Travis County FY2017
Jollyville Plateau Salamander (*Eurycea tonkawae*)
Monitoring Report



Photo: Jollyville Plateau salamander by Piers Hendrie

Travis County
Department of Transportation and Natural Resources
Natural Resources and Environmental Quality Division

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Background

On May 2, 1996, the City of Austin and Travis County were jointly issued a U.S. Fish and Wildlife Service (USFWS) regional permit referred to as the Balcones Canyonlands Conservation Plan (BCCP). This permit allows “incidental take” of eight locally occurring endangered species in compliance with Section 10(a)1(b) of the Endangered Species Act (U. S. Fish and Wildlife Service 1996a). The thirty-year permit covers approximately 561,000 acres in western Travis County, Texas identified in the Habitat Conservation Plan (HCP) and Final Environmental Impact Statement (U. S. Fish and Wildlife Service 1996b). The permit also covers incidental take of 27 species of concern should any become listed as threatened or endangered during the life of the permit.

The Jollyville Plateau salamander (JPS) (*Eurycea tonkawae*) occurs within the Balcones Canyonlands Preserve (BCP) and the overall management of Travis County preserve lands benefits the conservation of this species. Although the BCCP 10(a) permit does not cover “take” of this species or require mitigation, the BCCP partners have pledged to protect the species wherever it is located within the BCP.

On September 19, 2013, the U.S. Fish and Wildlife Service listed JPS as threatened (U. S. Fish and Wildlife Service 2012 and 2013) under the Endangered Species Act and designated thirty-two units of critical habitat (totaling 4,331 acres) in portions of Travis and Williamson Counties (Figure 1). The most significant threat is degradation of aquatic habitats, primarily in the form of reduced water quality and alteration of natural flow regimes due to extremely rapid human population growth and urbanization within this small range (USFWS 2013). About half of the total stream catchment area for JPS range has been developed and studies show urbanization has a strong negative effect on density and relative abundance of JPS throughout its range (Bendik et al. 2014)

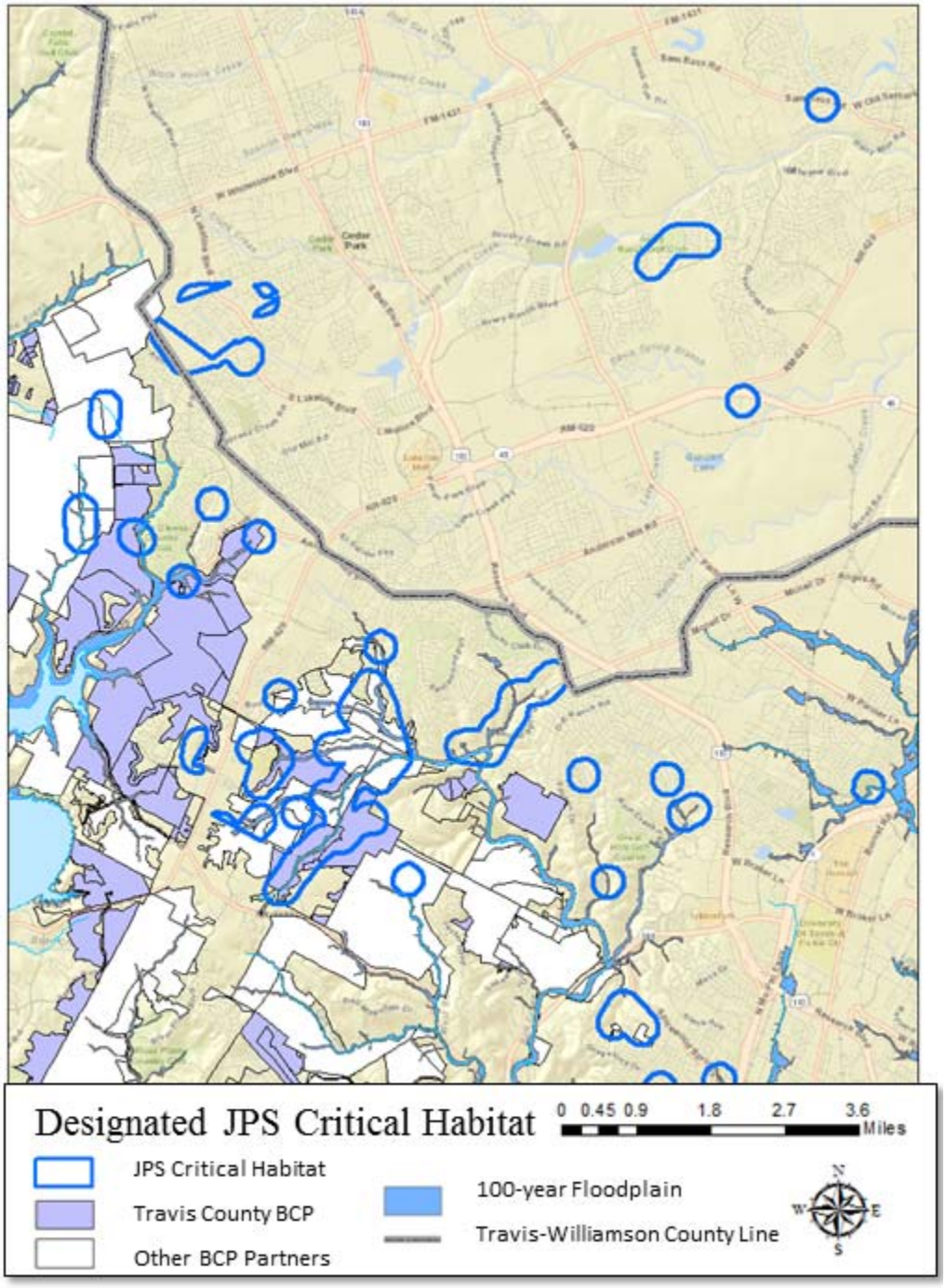

Figure 1. Critical Habitat Units designated for the Jollyville Plateau salamander in northwestern Travis and southern Williamson Counties. Surface critical habitat includes the spring outlet up to the high water line and 164-feet (50 m) downstream. Subsurface critical habitat includes a 984-foot (300 m) radius surrounding each spring.

Life History of JPS

The Jollyville Plateau Salamander is an aquatic, neotenic salamander that is endemic to the highly urbanized area of northwestern Travis and southern Williamson counties. As a perennibrachiate, these salamanders are restricted to karst-associated habitats such as surface springs, corresponding streams, and subsurface groundwater habitats. It is a member of the Plethodontidae, a large family in the order Caudata that is characterized by the absence of lungs.

JPS found in surface springs and streams have well developed eyes, a wide head, and dark greenish-brown body. Some cave-dwelling JPS exhibit reduced eyes, a flattened head, and loss of color (Chippendale *et al.* 2000). This study suggests a possibility of two lineages with a taxonomic split corresponding to major geologic and topographic features. The "plateau" clade occupies Bull, Walnut, Shoal, Brushy, South Brushy, and southeast Lake Travis watersheds. The "peripheral" clade is found in the Buttercup and northern Lake Travis watersheds. Further genetic research is currently being done to verify or deny this suggested speciation.

The eggs of JPS are rarely found on the surface, so it is possible that they are deposited underground (O'Donnell *et al.* 2005). The skin on the ventral side of the body is translucent so that eggs are visible in gravid female individuals which are often found on the surface.

It appears from the presence of juveniles on the surface in all seasons that they reproduce year round (Bendik 2011a, Hillis et al 2001). However, juvenile abundance often increases in the spring and summer suggesting higher reproduction in the winter and early spring (Bowles *et al*. 2006). At hatching, JPS are about 15 mm total length and reach reproductive maturity around 45-70 mm total length within six months to a year.

Their diet consists of small invertebrates, including fly larvae, amphipods, ostracods, copepods, water mites, snails, aquatic beetles, and damselfly, caddisfly, mayfly, and stonefly larvae. (COA 2001, Bendik 2011b, USFWS *in press*). If flatworms are present in JPS habitat, they may be part of the diet as flatworms are a primary food source of the Barton Springs salamander (Gillespie 2013). Their underground diet is likely more restricted to stygobitic invertebrates such as amphipods and isopods.

Predators of JPS may include centrarchid fish (sunfish and bass), crayfish, and large insects such as dragonfly nymphs and giant waterbugs (Bowles *et al.* 2006, Cole 1995). Adult cannibalism on juveniles has also been observed in the field and in captivity but is not thought to be a significant source of predation (personal observation).

Surface habitat of JPS consists of spring outlets, associated stream reaches, and in small hillside seeps. They can generally be found in the interstitial spaces underneath or between rocks, in vegetation or in leaf litter where they are hidden from predators. Like other Central Texas Eurycea, JPS also inhabit underground refugia including, subterranean streams and wet caves. Northwestern Travis and southern Williamson Counties encompass the nine watersheds containing known JPS localities: Brushy, Bull, Buttercup, Lake Creek, Lake Travis, Shoal, South Brushy, Walnut, and West Bull (Figure 2).

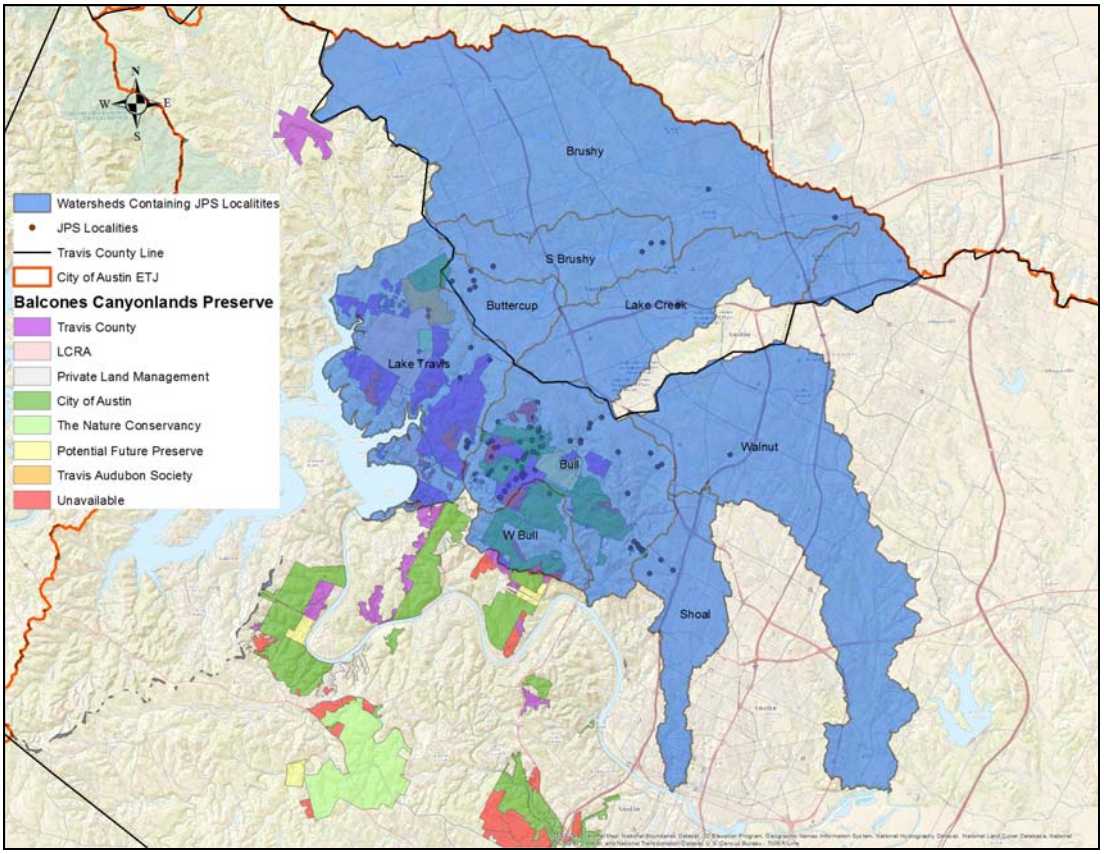

Figure 2. Nine watersheds containing JPS localities in Williamson and Travis Counties, Texas. Lake Travis Watershed is shown as subdivided to a smaller catchment area that incorporates all known JPS localities.

The narrow distribution of JPS has been explained by certain habitat requirements such as reliability of flow, minimal substrate siltation and calcium carbonate deposition, and availability of subsurface refugia (Dowling 1956, Rudolph 1978, Sweet 1982, Chippendale *et al.* 1993, Tumilson and Cline 1997, Bendik *et al.* 2016). Another requirement for survival and reproduction is well oxygenated groundwater with a narrow temperature range (Davis *et al.* 2001, Bowles *et al.* 2006, Bendik *et al.* 2016). Groundwater at JPS sites flow from the Northern Segment of the Edwards Aquifer and the Trinity Aquifer to local alluvial springs (Cole 1995). Groundwater in the Jollyville Plateau was characterized using water level monitoring, groundwater tracing, water chemistry and tritium dating. Results imply that the Jollyville Plateau Edwards Aquifer contains vadose zone conduits that transmit recharge water to springs and creeks with limited connection to the water table (Johns 2013).

In Travis County, most known JPS localities are found within the Bull Creek and Cypress Creek catchments. In 2016, a working group comprised of biologists from the City of Austin, Travis County and TPWD decided more attention needed to be focused on broadening the spatial understanding of distribution compared to long-term monitoring at specific, spring-based, localities. This decision came after several manuscripts were recently published on specific populations of JPS (Bendik et al. 2013a, Bendik *et al.* 2013b, Bendik *et al.* 2014, Gabor *et al.* 2016, Bendik 2017) and one (Bendik *et al.* 2016) showed occupancy and movement of JPS in the Bull Creek drainage differed from previous assumptions. For this reason, monitoring efforts will now focus on creek and tributary segments in terms of occupancy, specifically in the Cypress Creek and Long Hollow Creek drainages. The working group did continue to monitor three specific populations, Upper Ribelin, Lower Ribelin, and Testudo Tube, with capture-recapture methods. Continued monitoring of the first two sites is important for data associated with potential road construction nearby and the third remains important as a cave population where a capture-recapture study began in 2016.

Survey Methods

Occupancy surveys were conducted following protocol established in Bendik *et al.* 2016, except for the Concordia occupancy. Concordia occupancy was done, in part, as a student project where a greater density of sites was desired, therefore sites were spaced at 50 m rather than the usual 70 m or 140 m. One other noted difference in protocol was the random starting point of 0-100 m from a confluence in Bendik *et al*.

2016 but, in the case of Concordia, the random first site was chosen at a distance from the property boundary.

Capture-recapture surveys were conducted by exhaustively searching all cover objects on the surface of the stream (e.g., rock cover, leaf litter, and woody debris), capturing each salamander if possible, and counting each salamander not captured. Salamanders that were captured were then photographed on a grid so they could later be measured using Image J software and photo-matched following Bendik *et al.* 2014. Salamanders that were not captured were only counted if they traveled behind the observer and size (< 1 inch, 1-2 inches, ≥ 2 inches) was visually estimated. This was done as a drive survey, whereby observers would begin downstream removing cover objects to create an open "line" perpendicular to the bank that moved upstream until all cover objects were searched. To avoid double-counts, only salamanders that were chased (or captured and moved) downstream below the observer line were tallied. It was not possible to search the subsurface habitat for salamanders.

FY2017 Survey Sites and Results

The Travis County and City of Austin staff conducted occupancy surveys in two tributaries, one in the Bull Creek watershed and one in the Cypress Creek drainage during FY2017 (Figure 3). The survey of the Concordia tributary of Bull Creek yielded six spatially distinct sites, three of which were much further downstream than previously known sites (Figure 4). The survey of the Grandview Hills tributary of Cypress Creek yielded four new sites, all of which were much further downstream than previously known sites (Figure 5). A more in depth analysis of this data will be performed along with FY2018 data.

Travis County Natural Resources staff, along with staff from the City of Austin and Texas Parks and Wildlife Department, preformed capture-recapture surveys at three sites during FY2017: Lower Ribelin, Upper Ribelin, and Testudo Tube Cave. Table 1 lists the number of salamanders observed for these surveys. On average, 86 percent of the salamanders observed could be caught and photographed. These photos will be used to attempt to identify individuals between surveys and estimate population trends. The photos were taken on a grid for measuring and determining growth rates.

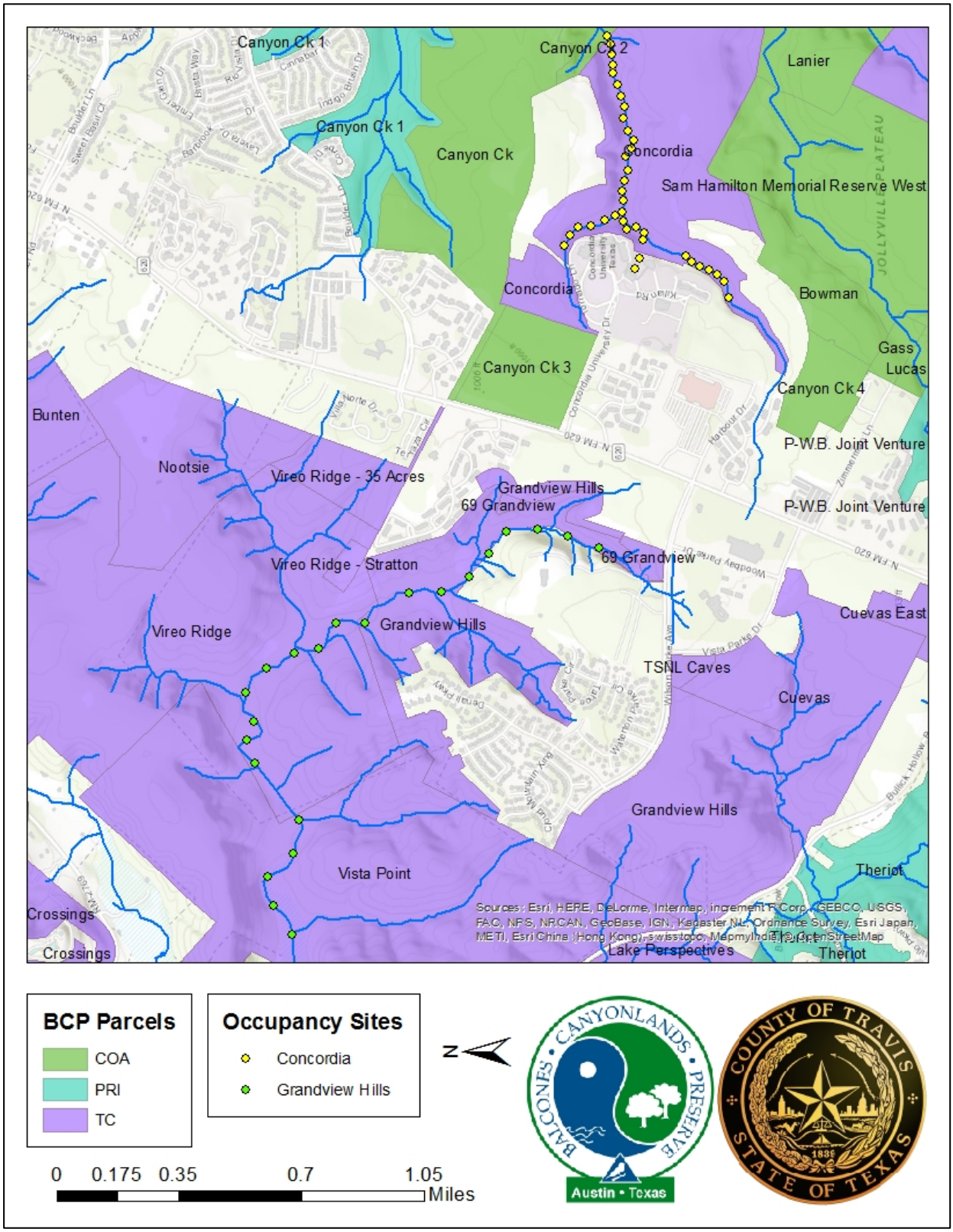

Figure 3. Two tributaries where occupancy surveys were conducted in FY2017. Concordia tributary contributes to the Bull Creek watershed while the Grandview Hills is a tributary to the Cypress Creek drainage within the Lake Travis watershed.

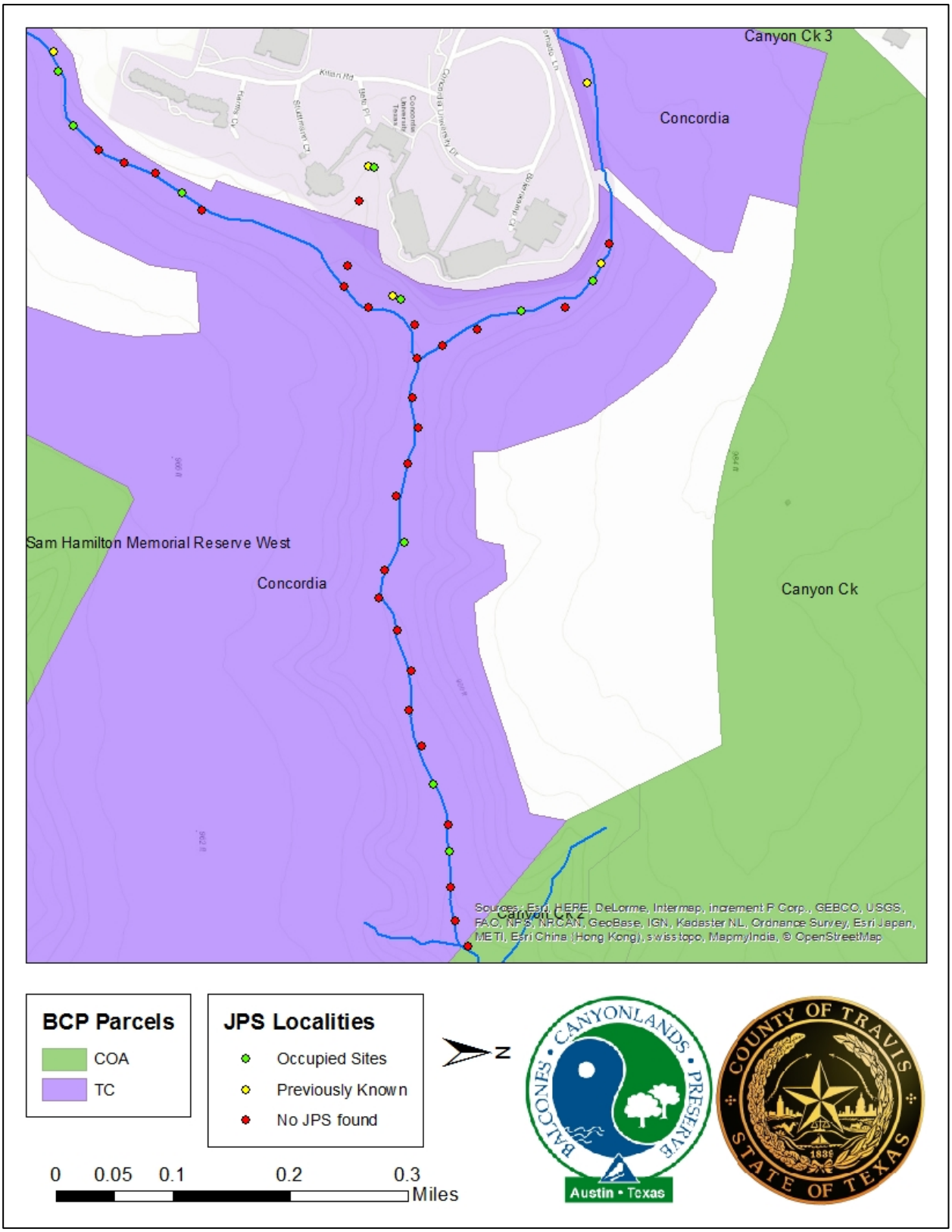

Figure 4. Concordia tributary occupancy survey also showing previously known localities.

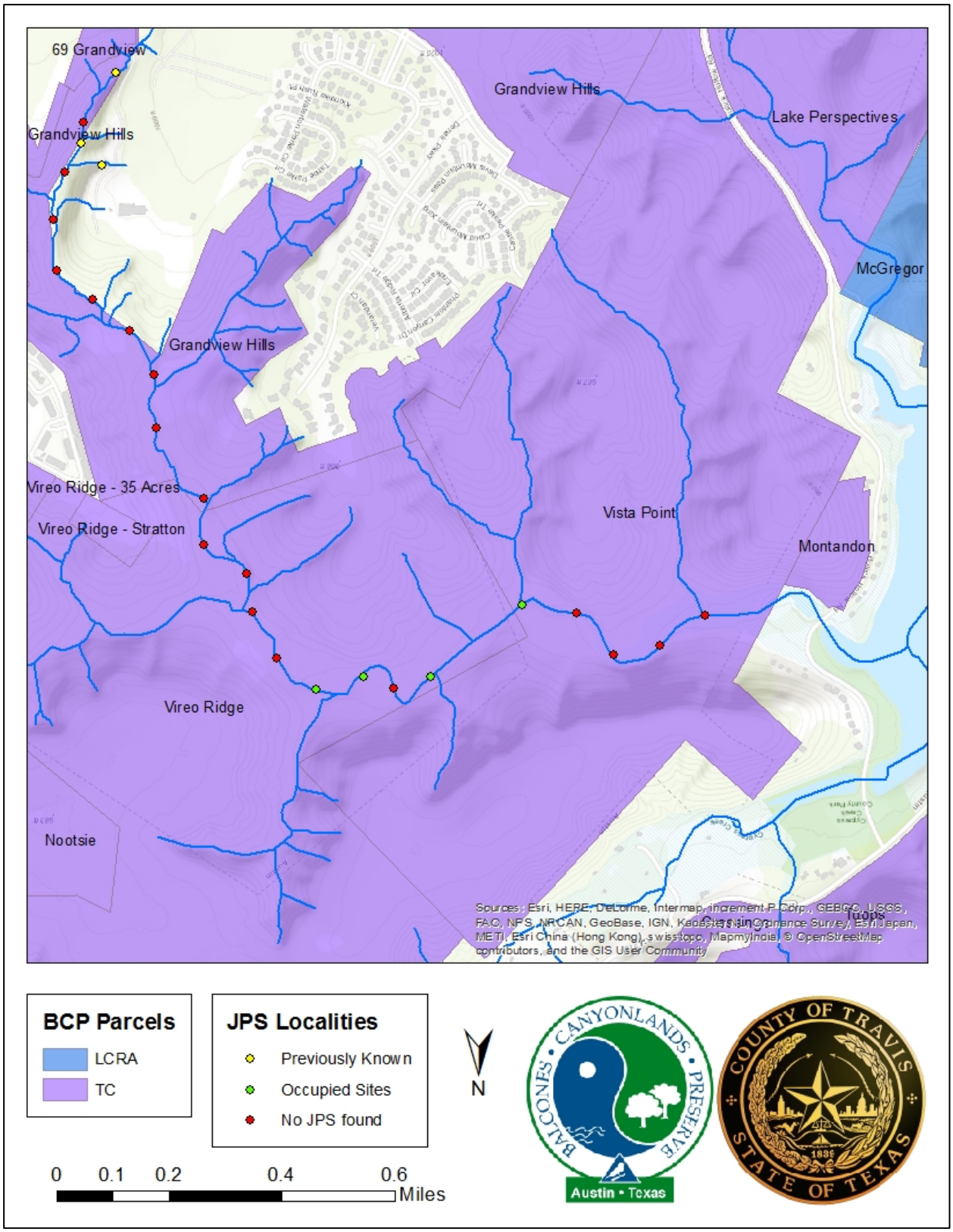

Figure 5. Grandview Hills tributary occupancy survey also showing previously known localities.

Table 1. Results of JPS surveys at three BCP sites in 2017.

Site	Date	# Salamanders
Testudo Tube	07/26/2017	12
Lower Ribelin	07/20/2017	153
Upper Ribelin	07/20/2017	113
Testudo Tube	09/07/2017	28

Water Quality

Travis County began routine water quality monitoring of basic parameters in January 2011 in cooperation with the Colorado River Watch Network administered by the Lower Colorado River Authority. As of 2016 and 2017, however, in collaboration with Travis County Environmental Quality and City of Austin Watershed Protection department, Travis County staff decided to add six BCP-related sites to the current COA Environmental Integrity Index (EII) and take over monitoring of some existing sites. This method will establish a long term monitoring scheme that will compare water quality characteristics, including biological and chemical components, to other sites, streams and watersheds with a numerical score. The new sites will also extend the EII program to the Lake Travis Watershed. The new sites have been established and 2018 data will be stored within Travis County and COA WPD databases. All methodology follows City of Austin (2002). References and Results for the other 118 sites can be found in Clamann *et al.* (2015).

Threats

Amphibians are sensitive indicators of environmental degradation (Barinaga 1990, Blaustein et al. 1994, Hartwell and Ollivier 1998). Amphibians with restricted ranges, in or near expanding metro areas, face great risk of extinction. Of the thirteen *Eurycea* salamanders in central Texas, seven are threatened by or completely surrounded by development. Most known localities are at risk from urbanization due to their localized recharge areas (Chippendale *et al.* 2000, Chippendale and Price 2005, USFWS 2012). Prior research has shown that salamander densities are reduced in urbanized stream catchments (Orser and Shure 1972, Willson and Dorcas 2003). Urbanization can cause changes to natural flow regime and degradation of surface and groundwater. These changes to habitat quality may be the largest threat facing JPS and must be considered in conservation efforts (Bowles *et al.* 2006).

The City of Austin's human population grew 192% from 1970 to 2007 (COA 2007). Bowles *et al.* (2006) found lower JPS density in developed tributaries compared to springs in undeveloped watersheds. Developed tributaries had higher concentrations of chloride, magnesium, nitrate-nitrogen, potassium, sodium, and sulfate (Bowles *et al.* 2006). Four of nine JPS sites monitored by the City of Austin from 1996 to 2007 showed statistically significant declines in salamander abundance over ten years (O'Donnell *et al.* 2006). Analysis of count data from 1996 to 2011 reveal that JPS populations declined in areas with the largest increases in residential development over a 15-year period and furthermore, densities of JPS are negatively correlated with residential development across its range (Bendik *et al*. 2014, Bendik *et al.* 2016).

Future Conservation Efforts

To address the conservation of JPS, Travis County will continue to manage and acquire land to protect endangered species, which will benefit this species and water quality. All streams within Travis County BCP tracts will be protected and if found to host JPS, will be managed to protect this species. Travis County will also collaborate in research efforts to elucidate many of the unknowns in regard to JPS life history, habitat preferences, potential threats, and the mechanics of the northern segment of the Edwards Aquifer. Also, Travis County will continue to contribute long-term monitoring by performing regular JPS surveys and water quality monitoring at creeks occupied by JPS and other BCP sites where appropriate. New occupancy studies will be conducted in FY2018 to better understand occupancy and distribution within the Cypress Creek Watershed and new JPS localities will be reported to the USFWS in annual reports (Figure 6). After discovery of additional populations, staff will return on a regular basis to verify JPS presence at these sites.

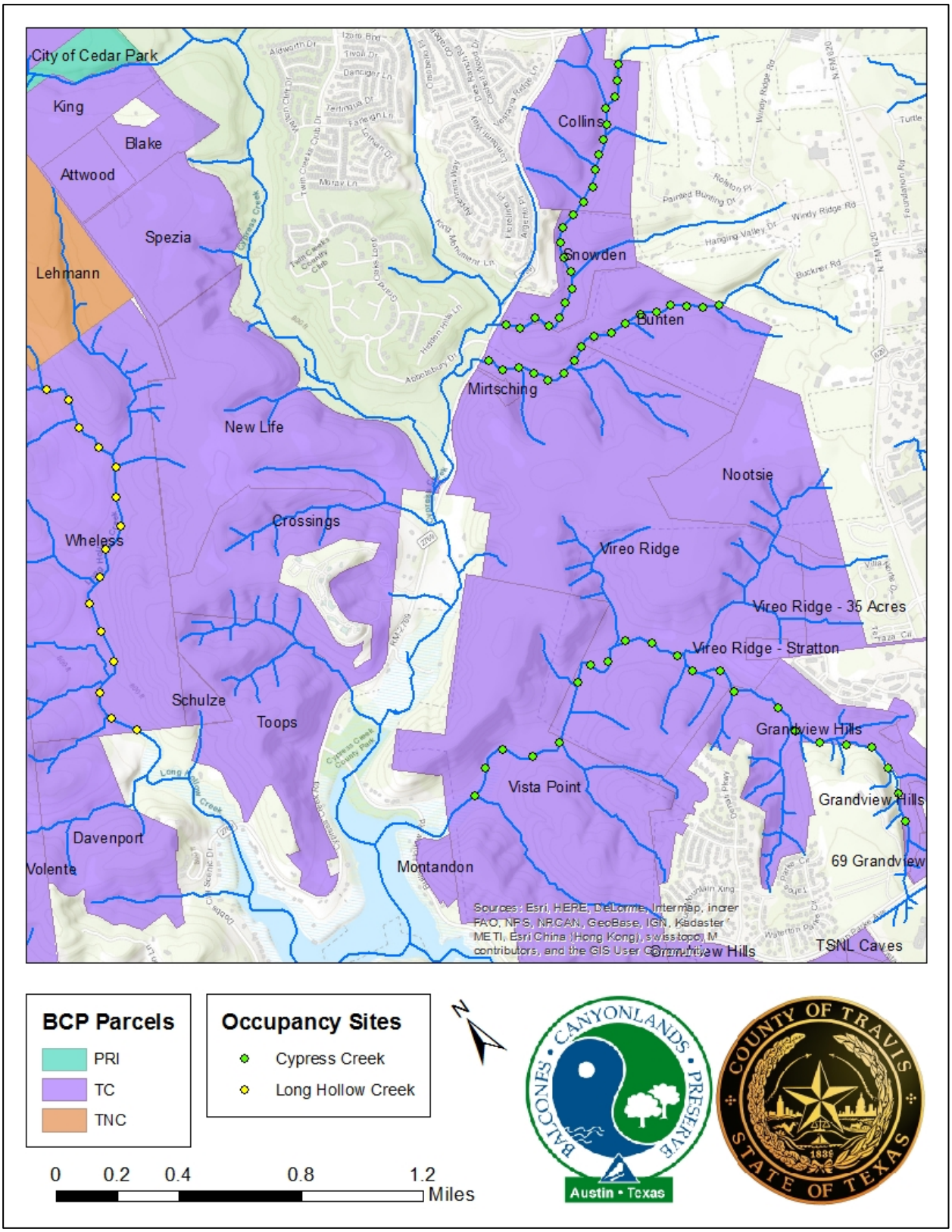

Figure 6. Creeks prepared in FY2017 that will be surveyed for occupancy of JPS in spring FY2018.

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