Evaluation of Proposed Infiltration Area on William H Russell Karst Preserve

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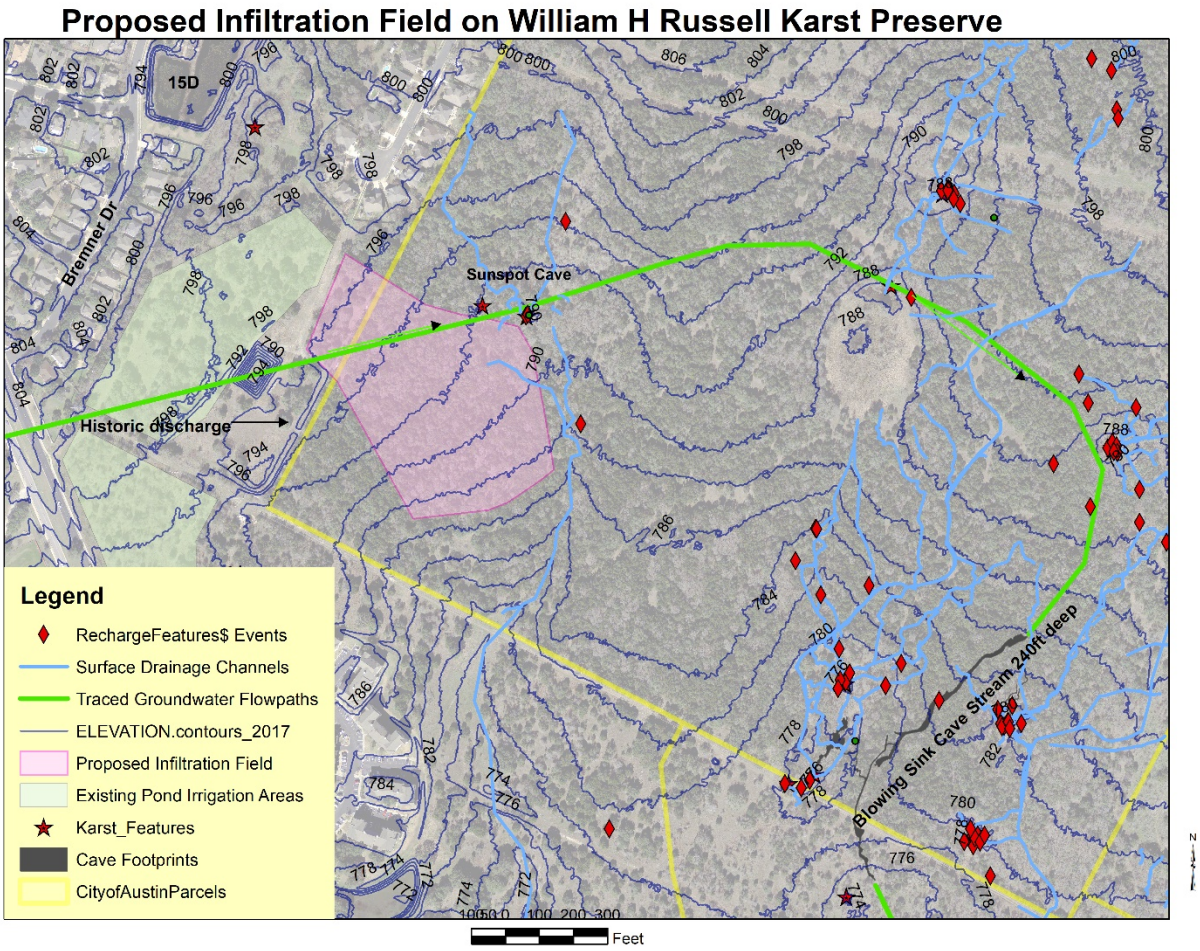
Introduction

On Thursday June 18, Greg Weems of Austin Mobility Corridor Project of Public Works set a meeting with Matt McCaw, Preserve Manager of the William H. Russell Karst Preserve, along with Nico Hauwert and David Gimnich of Austin Water Wildlands, Lee Sherman of Watershed Protection, and others to consider if it could be possible to utilize wetpond 15D as a stormwater control for Slaughter Lane improvements between Mopac and Slaughter Lane, which necessitates infiltrating treated stormwater on the William H Russell Karst Preserve. Expedited review was requested since decisions critical to the project had to be made soon, consequently data was researched and this report was fairly rapidly to facilitate the infrastructure development. The proposed infiltration field shown in Figure 1, that was used in this analysis was digitized by Nico Hauwert from a map presented in the June 18 video conference. While we requested and not receive maps of the proposed project and engineering evaluations of the 15D wet pond and associated drainage structures within the narrow time frame requested, the information we have is probably adequate for this evaluation but additional information could necessitate re-evaluation.

On Monday June 22, Greg Weems met with Matt McCaw, Charlie Kaough, hydraulic engineer of Watershed Protection Department, Nico Hauwert and Drew Thompson of Austin Water Balcones Canyonland Preserve Program to get better acquainted with the existing drainage system and to examine the proposed infiltration area. The following disclaimer applies to all maps used in this report:

"*This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries.*
This product has been produced by the Wildland Conservation Division for the sole purpose of geographic reference. No warranty is made by the City of Austin regarding specific accuracy or completeness."

Figure 1.



History of Divide Swamp and Wet Pond 15D

The 15D Water Quality Pond on Bremner Drive is a large sinkhole known to the Texas Speleological Survey as Divide Swamp Sink. Divide Swamp Sink appears as a water body in 1896 topographic map for the Austin Area. Lakes and ponds are not natural features on the Edwards Aquifer Recharge Zone, but it was common practice to plug large sinkholes on ranches to create temporary livestock ponds (Veni and Hauwert, 2015). Because sinkholes naturally contain drains that are connected to the underlying groundwater with sensitivity proportional to their size. This is because the bowl volume is factor of both catchment area and the ability of the drain to transmit suspended and dissolved material to the groundwater (Hauwert, 2009). Large sinkhole bowls are typically associated with underlying developed groundwater cave streams. Ponds installed in these large sinkholes tend to leak over time due to their well-developed internal drainage.

The large Divide Swamp Sink and encompassed 15 D water quality pond is also visible on 1896 Topographic map (Figure 2), 1940 aerial photograph (Figure 3), and 1955 USGS topographic map for Oak Hill Quadrangle (Figure 4). The 1940 aerial photograph was used to delineate the sinkhole rim for Divide Swamp Sinkhole (Figure 3). Texas Speleological Survey provided a report on Divide Swamp (Appendix A).

Figure 2. 1896 topographic map for Austin area showing Divide Swamp and 15 D water-quality pond as a circular water body

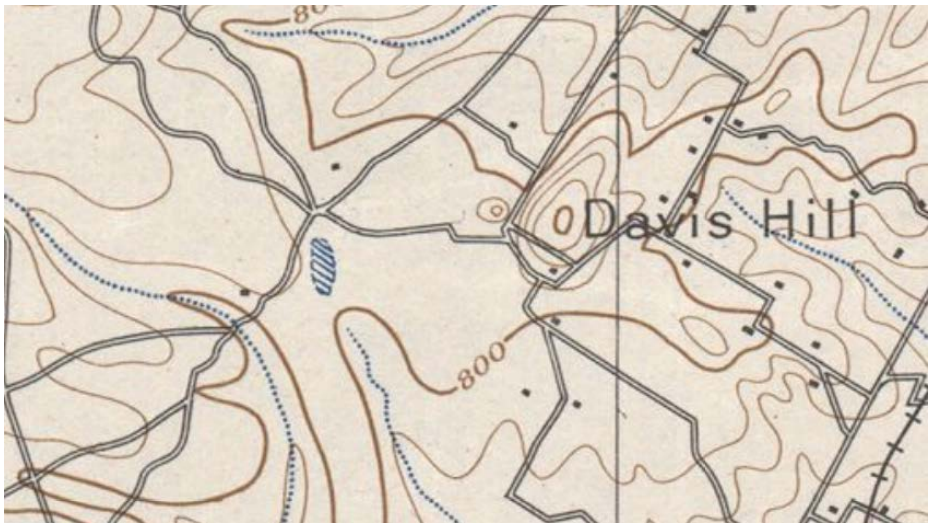


Figure 3. 1940 Aerial Photograph of William H Russell Karst Preserve Area

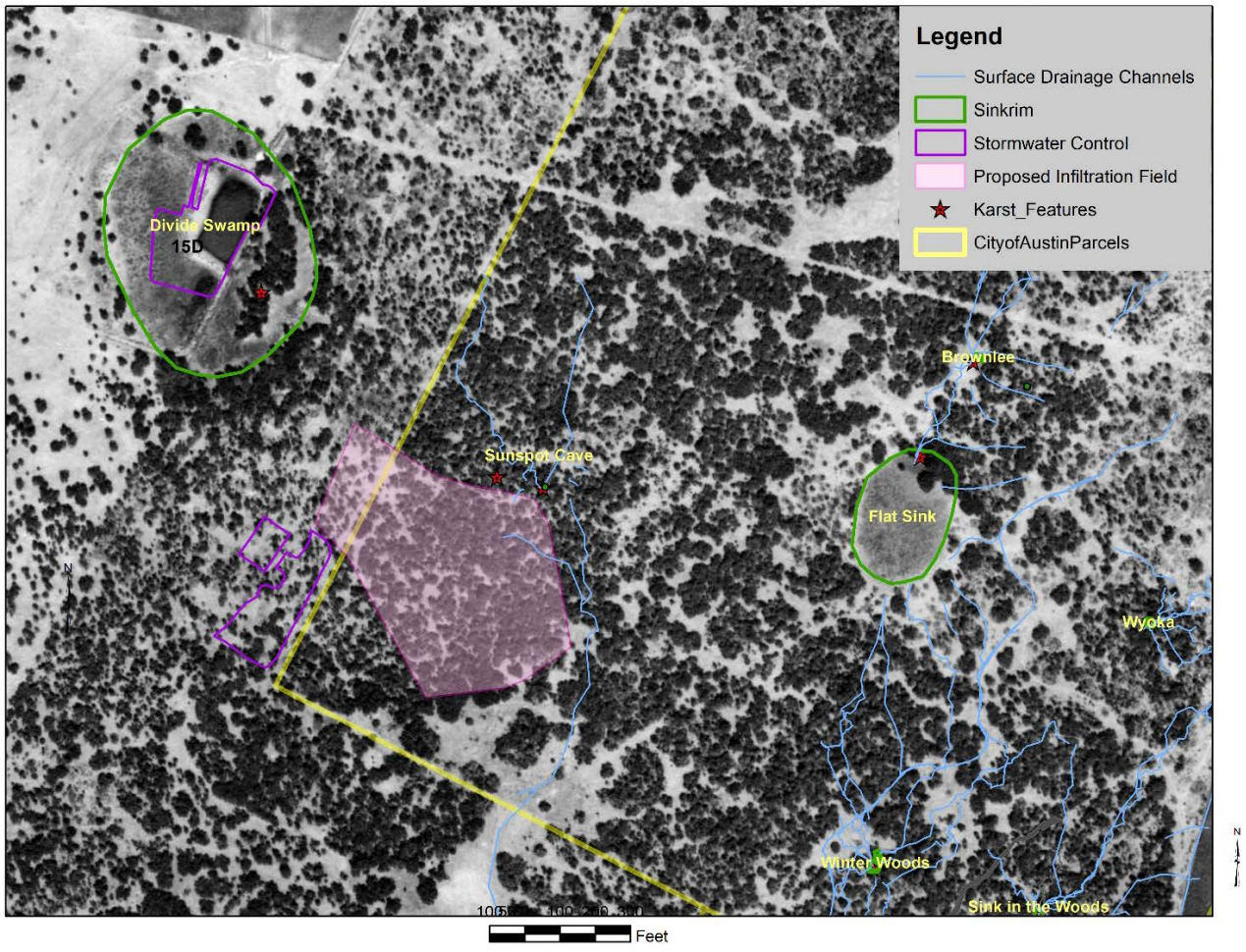
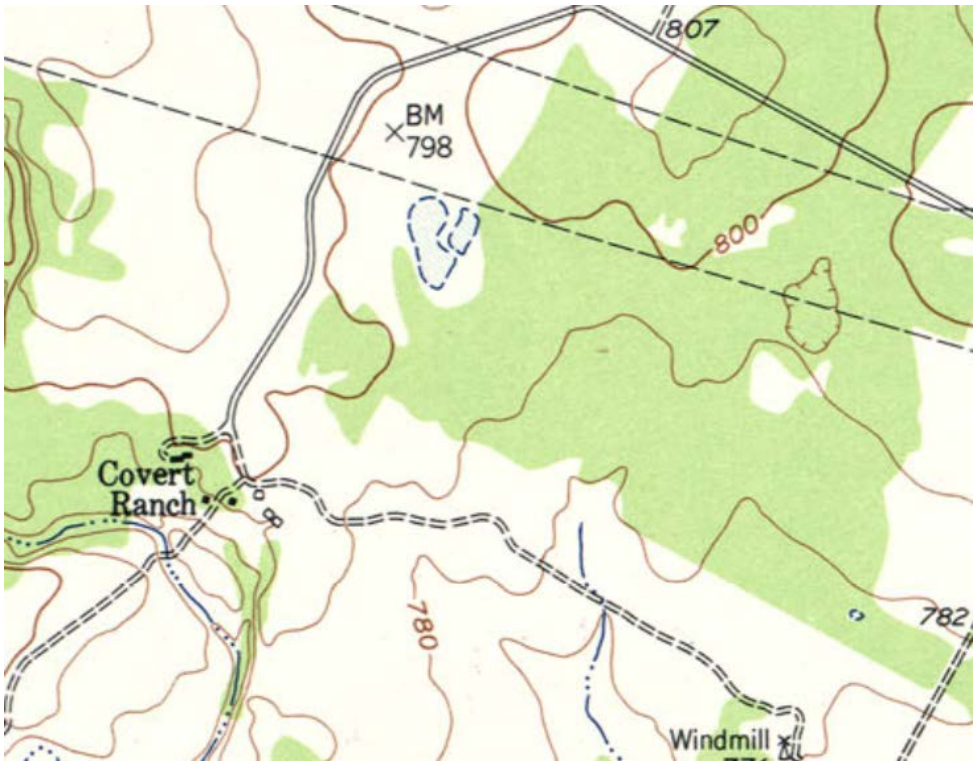


Figure 4. 1955 USGS topographic map for Oakhill Quadrangle showing Divide Swamp Sinkhole and pond 15D as a circular water pond on Covert Ranch



Blowing Sink Cave and Federal Permit Compliance

About 2,650 feet southeast of wetpond 15D and 1,150 to 2,000 feet from the proposed infiltration area on the William H Russell Karst Preserve is Blowing Sink Cave, one of the largest and deepest of the 62 caves that the City of Austin committed to protecting through the USFW 1996 Balcones Canyonland Conservation Plan (BCCP) Permit for rare karst invertebrate species of concern, including *Cicurina bandida* and *Rhadine austinica*. Blowing Sink Cave contains a flowing cave stream at a depth of 240 feet that was recently discovered to contain listed endangered Barton Springs salamander (*Eurycea sosorum*) and the imperiled *Stygobromus russelli*. The William H Russell Karst Preserve is also mapped as potential habitat for Golden-cheeked Warblers (*Setophaga chrysoparia*) that utilize ashe juniper trees for nesting and food supply. The federal BCCP permit requires that the City of Austin and Travis County preserve the environmental integrity of Blowing Sink Cave, along with 61 other karst features. The 1996 Habitat Conservation Plan (p. 4-29) further explains what is intended by environmental integrity:

"*This plan will protect the environmental integrity of these features through acquisition and management or implementation of a management/conservation agreement with entities that influence the hydrogeological area needed to protect the feature… The delineation of appropriate boundaries for the individual preserves will require additional studies by the BCCP Coordinating Committee to delineate the surface and subsurface hydro-geologic boundaries for the cave and the surface area necessary to maintain the biological resources important to the cave.*"

The 1996 permit further requires that where the surface and subsurface water source areas have not yet been delineated, no participation permits are to be awarded within ¼ mile of the cave.
The 1996 HCP also states:

> *"it must be stressed that the adequacy of the plan is contingent upon full implementation of the acquisition and management strategies detailed in the BCCP. Given the fact that several of the BCCP karst species of concern are known from only four or five caves, the loss of even one cave could result in a 20- to 25-percent reduction in the species population. This is especially important given the predicted 80 to 85 percent loss of potential karst habitat allowable under the proposed plan. In addition, numerous newly discovered species which are currently undergoing taxonomic verification have the potential to be federally-listed, with a high probability that other new rare species will be described from Travis County in the future. This Plan addresses 25 such species that would be protected upon full implementation."*

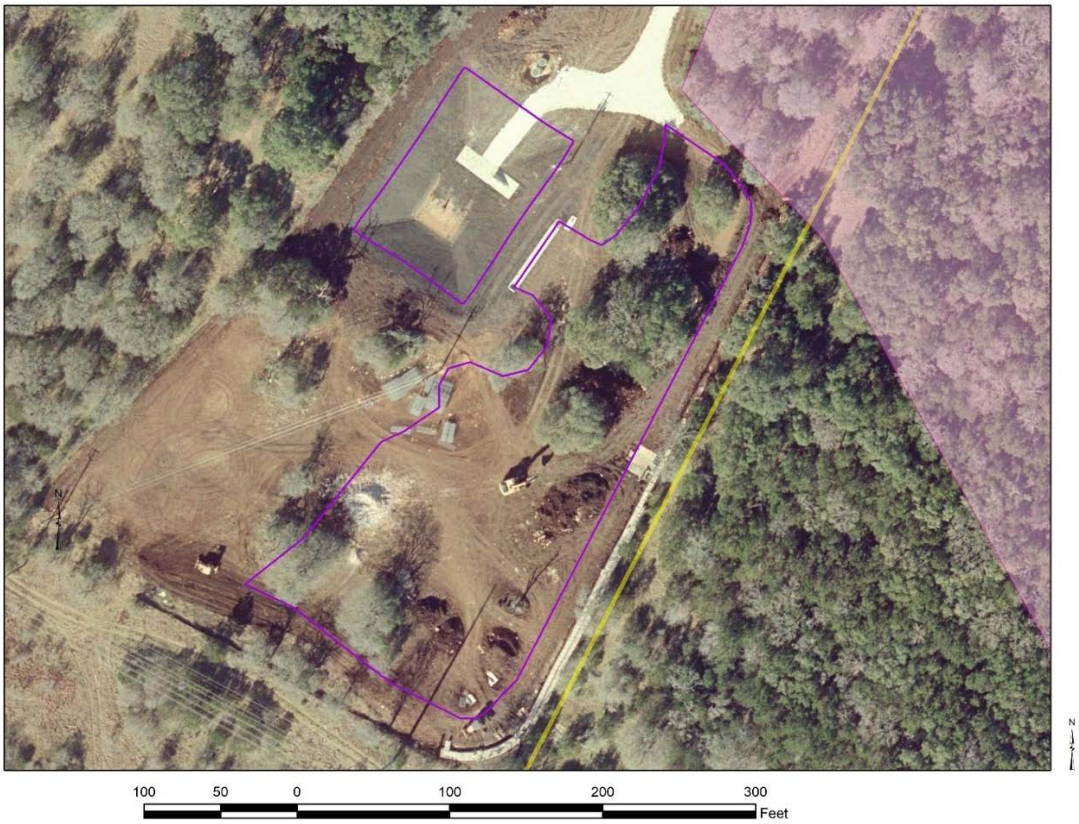
Additional information on implementation from the BCP Land Management Plan is provided below.

Local Surface and Subsurface Catchments for Blowing Sink Cave

The surface flow from the proposed infiltration which does not infiltrate through the soil or features like Sunspot Cave does not runoff through surface channels to the entrance of Blowing Sink Cave, but enters a tributary to Slaughter Creek which contains channel swallets such as Sunspot Cave and Brodie Cave. Therefore, the proposed infiltration area is not in the surface catchment area for Blowing Sink Cave. The entire surface catchment for Blowing Sink Cave has been mapped and is entirely contained within the William H. Russell Karst Preserve.

On June 22, 2020, Charlie Kaough showed the water quality detention pond, a concrete spreader, and rock berm that is intended to spread treated runoff from the detention pond and pumped overflow from wet pond 15D across the southwest corner of the William H Russell Karst Preserve. An aerial photograph from February 2003 shows the construction of the detention pond and spreader just west of the William H Russell Karst Preserve (Figure 5).

Figure 5. February 2003 Aerial Photograph Showing Infrastructure Construction West of William H. Russell Karst Preserve



On June 22, 2020, Matt McCaw, Drew Thompson and Nico Hauwert walked from the 2003 spreader location towards Sunspot Cave. It appeared that we were directly following subtle drainages based on runoff debris from the spreader area to an area upstream of Sunspot Cave. This direction was northeast, rather than a southeast direction predicted from two-foot contour interval coverages (Figure 1). Drew Thompson repeated walking surveys from the spreader area following individual subtle drainages and gps locating specific drainage points on June 26, 2020:

> *"On Friday June 26th 2020 I was out at the William H Russell Karst Preserve on the southwest side where they plan on putting the new overflow from the wet pond. At 10 a.m. a storm came through but only left us with under half an inch of rain and I was not able to witness any significant sheeting but was clearly able to see the flow path. Starting at the north end of the caged rock berm at UTM 0610213 3340789 I walked the drainage and followed the obvious paths of water from that point five times to see where it would take me. Two times the path took me to Sunspot Cave 0610353 3340782 and the other three times I found myself at the South boundary fence at 0610319 3340508.*
>
> *From the North of the caged rock berm 0610353 334082 and north to the pipeline easement is within the catchment of Sunspot Cave."*

A video by Drew of a surface drainage from the spreader to Sunspot Cave is shown at: https://drive.google.com/drive/folders/1-WZxqdCaNDm1QCJKS_VOz9WYYbl1kf59

This walking survey is intended to be verified in the future by walking the drainages under both dry and runoff conditions and map specific drainage paths as has been done on other portions of the William H Russell Karst Preserve as mapped in Figure 1. It is possible that the easternmost half to one-third of the proposed infiltration area shown on Figure 1 may be at a lower elevation than Sunspot Cave, if the runoff reached this area. Greg Weems asked if perhaps a berm could be installed to direct runoff away from Sunspot Cave. However, the federal permit and site deed does not allow altering hydrology, clearing vegetation needed to transport soil near the proposed infiltration area as discussed below.

On February 18, 2012 Nico Hauwert poured direct yellow 96 dye into Sunspot Cave that is in a natural channel on the north side of the proposed infiltration area (Figure 5). The dye was detected within the cave stream for Blowing Sink Cave (Figure 1 green line estimated flow path).

Figure 5. Dye is injected into natural runoff entering Sunspot Cave on February 18, 2012





This dye trace, along with a May 2010 dye injection into Wildflower Cave at the Lady Bird Johnson Wildflower Center that was also detected in the cave stream of Blowing Sink Cave established that the 15D wet pond and proposed infiltration area are in the subsurface catchment area for Blowing Sink Cave.

Regardless of whether stormwater runoff reached Sunspot Cave and recharged or infiltrated through heterogeneous soils and bedrock within the proposed infiltration area, the runoff would reach Blowing Sink Cave with less than background quality.

Deed Restriction

When the 165-acre portion of the William H Russell Karst Preserve was acquired by the City of Austin in 2000, the City Council established restrictions on its future use. The preserve is managed by Austin Nature Preserves of Austin Parks and Recreation Department.

Russell deed 165 acre tract:

1. Purpose. … c) maintain or improve the natural hydrological processes and land health that currently exist on the property, e) conservation, maintenance, and enhancement of the quality and quantity of the Barton Springs segment of the Edwards aquifer and water supply [the effects of the project on natural hydrology would be neutral at best and net negative at worst]
2. Prohibited uses

    2.1 No Surface Alteration

    Except as reasonably necessary for the appropriate management of the property as a nature preserve, there shall be no change in surface or subsurface hydrology in any manner.

    2.7 Water use

    The shall be no pollution, alteration, or manipulation of surface or subsurface water (including but not limited to ponds creeks or other water courses), nor shall activities be conducted on the property that would be detrimental to water purity or that could alter the natural water level or flow in or over the Property, except as reasonably necessary for the appropriate management of the property as a nature preserve…except for limited and reasonable use of existing creeks and stock tanks in connection with the educational use and preservation use of the Property.

4. Permitted uses. …the property may only be used as a nature preserve [i.e. not as a stormwater treatment solution for an unrelated project] and to provide passive recreation and outdoor education for the people of central Texas area concerning the nature, wildlife, and ecosystems of Central Texas.

Note that pre-existing infrastructure, including petroleum pipeline right-of-way and transmission line easements are specifically acknowledged by the deed**.**

Balcones Canyonlands Preserve Land Management Plan Tier II-a Chapter IX Karst Species Management

The BCP Land Management Plans are developed by BCP staff and approved by the BCP secretary and Coordinating Committee to specify how compliance with the federal permit will be accomplished.

P. 24.
"One of the main threats to the listed karst species is loss of habitat due to urban development activities. These species occur in an area that is undergoing continued urban expansion at a rapid rate and few caves are protected. Most of the species' localities occur adjacent to or near developed areas, or in areas that are proposed for development (USFWS 1996a).

The most significant effects of urban development on karst habitat are..pollutants from urban run-off, such as pesticides, which can contaminate caves and possibly harm or kill karst species or species that provide organic matter. Urban run-off can also alter the natural flow of nutrients through the cave system by replacing water flow and animal energy inputs with potentially contaminated seepage from yards and parking lots. If the surface and subsurface drainage basins are not adequately protected, contamination of this nature can be expected.

Conclusions

- Wet pond 15D is a sinkhole known as Divide Swamp that has a history of leaking and is strongly connected to upstream sources to federal permit Blowing Sink Cave.
- Blowing Sink Cave is preserved within the 191-acre William H Russell Preserve managed by Austin Nature Preserves with assistance from Austin Water Balcones Canyonland Preserve for rare cave invertebrate species of concern, listed endangered Barton Springs salamander (*Eurycea sosorum*), and potential habitat for listed endangered Golden-cheeked Warbler (*Setophaga chrysoparia*).
- The proposed infiltration area on the William H Russell Karst Preserve is within the subsurface catchment area for Blowing Sink Cave and within ¼ mile of the cave. The BCP cannot issue participation permits for the proposed infiltration area on the karst preserve.
- The preserve deed prohibits any use other than as a nature preserve, and prohibits the infiltration of treated stormwater, altering hydrology, or clearing vegetation except as needed for preserve operation.

References

Balcones Canyonlands Preserve (BCP). 2016. Karst species management, tier II-A, chapter IX. Austin, TX. https://www.traviscountytx.gov/images/tnr/Docs/draft_plan/tier_iia-9_karst_management.pdf

Hauwert, N. 2009. Groundwater Flow and Recharge within the Barton Springs Segment of the Edwards Aquifer, Southern Travis County and Northern Hays County, Texas: Ph.D. Diss., University of Texas at Austin, Texas. 328 p. http://repositories.lib.utexas.edu/handle/2152/14107

Hauwert, N. 2012a. Summary of Initial Hydrogeologic Study Results, Evaluation of Impacts from Davis Lane, and Proposed Solutions to Protect Water Sources to Goat, Maple Run, and Blowing Sink Balcones Canyonland Preserve Caves
http://www.austintexas.gov/watershed_protection/publications/document.cfm?id=196480

Hauwert, N. 2012b. Dye Trace Simulation of an Accidental Spill Phase 10: State Highway 45 Southwest and MoPac South into the Barton Springs Segment of the Edwards Aquifer Travis County, Texas: City of Austin Watershed Protection Dept. short report SR13-01. 75 p.
http://www.austintexas.gov/watershed_protection/publications/document.cfm?id=196481

U.S. Fish and Wildlife Service (USFWS). 1996. 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.

Veni, G. and Hauwert,, N. 2015. A Historical Review and Forward View of Cave and Karst Research in Texas. GSA Special Paper 516: Caves and Karst Across Time.

Appendix A Texas Speleological Survey Report on Divide Swamp

Divide Swamp
Oak Hill Quadrangle
Large Sink TRA234, Length of surface depression 500 feet, Width 300 feet, Elevation 795 feet.
Description: This karst feature is a large, slightly depressed, poorly drained along the Slaughter-Williamson Creek divide. Divide Swamp was originally a shallow depression about 500 by 300 feet, but has been considerably modified. Much of this area is only a foot or so below the surface level to the east, but after heavy rains, water stands for several days. Large sections of the western and northern part of this feature are now filled with rocks from the development of the Maple Run Subdivision. The Sendero subdivision wet pond is all that is left of the western portion of this feature, and much of the eastern portion in the Deer Haven Subdivision has been considerably modified.
There are no surface drainage channels leading from the Divide Swamp, and it is likely that before subdivision development rainfall was not sufficient to fill the feature. The several acres of sink bottom, were two to three feet below the drainage divide to the east, and the drainage area of the sink was approximately the same as the sink area. Thus even with no infiltration it would take at least a foot of rainfall to fill the feature. However with the greatly increased runoff from impervious cover resulting from development, and the filling of a large part of the feature, flooding of the feature will be more common. The Sendero wet pond was not well designed and plants and an appropriate ecology have not become established. Water entering the Dear Haven Subdivision from this wet pond is likely of poor quality. To prevent this water from accumulating in the Dear Haven Subdivision, becoming unsightly and breading mosquitoes, the developers of Dear Haven originally planned to pump the water across the low divide to the east onto the Blowing Sink Preserve. The TCMA objected to pumping the runoff onto the preserve, and the developer then agreed to pump the water into the Dear Haven reirrigation area, along with runoff from the rest of the Deer Haven Subdivision.
Following rainfall of four to five inches on August 26 that filled the wet pond and covered the lower part of the Dear Haven section of the sink, the water level dropped about three inches as water entered old fill in the southeastern part of the Dear Haven subdivision, mostly through a single depression. Additional rains filled the openings in the fill and by August 31 the Divide Swamp had filled to the top of the cement wall at the end of wet pond spillway. Despite a small amount of additional rain the water level had dropped about five inches by September 1.
Following a rainfall of approximately 12 inches in the afternoon of November 15, 2001 the entire Divide Swamp-Sendero Wet Pond filled and overflowed to the east, possibly for the first time ever. This runoff continued east to flow over the entrance to Sunspot Cave, about 400 feet east of the Dear Haven Subdivision. Most of this runoff was not recharged through Sunspot Cave as the water flowing to the cave during the flood was far in excess of the capacity of the cave entrance, and the cave was covered with about three feet of water, and the overland flow continued on to the east.
During development of the Deer Haven Subdivision the lots along the south end of Ovalla Drive were covered with fill to raise the surface level to prevent flooding of the lots. A pump station was established to pump the standing water in Divide Sink into the detention pond at the southeast corner of the Deer Haven property. Overflow from the sink flows into the detention pond and then flows east into a drainage that leads across Brodie Lane and eventually to Brodie Sink, where most of the flow is captured and recharged into the aquifer. Standing water in the detention pond is pumped to a reirrigation area to the west.
The Divide Swamp is well portrayed on the City of Austin 2 foot contour map quadrangle C-16. Deer Park was the old name for what is now the Deer Haven Subdivision, and drainage from this subdivision will be directed south, except for a protected area around Deer Park Cave. Deer Park cave is located north of the Divide Swamp just north of the Longhorn Pipeline.

Coordinates: 610100E / 3340750N NAD27 North of Bowie High School and just south of Davis Lane.