flowing water, but indications of diffuse seepage. Positions of all features were documented with a commercial handheld Global Positioning System (GPS) receiver and checked with field maps based on digital imagery. The locations of all features were mapped using ArcGIS software.

Characterizing Springs

Location accessibility and spring morphology on the Balcones Canyonland Preserve System limit the types of data that can be collected for characterization. FY2021 field survey consisted of a single researcher searching for spring locations and collecting data based on the equipment they could hike with and the nature of the unique conditions encountered at each site. Researchers focused on documenting those characteristics in the immediate vicinity of the spring orifice; however, in many cases, descriptions of spring-run habitat deemed suitable for stygofauna was additionally described. The following were collected in FY2021 as possible: size and description of orifice morphology, photographs, water depth, substrate composition, rock cover, calcium carbonate cementation, water temperature, ambient temperature, some measure of water quantity, notable flora and fauna, and other water quality parameters. Discharge was measured by capturing spring outflow for time. Spring outflow could be directly captured at a rock-face pour-off in a graduated cylinder or

diverted for capture using laminated paper or plastic sheeting. A visual estimate of percentage of flow captured was recorded. When outflow could not be captured, a description of the wetted perimeter and flow characteristics was described. Substrate in the immediate vicinity of the spring outlet was assessed as a visual estimate of the particles that fall within each category of the modified Wentworth scale. Rock cover and calcium carbonate cementation was measured by modifying established methods for Jollyville Plateau salamander occupancy surveys (Bendik et al. 2016). Researchers measured as a visual estimate of the percentage of rocks available (i.e. unembedded) for salamander cover (>8 mm) at the substrate surface in the immediate vicinity of the spring orifice. Calcium carbonate cementation was visually estimated as being in one of four categories: (1) no carbonate build-up; (2) low to moderate build up (but <50% area); (3) moderate to high build up (>50% area); and (4) complete covering of area with carbonate and tufa, in the immediate vicinity of the spring orifice. Water depth was measured at the thalweg of the spring orifice. Ambient temperature was measured within 0.5 meters of the spring orifice. Water temperature was measured as far into the spring orifice as a handheld probe thermometer (Reotemp K79-7) could reach. Other water quality parameters were collected when possible with a Hanna HI98194 meter and included: pH, ORP, DO, conductivity, resistivity, total dissolved solids, salinity, temperature, and atmospheric pressure. Weather conditions were noted at the beginning and the end of the survey day. Local temperature and humidity were recorded from the nearest reported Wunderground weather station. Researchers visually estimated cloud cover. Wind speed was estimated using the Bufort scale. Geologic formation was noted according to elevation *a posteriori*.

Stygofauna

Researchers searched for salamanders and macroscopic invertebrate stygofauna by removing and replacing all cover objects such as rocks and leaf litter within the wetted perimeter in the immediate vicinity of the spring orifice where water accumulated enough to provide useable habitat as pools, streams, or within surveyable portions of karst features. Search surface area and time were recorded. Submerged spring orifices can be difficult to discern. Further, Jollyville Plateau salamanders are known to range widely (500m+) in spring-influenced stream habitats (Bendik 2016). While traversing stream runs in search of spring locations, researchers frequently stopped to informally search what they evaluated as suitable habitat using their best judgement. Because locations were not known *a priori* in these cases, survey sites were not delimited, and searching times were not noted.

Drift nets and cotton mop-head material (mops) were used to sample for fauna as appropriate according to spring morphology and location accessibility. On retrieval, mops were carefully removed and visually searched for both salamanders and macro invertebrates. Drift nets consisted of 150 to 200 micron, mesh filter bags. Drift nets were checked at least once per week. On retrieval, nets were rinsed into a 250 micron sieve and then visually searched for any remaining macroinvertebrates. Sieve material was sorted and visually searched, both with the unaided eye and in combination with a 2x lens.

Specimen Collection and Curation

Macroscopic invertebrate stygofauna were collected and fixated in 95% nondenatured ethyl alcohol. Samples were sorted and assigned specimen numbers at the Reicher Ranch Wildlands Conservation Division office. Samples were then sent to the University of Texas Rio Grande Valley at Edinburg (gastropods), USFWS San Marcos Aquatic Resources Center (*Stygobromus*), Edwards Aquifer Research and Data Center at San Marcos (*Assellidae*), and the Texas Natural History Collection at the University of Texas at Austin (troglofauna) where they await further taxonomic scrutiny and curation. Epigean fauna is curated at Reicher Ranch. Accession information for all invertebrates collected as part of this project are housed with the City of Austin Wildlands Conservation Division.

Testudo Tube cave

Bi-annual monitoring events at Testudo Tube cave for Jollyville Plateau salamanders were conducted on January 21, 2021 and August 13, 2021. One biologist exhaustively searched a previously delineated monitoring zone of stream passage (Figure 1). Animals were captured with pool nets and held in mesh boxes in the water until they were photographed. Animals were photographed in an acrylic tray filled with spring water, placed on top of 1 cm grid background (Figure 2). These images can later be used to identify individuals and measure body length. Animals were released within the immediate vicinity of their capture. At the beginning of each survey, water temperature, specific conductivity, pH, and dissolved oxygen were measured with a Hydrolab Compact MS5.

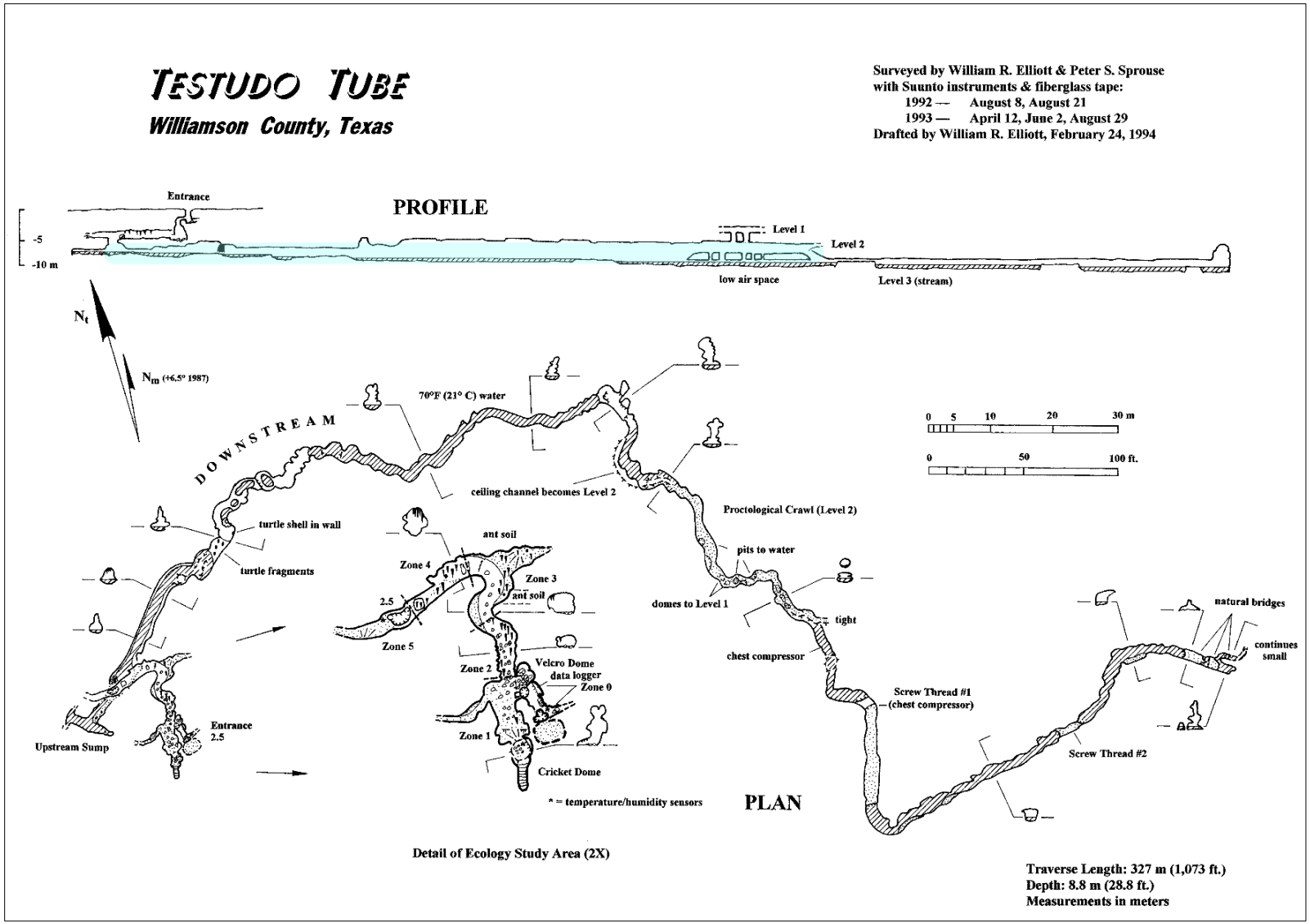

Figure 1. Map of Testudo Tube cave. The monitoring zone is highlighted in blue in the profile view.



Figure 2. Salamanders to be photographed in Testudo Tube Cave. Photo by Jonathan Scalise during a previous fiscal year survey (Jan 2019).

Springs Database

The Wildlands Conservation Division Springs Database was established by city staff biologist Colin Strickland in 2018. Colin compiled all known COA BCP springs data into a single format in ArcGIS and continues to add BCP springs data as collected through FY2021.

Results

Identifying Undocumented Springs

28 new spring locations were documented in FY2021 on City of Austin Balcones Canyonland Preserve tracts Cortaña, Reicher Ranch, Ulrich, Vireo Research Area, and Bull Creek Greenbelt. This brings the total number of documented springs on City of Austin BCP tracts to approximately 369 since FY 2017. These locations are depicted on maps shown in Figure 3. Location and characterization data are housed with the City of Austin Wildlands Conservation Division office.

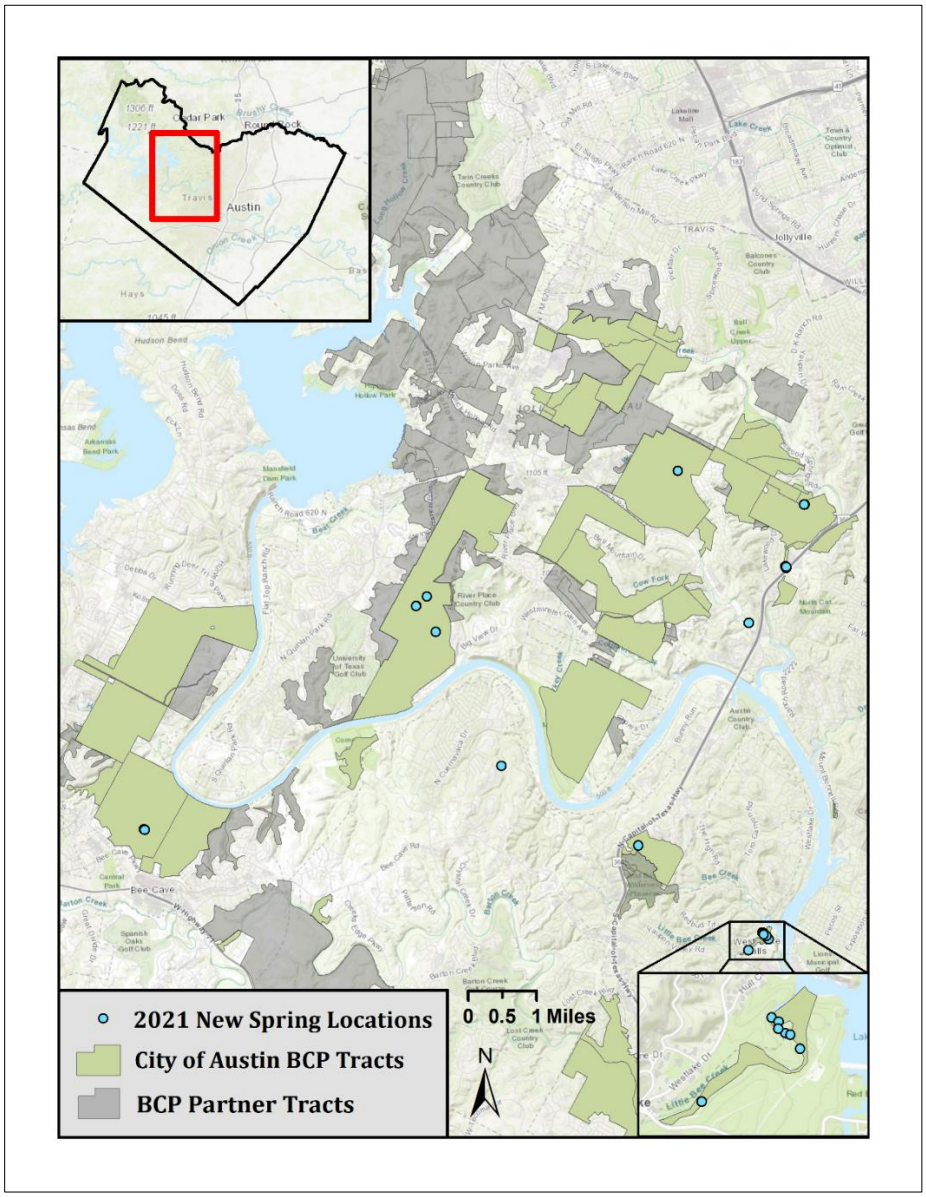

Figure 3. Springs documented on the City of Austin Balcones Canyonlands Preserve in FY2021. Map by Colin Strickland.

Fauna

No new locations for *Eurycea* neotenic salamanders on COA BCP were found in FY2021. Invertebrates were collected from 7 springs in FY2021. In addition, taxonomic identification of previous fiscal year's invertebrate collections were received in FY2021. A table of all invertebrate fauna collected from FY2017 through FY2021 with their current lowest level of taxonomic identification is found in Appendix 1. A summary of invertebrate stygofauna identified from FY2017 through FY2021 follows.

Multiple *Stygobromus* species have been collected in BCP springs, including *Stygobromus balconis* from Injured Spring, Chips Duet, John's Hollow, Amphipod Trickle, Gate Spring, and Mixon's Manumit; *Stygobromus russelli* from Squeaking Juniper, Greenbriar, Shutdown Stygos, Source of Giants, and Watering Pool; and *Stygobromus bifurcatus* from Surprise Amphipool, Robin's Secret, Sanders Sow, Misnamed Spring, and Mixon's Manumit (pictured in Figure 4). Individuals from three springs (Squeaking juniper, Steiner Sanctuary, and Giant Isopod) were identified to the *Stygobromus tenuis* group because they were juveniles and/or too small to distinguish to species. This group includes *S. balconis*, *S. bifurfactus*, and *S. russelli*. A map of the distribution of collected *Stygobromus* species is shown in Figure 5.



Figure 4. *Stygobromus balconis*, collected from a drift net at Mixon's Manumit spring on the Forest Ridge/ Bull Creek Park tract. Photo by Colin Strickland.

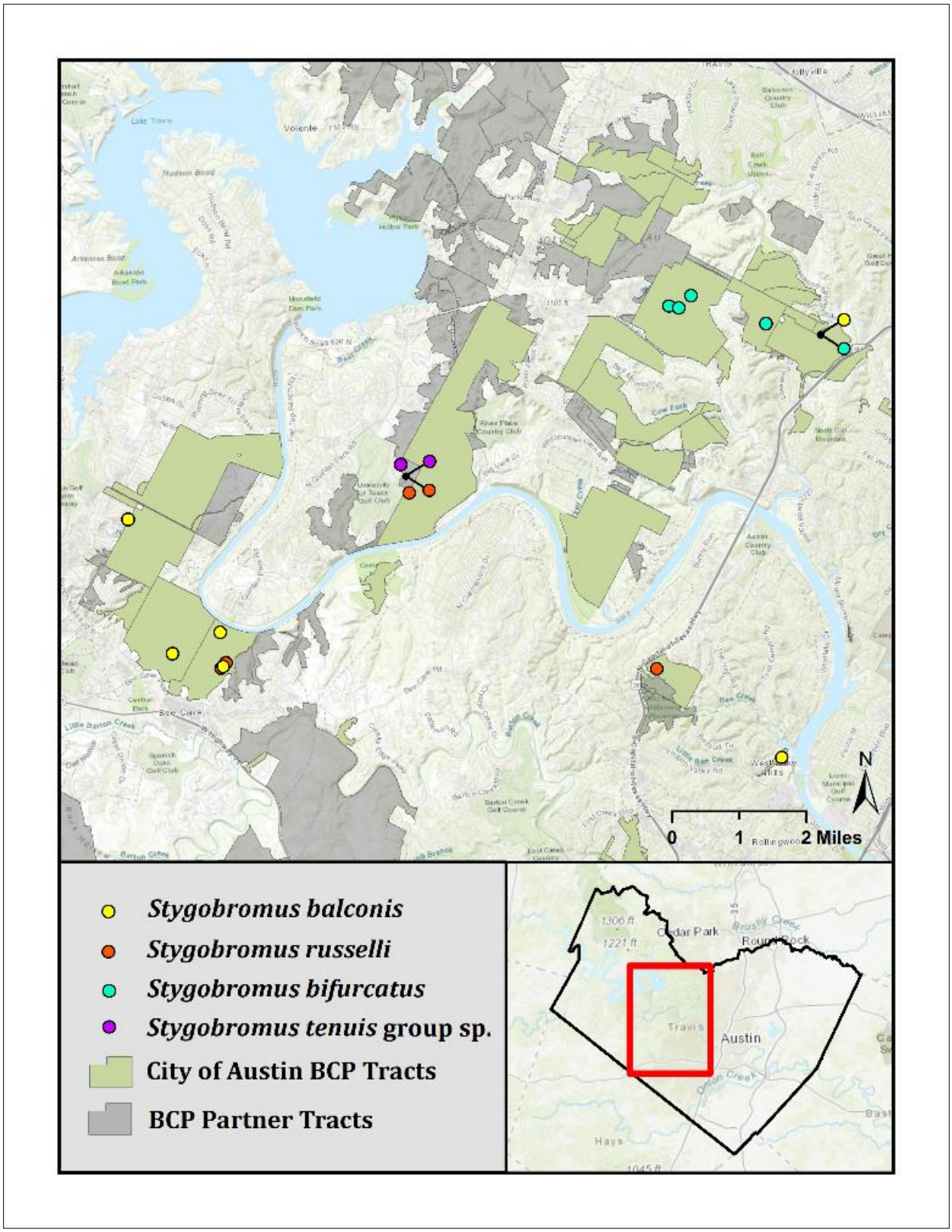

Figure 5. The distribution of *Stygobromus* species collected on City of Austin BCP tracts. Map by Colin Strickland.

Two stygobitic isopods have been collected: *Lirceolus hardeni* and *Caecidotea reddelli*. *L. hardeni* has been collected from Greenbriar and John's Hollow. These locations are mapped in Figure 6. *C. reddelli* has been collected from Springs of Promise, Robin's Secret, Greenbriar, Squeaking Juniper, Steiner Sanctuary, Giant Isopod, Source of Giants, John's Hollow, and Box Spring (pictured in Figure 7). These locations are mapped in Figure 9. A gravid female *Lirceolus hardeni* collected from Greenbriar Spring is shown in Figure 8-left. Figure 8-right depicts *Caecidotea reddelli* and *Lirceolus hardeni* indviduals, both collected from John's Hollow.

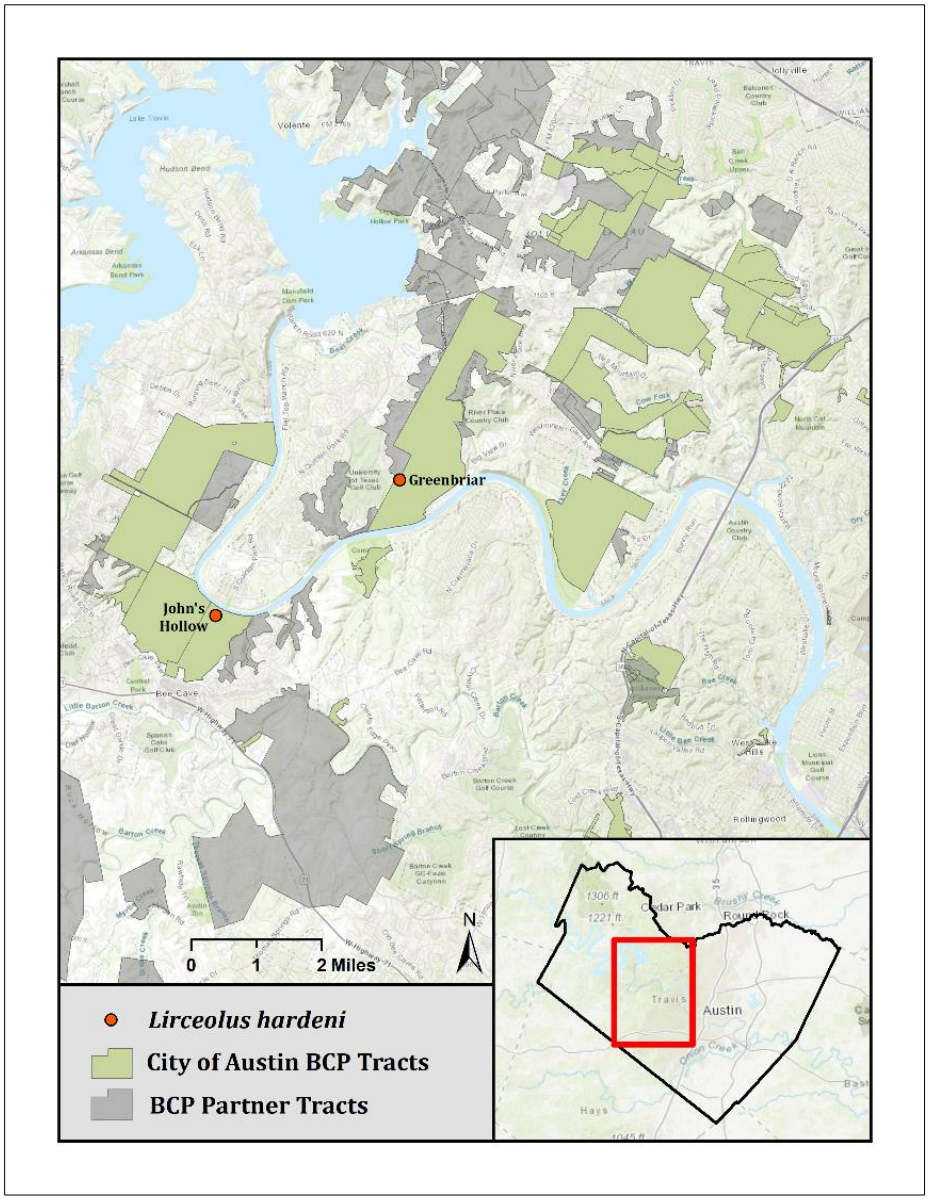

Figure 6. *Lirceolus hardeni*, one of two stygobitic isopods collected at springs on the City of Austin Balcones Canyonlands Preserve. Map by Colin Strickland.

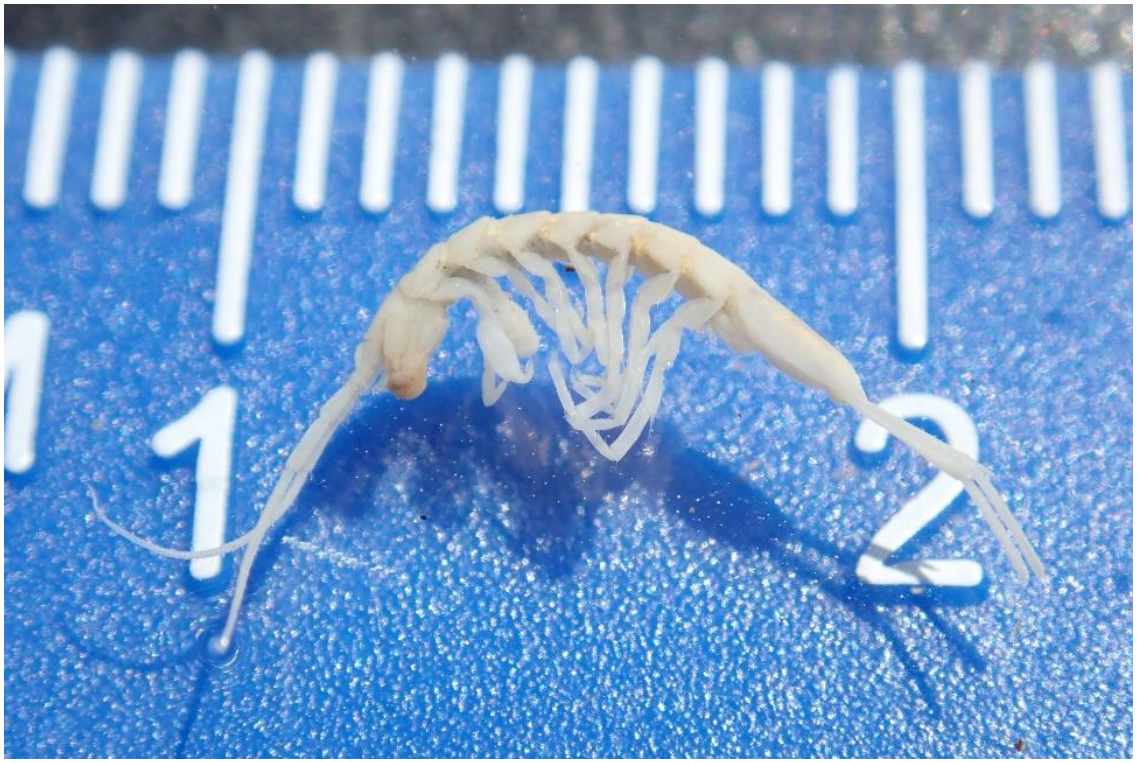

Figure 7. *Caecidotea reddelli* collected from Box Spring on the Ulrich Tract. Photo by Colin Strickland.



Figure 8. Stygobitic isopods collected from springs on City of Austin Balcones Canyonlands Preserve. A gravid female *Lirceolus hardeni* collected from Greenbriar Spring on the Cortaña tract (photo left). The photo-right shows a size comparison between *Caecidotea reddelli* (left) and Lirceolus hardeni (right), both collected from John's Hollow on the Bohls tract. Photos by Will Coleman.

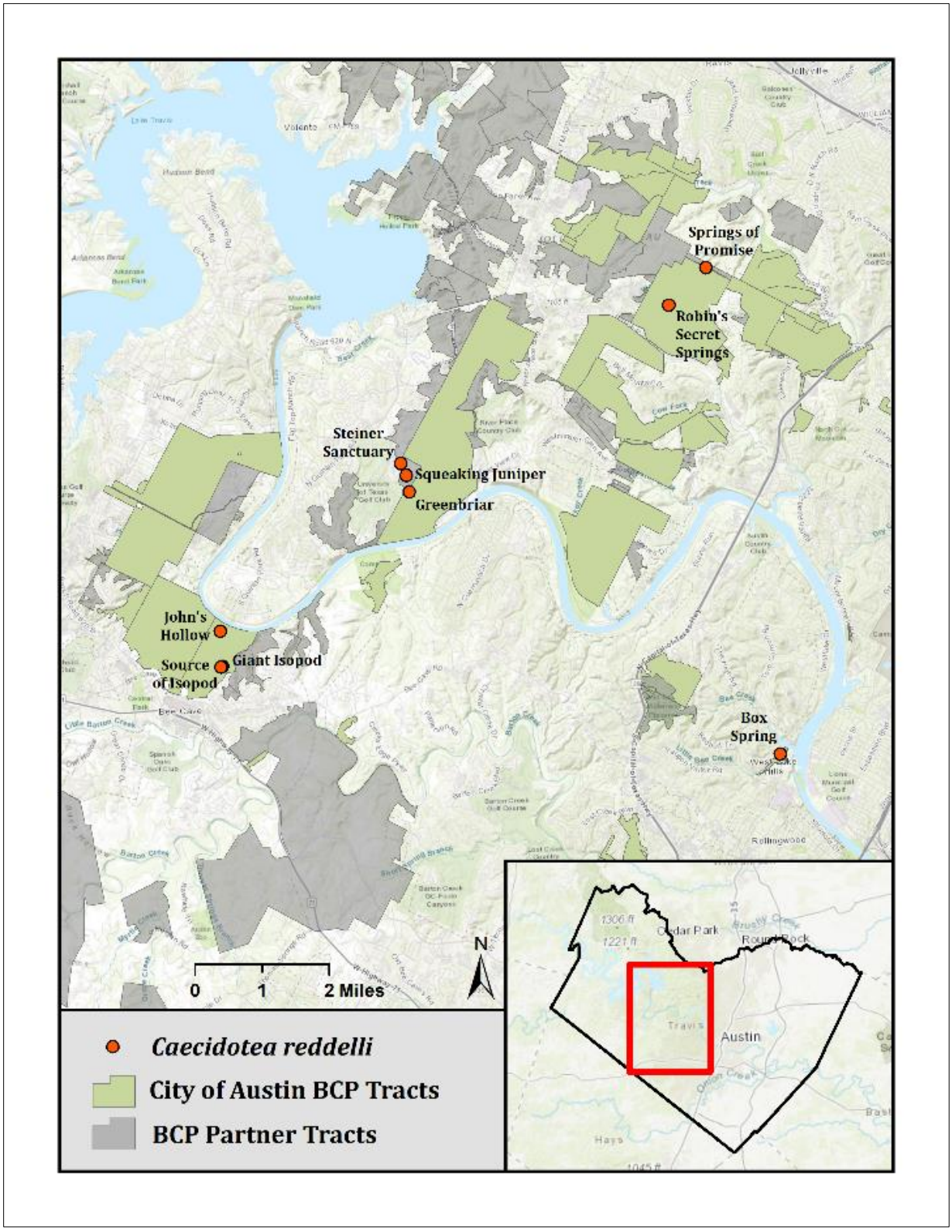

Figure 9. *Caecidotea reddelli*, a stygobitic isopod protected by the Balcones Canyonlands Conservation Plan was collected from multiple springs across the Balcones Canyonlands Preserve. Map by Colin Strickland.

Phreatodrobia nugax was collected from Steiner Sanctuary and Squeaking Juniper springs (Travis County BCP Steiner Ranch tract), Greenbriar (COA BCP Cortaña tract), and John's Hollow (COA BCP Bohls tract) (mapped in Figure 10). Eyeless flatworms were collected from Steiner Sanctuary (Travis County's Steiner Ranch tract). These specimens await further taxonomic scrutiny. Their locations are mapped in Figure 11. *Hyalella azteca*, an eyed amphipod, was collected from Greenbriar spring on the Cortaña tract (mapped in Figure 12).

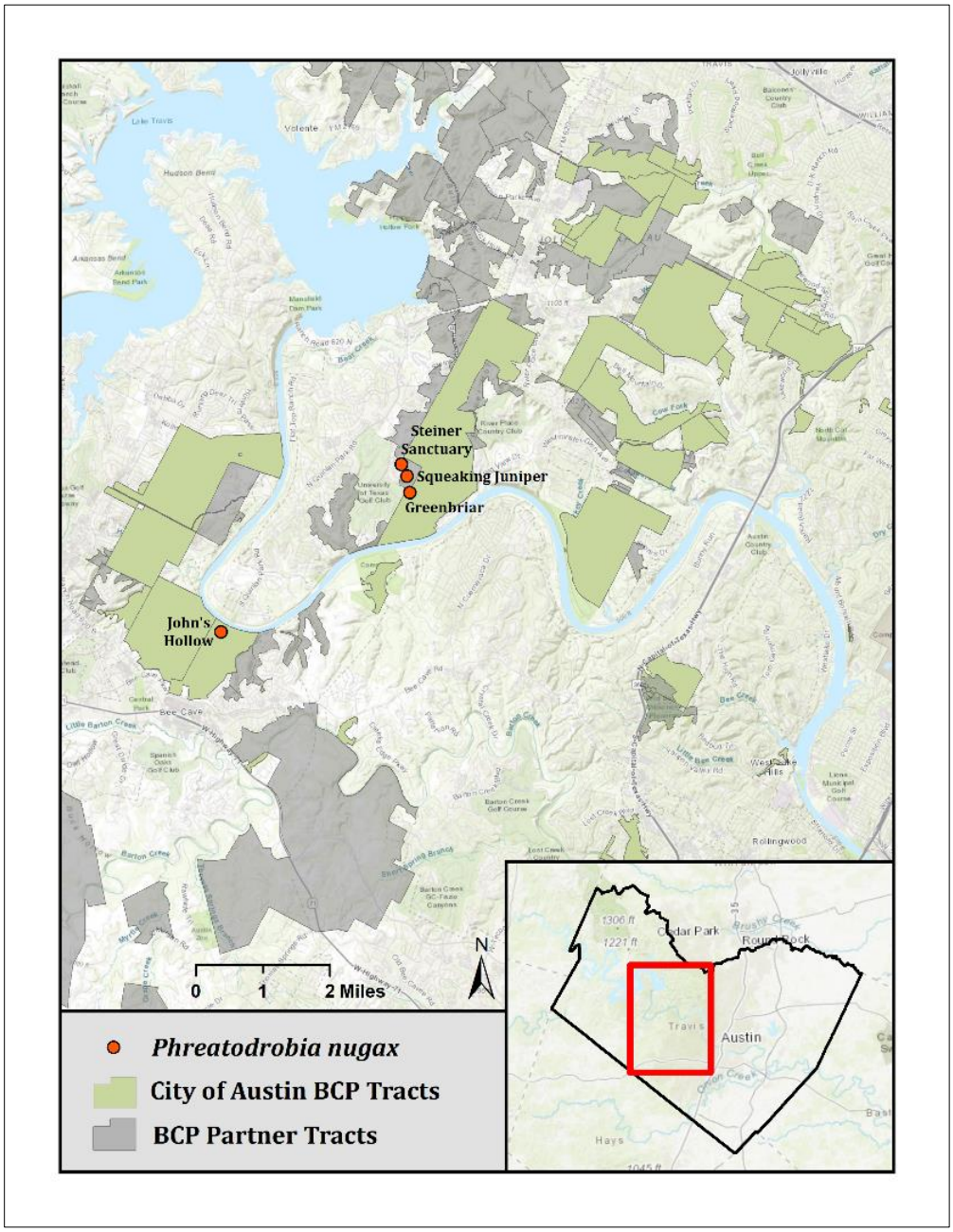

Figure 10. New locations for *Phreatodrobia nugax*, a stygobitic snail found in springs on the Bohl's, Cortaña, and Steiner Ranch tracts. Map by Colin Strickland.

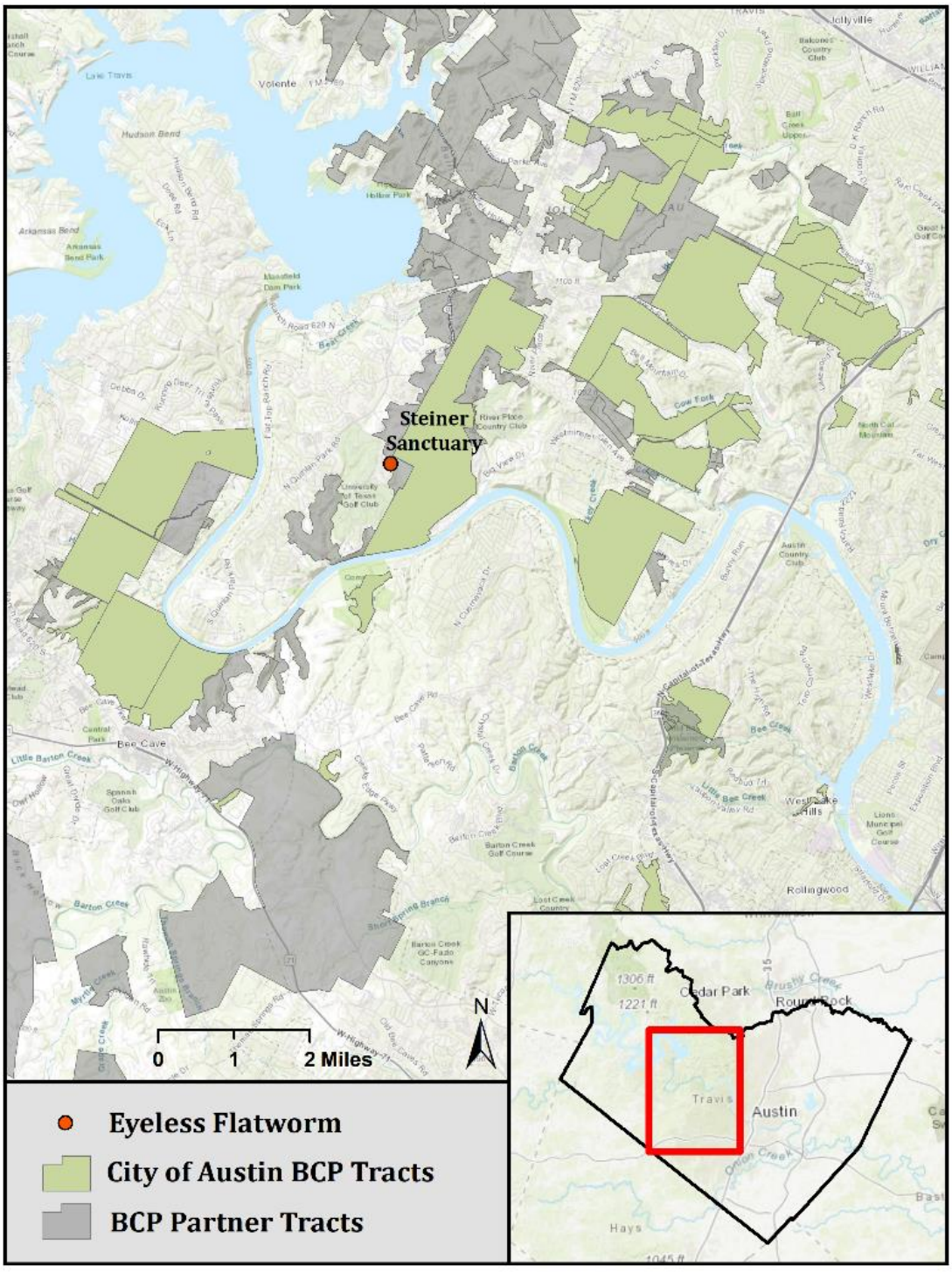

Figure 11. Eyeless flatworms were collected at Steiner Sanctuary spring on the Cortana tract. These specimens await further taxonomic scrutiny, but may be *Sphalloplana mohri*, a species protected by the Balcones Canyonlands Conservation Plan. Map by Colin Strickland.

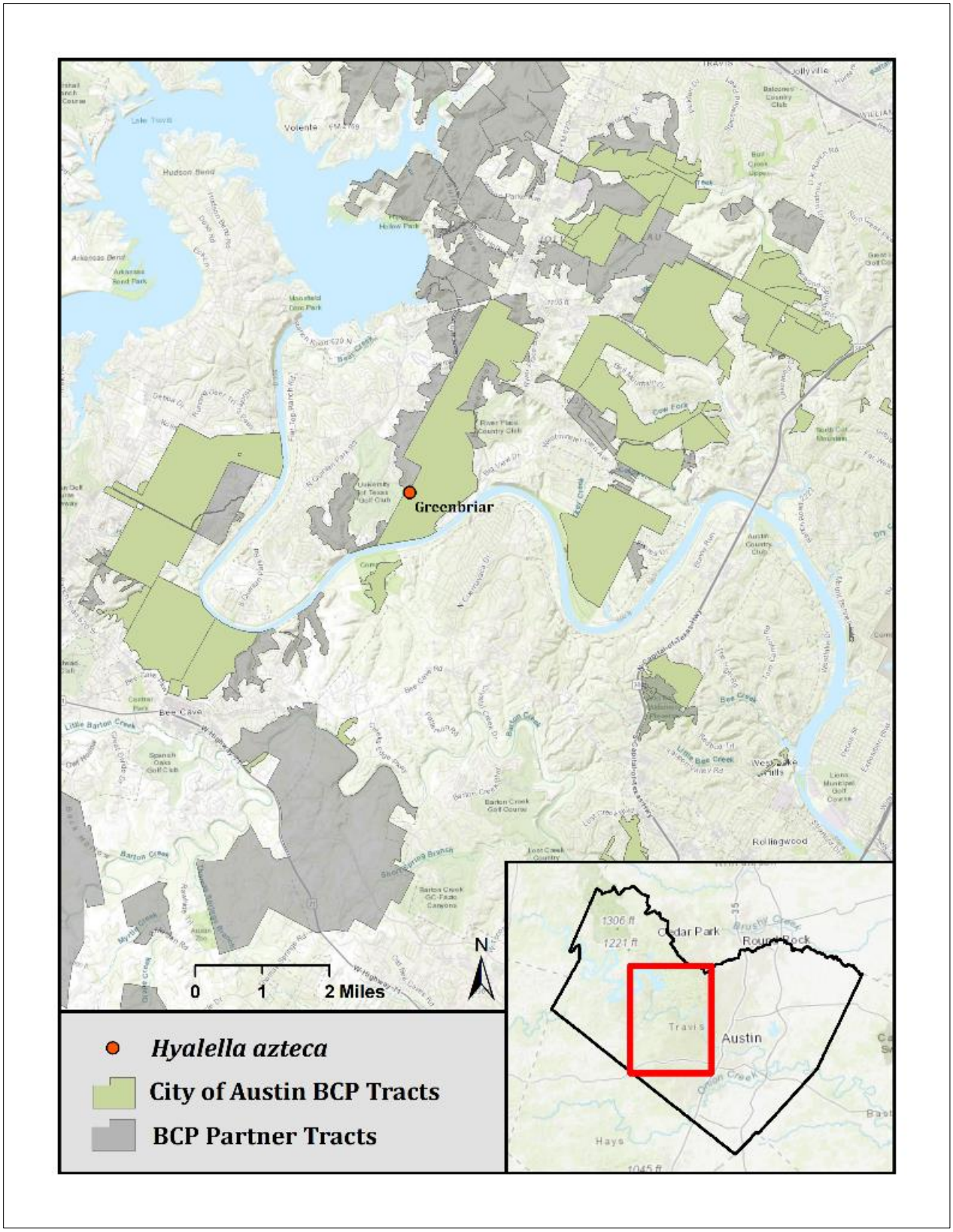

Figure 12. *Hyalella azteca* was collected on the Cortaña tract. Map by Colin Strickland.

Other species of interest were collected at springs in addition to stygofauna. An epigean sucking millipede (order Siphonphorida) was collected in a drift net at Steiner Sanctuary Spring. This individual is depicted in Figure 13.



Figure 13. An epigean sucking millipede of the order Siphonphorida collected from a drift net at Steiner Sanctuary spring. Photo by Colin Strickland.

Multiple troglobitic species were collected in springs. The locations for collected eyeless millipedes (pictured in Figure 14), cave isopods (family Trichoniscidae), and eyeless springtails are mapped with nearby USFWS Karst Faunal Regions in Figures 15 through 17.



Figure 14. Troglobitic millipedes collected from a drift net at Steiner Sanctuary, a spring on the Travis County Steiner Ranch tract. Photos by Colin Strickland.

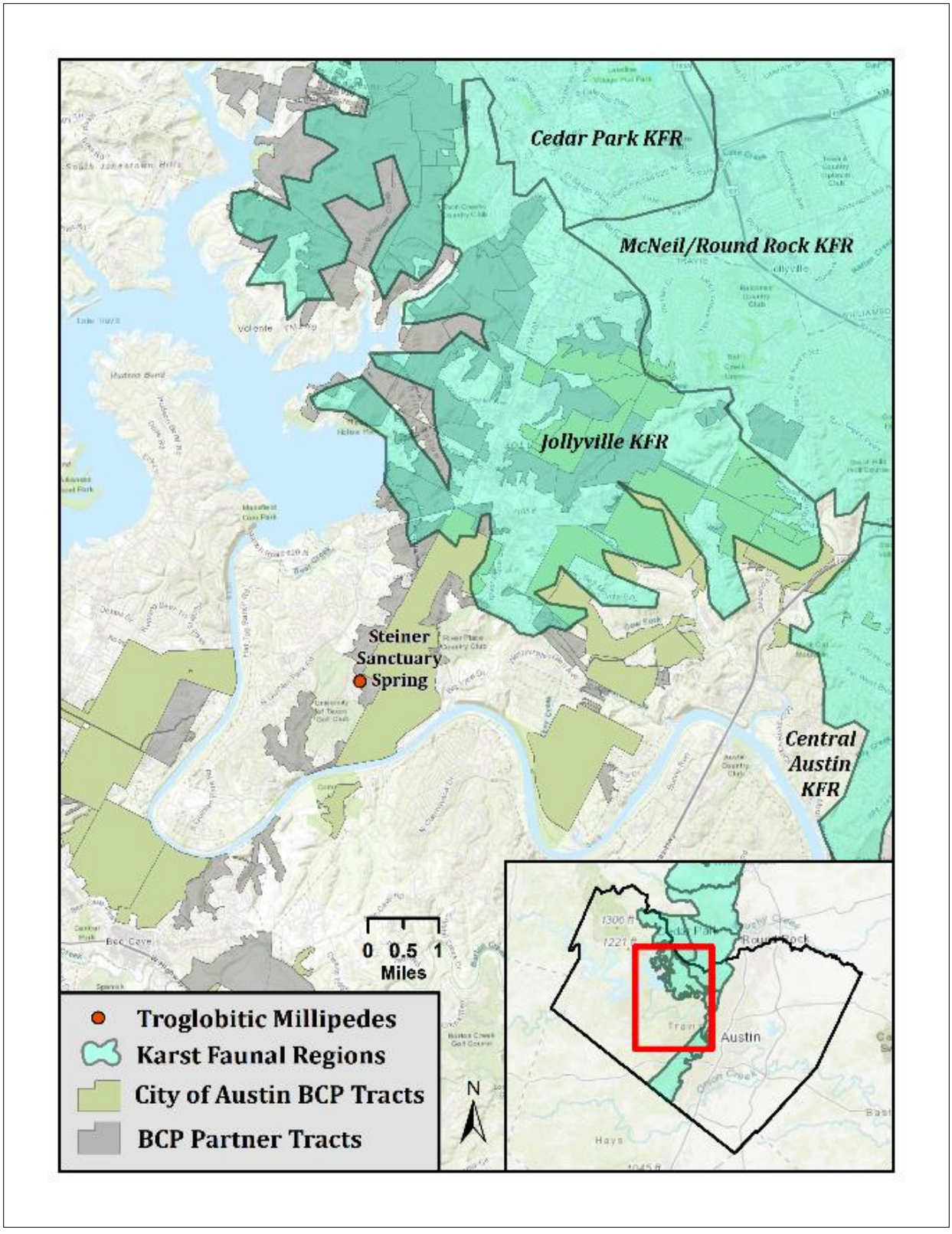

Figure 15. White, eyeless millipedes were collected from a spring on the Travis County Steiner Sanctuary tract outside of USFWS Karst Faunal Regions. Map by Colin Strickland.

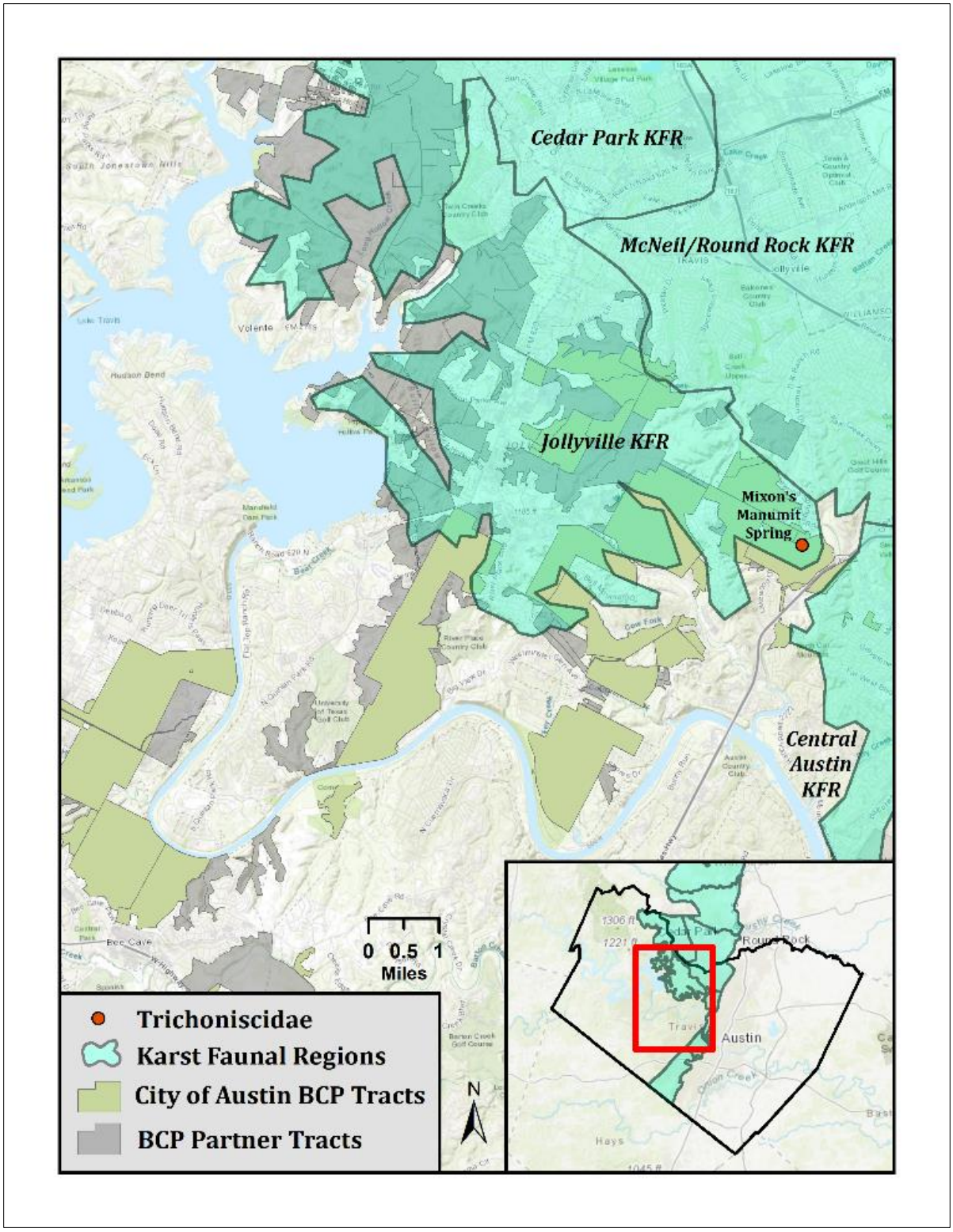

Figure 16. Troglobitic isopods were collected from drift nets in Mixon's Manumit, a spring on the Forest Ridge/Bull Creek Park tract. Map by Colin Strickland.

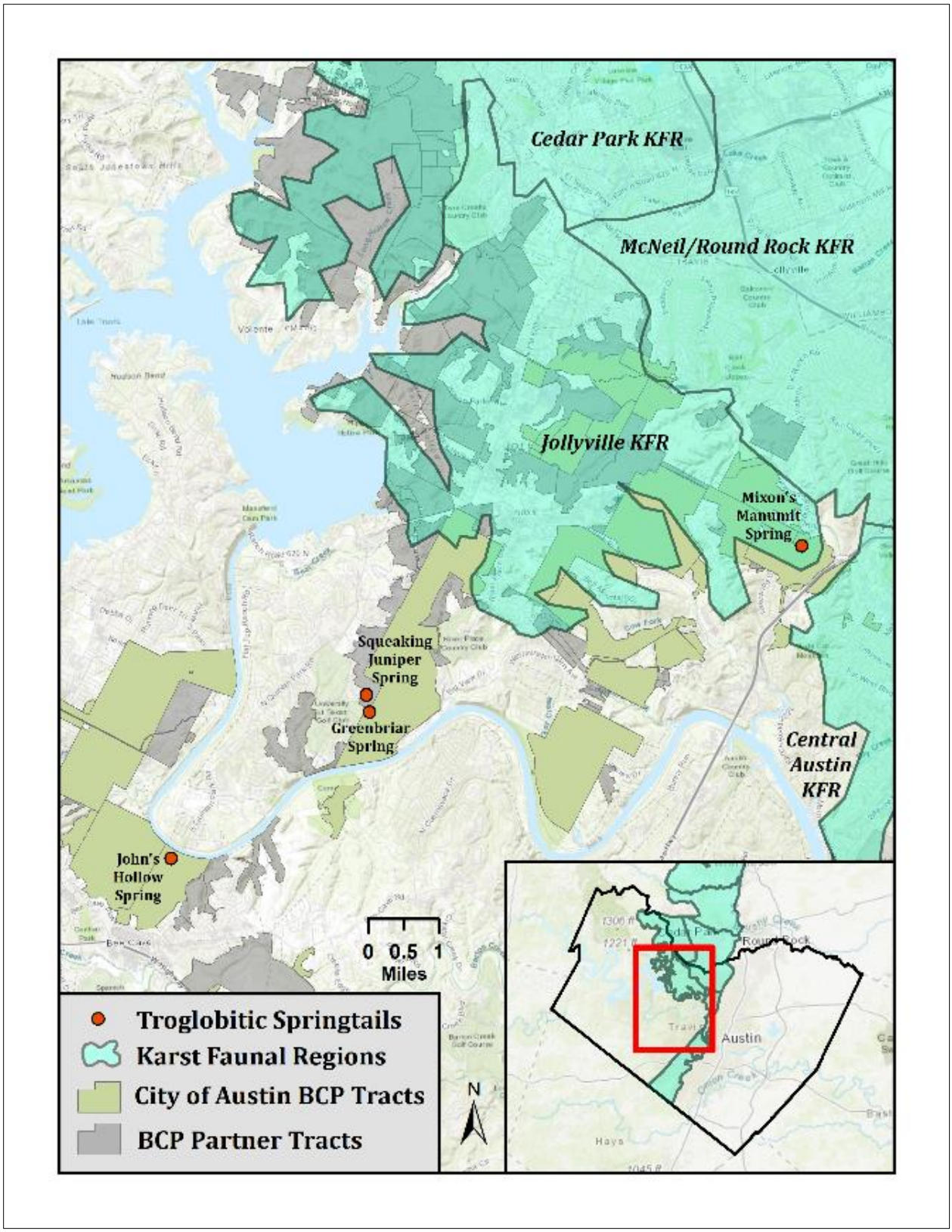

Figure 17. Eyeless springtails were collected at springs outside of USFWS Karst Faunal Regions. Map by Colin Strickland.

Testudo Tube cave

On the 21 Jan 2021 survey, 16 Jollyville Plateau salamanders were observed, 11 of which were captured and photographed. One individual had only one eye, and is pictured in Figure 18. Large amounts of calcite rafts on pools obscured salamander sighting. After the first pool, multiple pools were observed to be dry that had been observed to be wet in the previous four survey years. Approximately 20 white, eyeless planaria and approximately 20 *Stygobromus* sp. were also observed.

On the 13 August 2021 survey, 11 salamanders were observed, 9 of which were captured and photographed. Six of these salamanders were observed in the first pool, with no salamanders found again until the last pool. The pools that were observed to be dry in the January survey were observed to be wet in the August survey. One salamander was observed to be emaciated as compared to others captured (Figure 19, right). One salamander was gravid (Figure 20). Troglobites were observed but not the focus of this survey. Biologists observed approximately 20 white, eyeless planaria and approximately 30 *Stygobromus* sp.. Additional individual salamanders observed from both survey dates are depicted in Figure 21. A summary of water chemistry data collected on these two survey dates is in Appendix B.

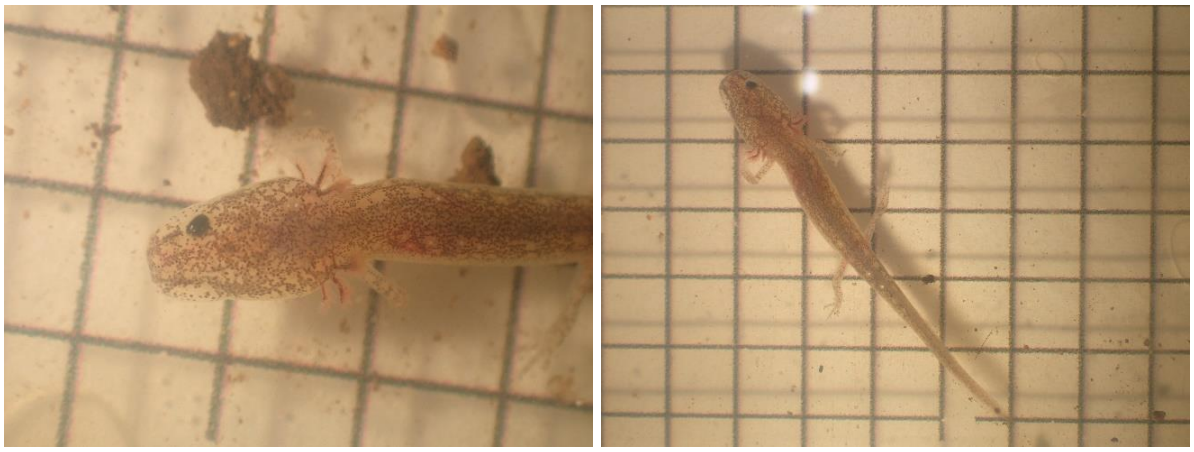

Figure 18. A salamander with one eye observed in Testudo Tube cave on 21 Jan 2021. Photos by Colin Strickland.



Figure 19. One salamander (photo right) appeared emaciated as compared to others captured on the 13 Aug 2021 survey. Photos by Colin Strickland.

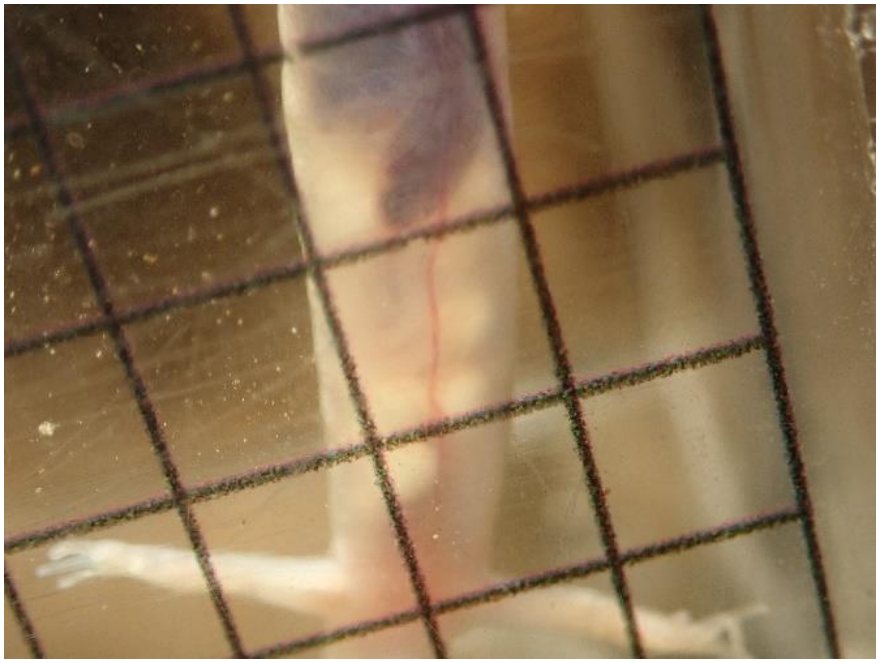

Figure 20. Gravid Jollyville Plateau salamander observed in the 13 August 2021 survey of Testudo Tube Cave. Photo by Colin Strickland.



Figure 21. Jollyville Plateau salamanders observed in situ on the 21 Jan 2021 survey (photo left) and the 13 Aug 2021 survey (photo right). Photos by Colin Strickland.

Discussion

Twenty-eight spring locations were documented on the Balcones Canyonlands Preserve in FY2021 (Figure 3). This brings the total number of documented springs on city of Austin BCP tracts to approximately 369 since FY 2017.

Research goals were met with the expanded assessment of aquatic target species. Invertebrates were sampled at 7 springs, and additional taxonomic data from specimens collected from previous fiscal years was obtained in FY 2021. All species reported are new occurrence records. *Caecidotea reddelli* is a species of concern protected by the Balcones Canyonlands Conservation Plan (BCP 2007a). *Stygobromus russelli* is identified as an additional species of concern by the BCCP and a species status of vulnerable (BCP 2007a, Hutchins 2017). *Stygobromus balconis*, is a Texas state species of greatest conservation need with a conservation status of imperiled (TPWD 2020, Hutchins 2017). The BCCP identifies *Stygobromus bifurcatus* as an additional species of concern and it has a conservation status of vulnerable (BCP 2007a, Hutchins 2017). The individuals identified to the *Stygobromus tenuis* group were juveniles and too small to distinguish to species. This group includes *S. balconis*, *S. bifurfactus*, and *S. russelli*. *Phreatodrobia nugax* has a conservation status of vulnerable (Hutchins 2017).

The majority of isopods collected were *Caecidotea reddelli*, with only two locations for *Lirceolus hardeni*. This may be the result of sampling bias as *C. reddelli* is larger than *L. hardeni* and may thus be easier to visually locate.

Sphalloplana mohri is a BCCP species of concern with a conservation status of vulnerable (BCP 2007a, Hutchins 2017). White, eyeless flatworms have been collected from Steiner Sanctuary spring and observed in Testudo Tube cave. White, eyeless flatworms are assumed to be *Sphalloplana mohri*, being that it is the only stygobitic flatworm species described in Texas, with the exception of *Dendrocoelopsis americana* reported from Rockwell County (B. Hutchins pers. comm.); however, there is not currently a taxonomic expert available to confirm the identities of these collections.

Numerous other non-stygobitic species of interest were collected at springs. The sucking millipede (order Siphonophorida) collected from a drift net in Steiner Sanctuary spring is a terrestrial species occasionally observed in caves of the north Austin, Texas area (M. Sanders pers. comm.). In addition, multiple troglobitic specimens were collected in springs, including trichoniscids and white, eyeless millipedes and springtails. The BCCP lists the Speodesmus N. S. as a species of concern; however, preliminary identification indicates that the millipedes collected appear to be of the *Cambala* genus (C. Strickland pers. comm. 2021). In addition, the BCCP lists Trichoniscinae N. S. as a species of concern. We await further taxonomic scrutiny of these troglobitic species collected by species experts.

Spring Management Activities Planned for FY2022

Biologists will continue to search COA BCP for undocumented spring locations and continue to refine methods of spring characterization. Sites will be prioritized for further characterization. Biologists will revisit a portion of previously documented locations to observe known springs and potentially find more springs under varying seasonal conditions. The collection of samples at some springs for water quality analysis is anticipated as are additional measures of water quantity. Faunal survey may include an expansion of methods for more representative sampling (e.g. identify microscopic fauna) and developing methods for trapping on existing wells.

The on-going management activities for FY2021 are in accordance with the Balcones Canyonland Conservation Plan spring management obligations and research goals that contribute to the knowledge, recovery, and protection of BCP species; however, much of the BCP awaits survey for springs and groundwater fauna.

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(BCP 2007d) Tier II A, Chapter X Animal Management
(BCP 2007e) Tier II A, Chapter XI Water Quality Management
(BCP 2007f) Tier II C, Bull Creek Macrosite
(BCP 2007g) Tier III, City of Austin Cortana Tract, North Lake Austin Macrosite
(BCP 2007h) Tier III, City of Austin Lower Bull Creek, Bull Creek Macrosite
(BCP 2007i) Tier III, City of Austin Cowfork/Coldwater Tracts (Park West, Long Canyon, Coldwater) North Lake Austin, Macrosite
(BCP 2007j) Tier III, City of Austin South Lake Austin Tracts (Reicher Ranch, Double J&T, Bohls) South Lake Austin Macrosite

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Appendix A. Faunal Table

Summary of invertebrates collected at springs on the Balcones Canyonlands Preserve for FY 2017 through FY 2021.

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Surprise Amphipool	Jester	11-Sep-18	*Stygobromus bifurcatus*	C. Strickland	2-Dec-19	Free living at orifice (no trap)
Springs of Promise	Kent Butler	1-Oct-18	*Caecidotea reddelli*	T. Jackson	2-Dec-19	Free living at orifice (no trap)
Springs of Promise	Kent Butler	1-Oct-18	*Leuctridae* stet.	T. Jackson	2-Dec-19	Free living at orifice (no trap)
Robin's Secret	Kent Butler	11-Jun-19	*Caecidotea reddelli*	T. Jackson	2-Dec-19	Cotton mop material
Robin's Secret	Kent Butler	11-Jun-19	*Stygobromus bifurcatus*	R. Gibson	2-Dec-19	Cotton mop material
Robin's Secret	Kent Butler	11-Jun-19	*Suragina* stet.	T. Jackson	2-Dec-19	Cotton mop material
Robin's Secret	Kent Butler	11-Jun-19	Stenelmis stet.	T. Jackson	2-Dec-19	Cotton mop material
Sanders Sow	Kent Butler	12-Jun-19	*Stygobromus bifurcatus*	R. Gibson	2-Dec-19	Cotton mop material
Sanders Sow	Kent Butler	12-Jun-19	Ostracoda stet.	T. Jackson	2-Dec-19	Cotton mop material
Sanders Sow	Kent Butler	12-Jun-19	*Chimarra* stet.	T. Jackson	2-Dec-19	Cotton mop material
Sanders Sow	Kent Butler	12-Jun-19	*Tipula* stet.	T. Jackson	2-Dec-19	Cotton mop material
Sanders Sow	Kent Butler	12-Jun-19	Chironomidae stet.	T. Jackson	2-Dec-19	Cotton mop material
Frog Spring	Vaught Ranch	13-Aug-19	*Stenelmis* stet.	T. Jackson	2-Dec-19	Free living at orifice (no trap)
Frog Spring	Vaught Ranch	13-Aug-19	*Marilia* stet.	T. Jackson	2-Dec-19	Free living at orifice (no trap)
Frog Spring	Vaught Ranch	13-Aug-19	*Dugesia* stet.	T. Jackson	2-Dec-19	Free living at orifice (no trap)
Avian Assembly Right	Cortana	14-Jan-20	Invertebrate eggs	B. Hutchins	11-Mar-20	Free living at orifice (no trap)

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Avian Assembly Right	Cortana	14-Jan-20	*Hyalella* stet.	C. Strickland	13-Oct-20	Free living at orifice (no trap)
Greenbriar	Cortana	10-Feb-20	*Caecidotea reddelli*	C. Strickland	25-Feb-20	Drift net: 150 micron
Greenbriar	Cortana	10-Feb-20	*Phreatodrobia nugax*	B. Hutchins	25-Feb-20	Drift net: 150 micron
Greenbriar	Cortana	10-Feb-20	*Hawaiia minuscula*	B. Hutchins	11-Mar-20	Drift net: 150 micron
Squeaking Juniper	Cortana	13-Feb-20	*Stygobromus russelli*	R. Gibson	30-Sep-21	Cotton mop material
Squeaking Juniper	Cortana	13-Feb-20	*Caecidotea reddelli*	C. Strickland	25-Feb-20	Cotton mop material
Greenbriar	Cortana	18-Feb-20	*Lirceolus hardeni*	W. Coleman	18-Oct-21	Drift net: 150 micron
Greenbriar	Cortana	18-Feb-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
Greenbriar	Cortana	18-Feb-20	*Stygobromus russelli*	R. Gibson	12-Nov-20	Drift net: 150 micron
Greenbriar	Cortana	18-Feb-20	*Hyalella azteca*	R. Gibson	12-Nov-20	Drift net: 150 micron
Greenbriar	Cortana	18-Feb-20	Acariformes stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Squeaking Juniper	Cortana	18-Feb-20	*Stygobromus* sp. juv.	R. Gibson	30-Sep-21	Drift net: 250 micron
Squeaking Juniper	Cortana	18-Feb-20	*Caecidotea reddelli**	C. Strickland	25-Feb-20	Drift net: 250 micron
Squeaking Juniper	Cortana	18-Feb-20	*Phreatodrobia nugax*	B. Hutchins	25-Feb-20	Drift net: 250 micron
Squeaking Juniper	Cortana	18-Feb-20	*Euglandina* sp.	B. Hutchins	11-Mar-20	Drift net: 250 micron
Squeaking Juniper	Cortana	18-Feb-20	Philapotamidae stet.	C. Strickland	25-Feb-20	Drift net: 250 micron

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Steiner Sanctuary	Cortana	18-Feb-20	*Stygobromus* sp. juv.	R. Gibson	30-Sep-21	Drift net: 250 micron
Steiner Sanctuary	Cortana	18-Feb-20	*Phreatodrobia nugax*	B. Hutchins	25-Feb-20	Drift net: 250 micron
Steiner Sanctuary	Cortana	18-Feb-20	*Caecidotea reddelli*	C. Strickland	25-Feb-20	Drift net: 250 micron
Steiner Sanctuary	Cortana	18-Feb-20	*Collembola* stet.	C. Strickland	25-Feb-20	Drift net: 250 micron
Steiner Sanctuary	Cortana	18-Feb-20	Diplopoda stet.	C. Strickland	13-Oct-20	Drift net: 250 micron
Steiner Sanctuary	Cortana	18-Feb-20	Diptera stet.	C. Strickland	13-Oct-20	Drift net: 250 micron
Greenbriar	Cortana	24-Feb-20	Hemiptera stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Greenbriar	Cortana	24-Feb-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
Greenbriar	Cortana	24-Feb-20	Entomobryibae stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Greenbriar	Cortana	24-Feb-20	*Gastrocopta* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
Greenbriar	Cortana	24-Feb-20	Tricladida stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Squeaking Juniper	Cortana	24-Feb-20	*Stygobromus russelli*	R. Gibson	12-Nov-20	Drift net: 250 micron
Squeaking Juniper	Cortana	24-Feb-20	Trichoptera stet.	C. Strickland	29-Sep-20	Drift net: 250 micron
Steiner Sanctuary	Cortana	24-Feb-20	Siphonophoridae stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	24-Feb-20	Diplopoda stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	24-Feb-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Steiner Sanctuary	Cortana	24-Feb-20	*Stygobromus tenuis* group*	R. Gibson	12-Nov-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	24-Feb-20	Hemiptera stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	24-Feb-20	Diptera stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	24-Feb-20	Odonata stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Greenbriar	Cortana	2-Mar-20	*Stygobromus russelli*	R. Gibson	12-Nov-20	Drift net: 150 micron
Greenbriar	Cortana	2-Mar-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
Greenbriar	Cortana	2-Mar-20	unknown	C. Strickland	29-Sep-20	Drift net: 150 micron
Greenbriar	Cortana	2-Mar-20	Trichoptera stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Greenbriar	Cortana	2-Mar-20	Planaria stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Squeaking Juniper	Cortana	2-Mar-20	*Stygobromus russelli*	R. Gibson	12-Nov-20	PVC pipe trap with 250 micron net
Squeaking Juniper	Cortana	2-Mar-20	Trichoptera stet.	C. Strickland	29-Sep-20	PVC pipe trap with 250 micron net
Steiner Sanctuary	Cortana	2-Mar-20	Diplopoda stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	2-Mar-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
Steiner Sanctuary	Cortana	2-Mar-20	*Stygobromus tenuis* group	R. Gibson	12-Nov-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	2-Mar-20	Acariformes stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	2-Mar-20	Planaria stet.	C. Strickland	29-Sep-20	Drift net: 150 micron

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Steiner Sanctuary	Cortana	2-Mar-20	Dytiscidae stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	2-Mar-20	Diptera stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	2-Mar-20	Planaria stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Greenbriar	Cortana	5-Mar-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
Greenbriar	Cortana	5-Mar-20	*Stygobromus russelli*	R. Gibson	12-Nov-20	Drift net: 150 micron
Greenbriar	Cortana	5-Mar-20	Entomobryibae stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Greenbriar	Cortana	5-Mar-20	Trichoptera stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Greenbriar	Cortana	5-Mar-20	Dytiscidae stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Injured Spring	JJ&T	5-Mar-20	*Stygobromus balconis*	R. Gibson	12-Nov-20	Drift net: 150 micron
Injured Spring	JJ&T	5-Mar-20	Stratiomyidae stet.	T. Jackson	29-Sep-20	Drift net: 150 micron
Injured Spring	JJ&T	5-Mar-20	Odonata stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Squeaking Juniper	Cortana	5-Mar-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	PVC pipe with 250 micron net
Squeaking Juniper	Cortana	5-Mar-20	*Stygobromus tenuis* group*	R. Gibson	12-Nov-20	PVC pipe with 250 micron net
Squeaking Juniper	Cortana	5-Mar-20	Entomobryibae stet.	C. Strickland	13-Oct-20	PVC pipe with 250 micron net
Squeaking Juniper	Cortana	5-Mar-20	Symphypleona stet.	C. Strickland	13-Oct-20	PVC pipe with 250 micron net

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Squeaking Juniper	Cortana	5-Mar-20	Diplopoda stet.	C. Strickland	13-Oct-20	PVC pipe with 250 micron net
Steiner Sanctuary	Cortana	5-Mar-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
Steiner Sanctuary	Cortana	5-Mar-20	*Stygobromus tenuis* group	R. Gibson	12-Nov-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	5-Mar-20	Diplopoda stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	5-Mar-20	Diptera stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Steiner Sanctuary	Cortana	5-Mar-20	Hemiptera stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Shutdown Stygos	Bohls	27-Mar-20	*Stygobromus russelli*	R. Gibson	12-Nov-20	Free-living at orifice (no trap)
Shutdown Stygos	Bohls	27-Mar-20	Gastropoda indet.	K. Perez	22-Oct-20	Free-living at orifice (no trap)
Chips duet	Bohls	31-Mar-20	*Stygobromus balconis*	R. Gibson	12-Nov-20	Free-living at orifice (no trap)
Giant Isopod	Bohls	31-Mar-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Free-living at orifice (no trap)
Giant Isopod	Bohls	31-Mar-20	*Stygobromus* stet.	C. Strickland	28-Sep-20	Free-living at orifice (no trap)
Giant Isopod	Bohls	31-Mar-20	Tricladida stet.	C. Strickland	28-Sep-20	Free-living at orifice (no trap)
Giant Isopod	Bohls	31-Mar-20	Entomobryomorpha stet.	C. Strickland	28-Sep-20	Free-living at orifice (no trap)
Source of Giants	Bohls	6-Apr-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Free-living at orifice (no trap)
Source of Giants	Bohls	6-Apr-20	*Stygobromus russelli*	R. Gibson	12-Nov-20	Free-living at orifice (no trap)

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
John's Hollow	Bohls	13-May-20	*Stygobromus balconis*	R. Gibson	12-Nov-20	Drift net: 150 micron
John's Hollow	Bohls	13-May-20	*Lirceolus hardeni*	W. Coleman	18-Oct-21	Drift net: 150 micron
John's Hollow	Bohls	13-May-20	*Gastrocopta sp.*	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	13-May-20	Dytiscidae stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	13-May-20	Coleoptera stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	*Stygobromus balconis*	R. Gibson	12-Nov-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	*Lucidella* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	*Glyphyalinia* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	*Gastrocopta* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	*Fossaria* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	Entomobryibae stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	Dytiscidae stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	Trichoptera stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	Entomobryomorpha stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	19-May-20	Odonata stet.	C. Strickland	29-Sep-20	Drift net: 150 micron

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
John's Hollow	Bohls	19-May-20	Trichoptera stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
Tunnel	Bohls	19-May-20	*Physa* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
Tunnel	Bohls	19-May-20	Trichoptera stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
Tunnel	Bohls	19-May-20	Tabanidae stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
Tunnel	Bohls	19-May-20	Polycentropodidae stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Stygobromus balconis*	R. Gibson	12-Nov-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Gastrocopta* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Physa* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Glyphyalinia* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Helicodiscus* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Lucidella* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	*Phreatodrobia nugax*	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	Trichoptera stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	Trichoptera stet.	C. Strickland	29-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	26-May-20	Entomobryomorpha stet.	C. Strickland	29-Sep-20	Drift net: 150 micron

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Tunnel	Bohls	26-May-20	Tricladida stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Tunnel	Bohls	26-May-20	Culcidae stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
Tunnel	Bohls	26-May-20	Diptera stet.	C. Strickland	13-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	*Caecidotea reddelli*	W. Coleman	18-Oct-21	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	*Lirceolus hardeni*	W. Coleman	18-Oct-21	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	*Stygobromus balconis*	R. Gibson	12-Nov-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	*Glyphyalinia* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	*Helicodiscus* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	*Phreatodrobia nugax*	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	*Physa* sp.	K. Perez	22-Oct-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	Philopotamidae stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	Coleoptera stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	Reduviidae stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	Dytiscidae stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
John's Hollow	Bohls	4-Jun-20	Curculionoidea stet.	C. Strickland	28-Sep-20	Drift net: 150 micron
Only 1 Pig	JJ&T	21-Jul-20	*Strobilops* sp.	K. Perez	22-Oct-20	Drift net: 250 micron

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Only 1 Pig	JJ&T	21-Jul-20	*Carychium* sp.	K. Perez	22-Oct-20	Drift net: 250 micron
Only 1 Pig	JJ&T	21-Jul-20	*Gastrocopta* spp.	K. Perez	22-Oct-20	Drift net: 250 micron
Only 1 Pig	JJ&T	21-Jul-20	*Hawaiia minuscula*	K. Perez	22-Oct-20	Drift net: 250 micron
Amphipod Trickle	Reicher Ranch	23-Jan-21	*Stygobromus balconis*	R. Gibson	10/19/2021	Free-living at orifice (no trap)
Box Spring	Ulrich	9-Mar-21	*Caecidotea reddelli*	B. Hutchins	11/15/2021	Free-living at orifice (no trap)
Gate Spring	Ulrich	9-Mar-21	*Stygobromus balconis*	R. Gibson	10/19/2021	Free-living at orifice (no trap)
Sander's Sow	Kent Butler	3-May-21	Gastropoda stet.	C. Strickland	9/24/2021	Cotton mop material
Sander's Sow	Kent Butler	3-May-21	Hemiptera stet.	C. Strickland	9/24/2021	Cotton mop material
Misnamed Spring	Kent Butler	6-May-21	*Stygobromus bifurcatus*	R. Gibson	10/19/2021	Drift net: 200 micron
Misnamed Spring	Kent Butler	6-May-21	Gastropoda stet.	C. Strickland	9/23/2021	Drift net: 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	25-May-21	*Stygobromus bifurcatus**	C. Strickland	9/24/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	25-May-21	Gastropoda stet.	C. Strickland	9/24/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	25-May-21	Chironomidae stet.	C. Strickland	9/24/2021	Two drift nets: 150 & 200 micron
Watering Pool	Vireo Research Area	26-May-21	*Stygobromus russelli*	R. Gibson	10/19/2021	Free-living at orifice (no trap)
Watering Pool	Vireo Research Area	26-May-21	Gastropoda stet.	C. Strickland	9/23/2021	Free-living at orifice (no trap)

Spring Locality	BCP Tract	Date of Collection	Identification	ID By	ID Date	Collection Method
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	*Stygobromus balconis*	R. Gibson	10/19/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Gastropoda stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Gastropoda stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Gastropoda stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Gastropoda stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Trichoniscidae stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Collembola stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Chironomidae stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Trichoptera stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron
Mixon's Manumit	Forest Ridge/Bull Creek Park	1-Jun-21	Collembola stet.	C. Strickland	9/23/2021	Two drift nets: 150 & 200 micron

Appendix B. Water Chemistry Data

Water chemistry data collected in Testudo Tube Cave for FY 2021.

Parameter	21 Jan 2021	13 Aug 2021
Temp (°C)	20.30	20.40
Spc (µS/cm)	722.8	685.4
pH	7.05	6.94
DO (mg/L)	7.42	6.71