Hydrogeologic Study of Spanish Wells Cave

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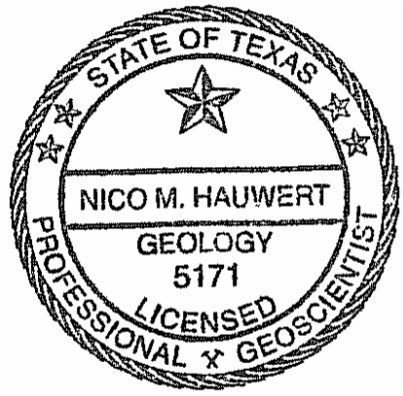

Nico M. Hauwert

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I. Abstract

Spanish Wells is a rarely visited cave included in the City of Austin/Travis County and partners USFW Balcones Canyonland Conservation Plan (BCCP) federal 10A permit. On May 18, 2013 data was collected at Spanish Wells to create a basic hydrogeological study. The data collected included surface and cave geology, gps location of the entrance, sinkhole rim, and surface catchment area; and cave survey data to map the footprint of the cave and overestimate the surface catchment area by extending the elevation of the cave stream across surface topography.

Spanish Wells Cave was mapped to be 45 feet long and 22 feet deep, although hand excavation and exploration would likely produce additional passage. The surface of the cave stream was surveyed to be 1127 $\pm$ 3 feet msl. The cave is interpreted to be primarily developed within the Whitestone lentil, containing three-feet thick interbedded Edwards formation. The lower cave stream appears to be perched over the upper 10 feet of the Comanche Peak formation. The surface catchment of Spanish Wells cave is 6.4 acres in area, extending about 800 feet southwest to a hilltop. A potential subsurface catchment area of 474 acres, primarily including areas 4,000 feet to the northeast and up to 5,000 feet to the southeast, likely overestimates the actual infiltration source to the cave. Further investigation using introduced tracers could potentially refine the actual subsurface catchment area, which may be closer to 150 acres and extending west up to 1,000 feet along the edge of a ridge. The cave stream appears to be obstructed by breakdown talus, creating disconnected pools. The cave stream likely discharges at an unnamed spring 1,500 east of Spanish Wells Cave entrance or Flag Spring about 5,000 feet southeast.

II. Introduction

Spanish Wells Cave is included as one of 62 caves on the City of Austin and Travis County joint 1996 Balcones Canyonland Conservation Plan federal 10A permit. An account by Elliott (1996) describes an October 6, 1963 visit to the cave by Bill Russell. Described as very dry conditions, Bill Russell reported that the western half of the cave was covered in a 4 feet wide pool of water. Bill Russell sketched the cave. A talus slope was noted at the base of the entrance shafts in the main chamber. On June 9, 1967 caver Robert W. Mitchell visited the cave to collect blind flatworms reported by Bill Russell and later identified as *Spalloplana kuischeri* Mitchell in its only know locality. The 1967 trip was the last reported trip into the cave before 2013.

On May 18, 2013, Travis County staff obtained permission to access Spanish Wells Cave from the ranch owner. The investigators included Travis County staff cave biologist Todd Bayless, biologist Renee Fields, City of Austin Water Utility Department cave biologist Mark Sanders, City of Austin Watershed Department hydrogeologists Scott Hiers and

Nico Hauwert. Scott Hiers and Nico Hauwert both made surface geologic observations. This report includes the observations, measurements, and photographs by Nico Hauwert to describe hydrogeological features associated with Spanish Wells Cave on May 18, 2013. The condition of the single day observation is drought conditions, but several days after a heavy rain.

III. Methodology

A Trimble XT global positioning unit was used to document locations and elevations, generally within 3 feet. While this is not survey grade it is adequate for the purposes of the hydrogeological study. Beyond surface features located with gps, elevations were derived from the US Geological Survey Nameless Quadrangle 1986 surface topography map, acquired in digitally courtesy of the University of Texas.

A cave map was surveyed using a Bosch laser rangefinder to measure distances and a Suunto Tandem compass to measure azimuths and inclinations from station to station. The original survey point was a gps-located position at the cave entrance, a sharp jutting rock point at the main shaft entrance. Photographs were taken inside the cave as the survey was progressing Appendix A).

The surface catchment area for Spanish Wells Cave was delineated primarily using a field gps located surface-water divides. The general methodology for surface catchment area delineation is described by Hauwert et al, 2004 and Hauwert, 2009. A 1986 USGS Nameless quadrangle sheet was also included in the final delineation of the surface catchment area to the two Spanish Wells Cave entrance shafts. It is conceivable that as the subsurface extent of the cave is expanded or surface recharge features are connected physically or hydraulically to the cave that additional surface catchment areas may be associated with those future discovered cave entrances.

The subsurface extent of Spanish Wells was based on the surveyed elevation of the cave stream (1127 $\pm$ 3 feet msl) extended on the surface to the nearest contour interval (1120 feet msl) on the USGS Nameless Quad. The general methodology described by Hauwert and Cowan (2013) for delineating subsurface catchments includes the use of elevation, footprints, water locations and discharge characteristics, tracers, water chemistry, and hydrostratigraphic characteristics. It is possible to further refine subsurface catchment area for Spanish Wells Cave closer to its actual size using more methods than the relatively simple elevation-based methods utilized here. In this report, the potential subsurface catchment area defined may be considerably larger than the actual area contributing infiltration to the cave. About 4,000 feet to the northeast, the subsurface catchment area was delineated at a higher elevation (about 1130 ft msl), because the 1120 ft msl contour extended unlikely far to the north and east along narrow ridges, requiring very low gradient flow (3 vertical feet/4,000 feet distance) and several sharp angle bends along narrow ridges.

IV. Results

IV.1. Cave Map

Spanish Wells Cave was mapped to be 45 feet long and 22 feet deep, although hand excavation and exploration would likely produce additional passage (Figures 1, 2, and 3). Note the 10A permit does not provide for excavation of permit caves without specific authorization. The main and second shafts descend 19 feet from the dual entrances into a breakdown talus cone. A cave pool extends from the floor of the main chamber to the northeast. The surface of the cave stream was surveyed to be 1127 $\pm$ 3 feet msl. A slightly higher bypass crawl starts from the DI drip area and strongly protruding rock (Jut Rock) and joins the cave stream in the Serpentine Room. The bypass crawl is partially block by a large fallen block. Within the Serpentine Room, the cave stream appears to follow deeply incised meandering loops. The "keyhole" morphology is classic vadose water created or modified passage. As the fissures are tight, the Serpentine Room is traversed along the dry upper level, and water at the bottom of the serpentine fissures is only occasional observed. Beyond the Serpentine Room after a right angle turn to the west, is the 10 feet long Ghost Owl Crawl, named after a honeycombed textured rock resembling an owl face. The passage becomes impassable at a small conduit extension of the cave.

On the southeast side of the Main Chamber is a higher crawl, named the Upper Duct Crawl, as it resembles an air conditioning duct. A possible extension of the cave stream can be observed below a dome about 7 feet southeast of the Main Chamber. The Upper Duct Crawl continues to the northeast, relatively tight but potentially passable with minor hand excavation of loose rock.

IV.2. Geology

The upper portions of Spanish Wells Cave is interpreted to be developed within the Whitestone Lentil, based on the oolitic cross bedded grainstone observed in the upper 6 feet beneath the entrance shaft (Figure 2). This bed is believed to be locally present in Lime Creek Quarry to the northeast, but is absent in most of Travis and Williamson County. The presence of toucasia wackestones observed in a 3.1 ft thick bed in Spanish Wells caves and on surface near the same elevation about 700 northeast along a dirt road, suggests possible interfingering of Edwards formation beds. The lower cave extent, primary D1 cave drip, and cave stream appear to be developed in a burrowed honeycomb unit that may be the Comanche Peak formation. Veni (1998) described the tendency for cave streams to perch over the Comanche Peak formation in this North Austin.

IV.3. Surface Catchment Area

The surface catchment of Spanish Wells Cave was field mapped using gps to be 6.4 acres in area (Figure 4). From the cave entrance the surface catchment area primarily extends about 800 feet southwest to a hilltop summit of a ridge.

IV.4. Subsurface Catchment Area

The potential subsurface catchment area is interpreted to be less than 474 acres in areas, based on the elevation data of the cave stream and surface topography (Figure 4). While the cave stream in Spanish Wells Cave was not observed to be actively flowing, but rather pooling up to 3 to 4 feet deep. It seems unusual that such as deeply incised well defined cave stream simply pools, without some obstruction. Also note that pools of water were observed on both sides on the talus in the Main Chamber. It is possible that the thick talus fill below the Main and Second shafts in the main chamber washed in from surface erosion and possibly collapse and that this fill blocks the natural cave stream flow, which otherwise might resemble the flowing cave stream in local caves such as Testudo and Marigold caves. It is believed that the cave stream originates within 150 acres west and north of the cave, and flows east to discharge at local springs such as an un-named spring discharging an estimated 20-30 gallons per minute spring observed 1,500 feet directly east of the cave entrance or Flag Spring mapped on the USGS Quad about 5,000 feet southeast of Spanish Wells Cave entrance.

A D1 drip was mapped in Spanish Wells Cave, discharging without speleothems from a honeycombed bed believed to be uppermost Comanche Peak formation. Note that this observation was made during a severe drought several days after a large rain. It is possible that other drips may be observed in Spanish Wells cave under different conditions.

V. Conclusion

A basic hydrogeological study was prepared based on a data collected from a single visit to Spanish Wells Cave under drought conditions on May 18, 2013. The mapped cave extent was 45 feet long and 22 feet deep. Prominent cave passages include dual 19 feet deep vertical shafts extending into a partially talus-filled Main Chamber. A pooled cave stream extends to the northwest. A possible downstream upper passage extends to the east and northeast.

The cave is primarily developed within the Whitestone lentil and lower cave stream is interpreted to be incised and perched upon the uppermost 10 feet of the Comanche Peak formation. The surface catchment is 6.4 acres in size, extending as an oval about 800 feet southwest to a prominent hilltop. A potential subsurface catchment area of 474 acres was defined using the surveyed elevation of Spanish Wells cave stream surface extended on the available surface topographic coverage. One minor drip, D1, was the only active drip observed.

Our understanding of the hydrogeology of Spanish Wells Cave can potentially be refined with additional visits to the cave under various climatic conditions. The cave potentially extends beyond the areas mapped here. The subsurface catchment area and discharge points can potentially be defined or refined to a smaller area using introduced tracers. Further consideration may be warranted for restoring the cave by removing fallen breakdown talus that may be blocking flow of the cave stream.

VI. References

Elliott, William R., 1997, The caves of the Balcones Canyonland Conservation Plan, Travis County, Texas, Unpublished report to Travis County, 156 p.

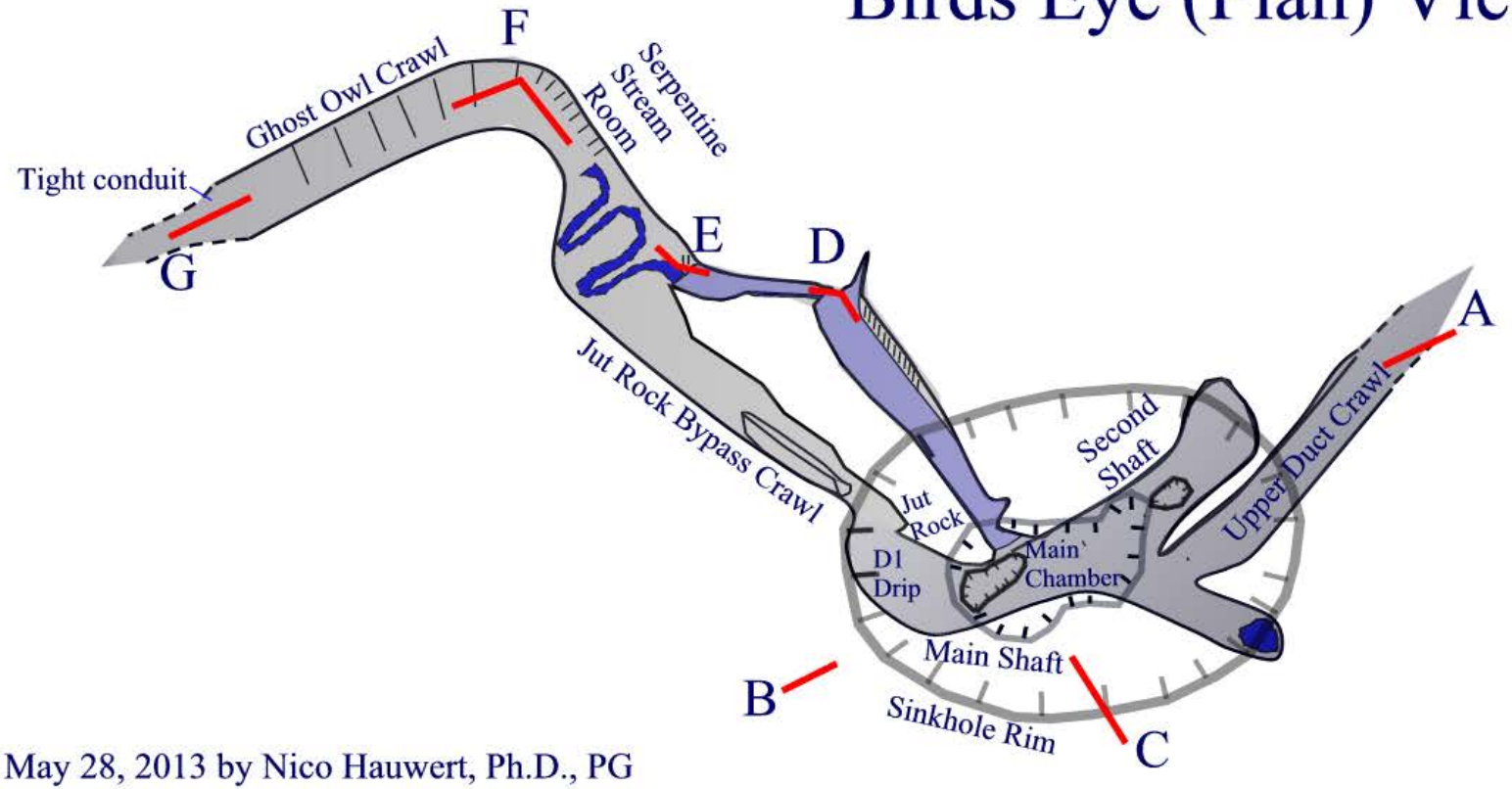
Hauwert, Nico M., 2009, Groundwater Flow and Recharge within the Barton Springs Segment of the Edwards Aquifer, Southern Travis County and Northern Hays County, Texas: Ph.D. Diss., University of Texas at Austin, Texas. 328 p. http://repositories.lib.utexas.edu/handle/2152/14107

Hauwert, N., and Cowan, B. 2013, Delineating Source Areas To Cave Drips And Cave Streams In Austin Texas, USA: 13th Sinkhole Conference, Carlsbad, NM. http://www.karstportal.org/node/11735?destination=node/11735

Veni, George, 1998, Hydrogeologic investigation of caves and karst along Parmer Lane near Upper Walnut Creek, Travis County, Texas: consulting report prepared for Hicks and Company, Austin, Texas. 56 p.

Figure 1

Spanish Wells Cave
Birds Eye (Plan) View



Mapped May 28, 2013 by Nico Hauwert, Ph.D., PG
City of Austin Watershed Protection Department

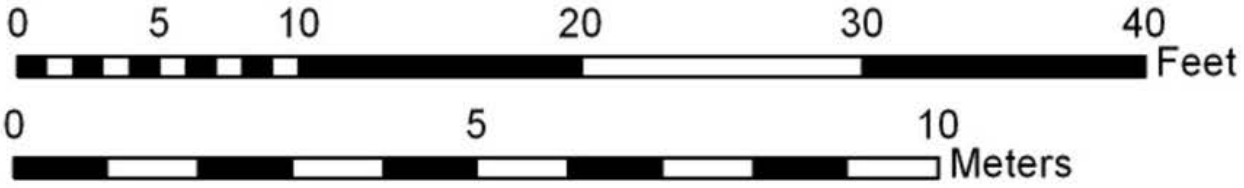




Figure 2 Spanish Wells Cave Profile 1

Mapped May 28, 2013 by Nico Hauwert, PhD, PG.
City of Austin watershed Protection Department

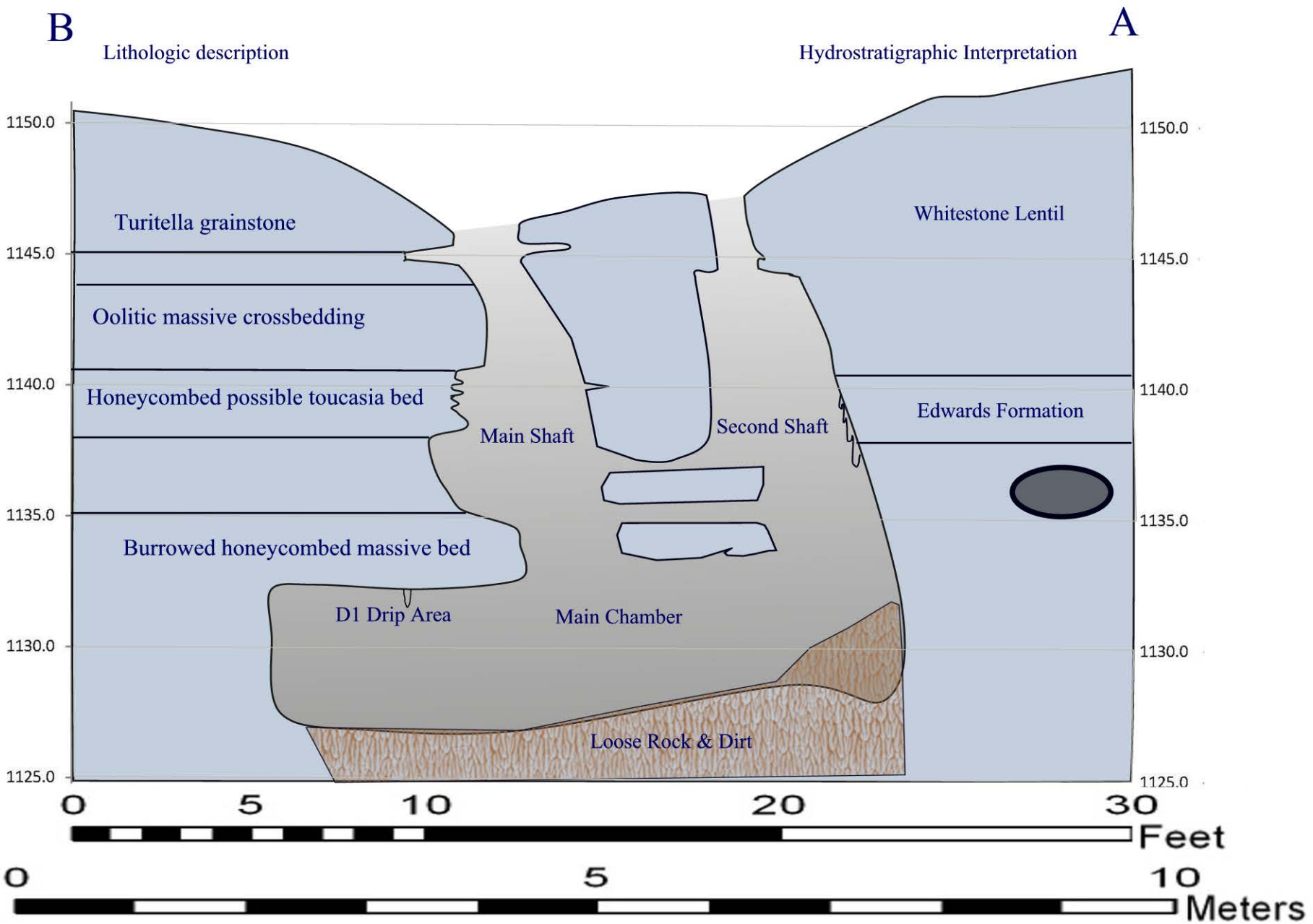
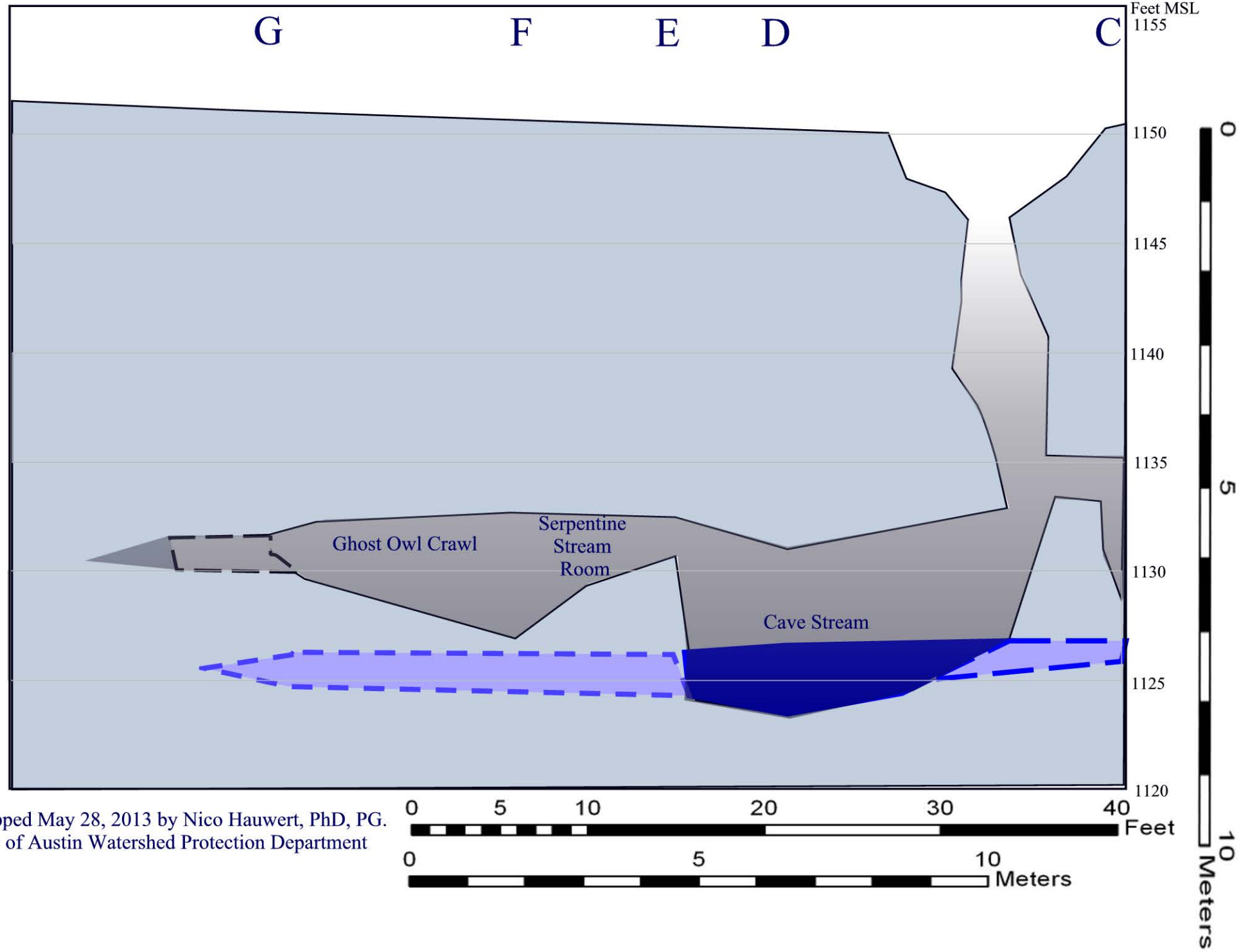


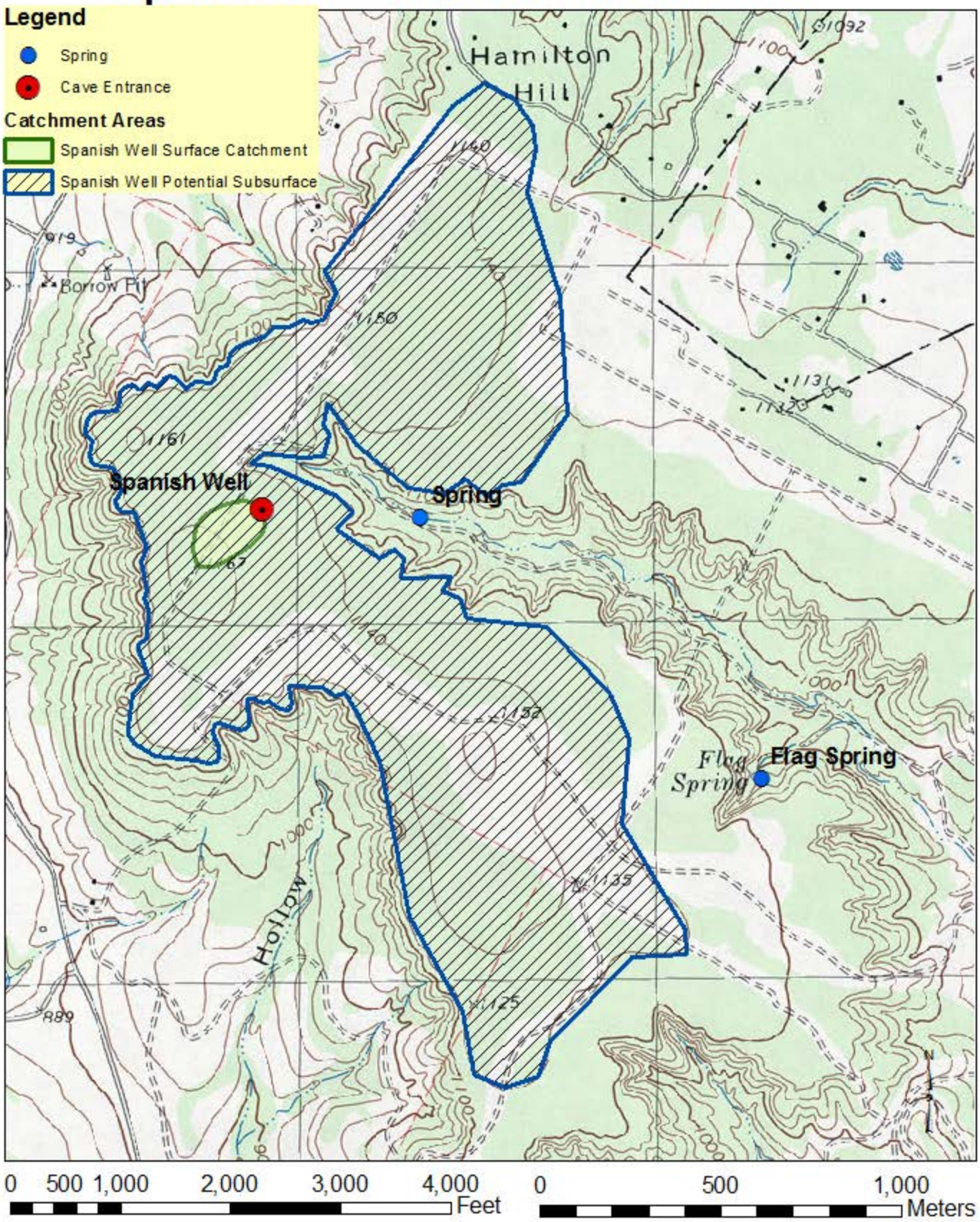
Figure 3 Spanish Wells Cave Profile 2



Mapped May 28, 2013 by Nico Hauwert, PhD, PG.
City of Austin Watershed Protection Department

Figure 4

Spanish Well Cave Catchment Areas



Interpretation by Nico Hauwert, CoA WP from field gps locations on 5/28/2013, cave survey elevations, and USGS Nameless Quad 1986 map.Actual subsurface catchment is likely smaller.

Appendix A. Photo Tour of Spanish Wells May 18, 2013

Spanish Well Cave-Entrance Area









Main Chamber



View up Main Shaft



View up Second Shaft





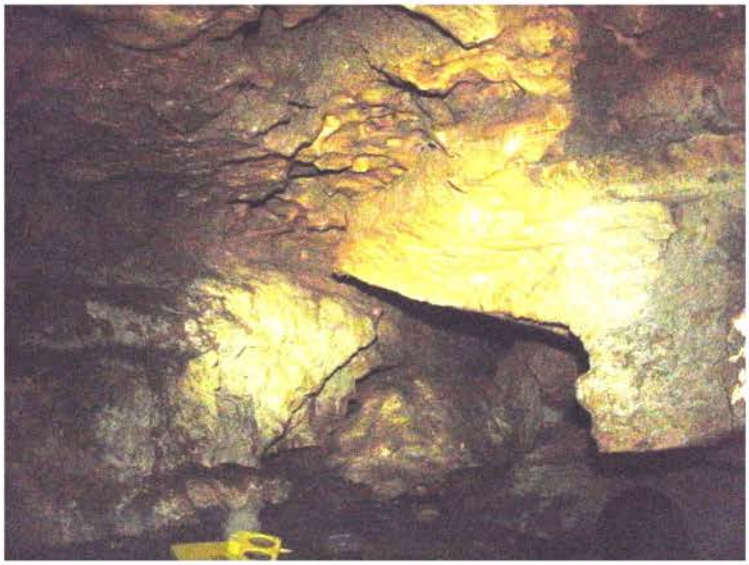
Dog Tag found





Breakdown Mound and Passage Connecting Main and Second Shafts

D1 Drip and Jut Rock Crawl



Jut Rock



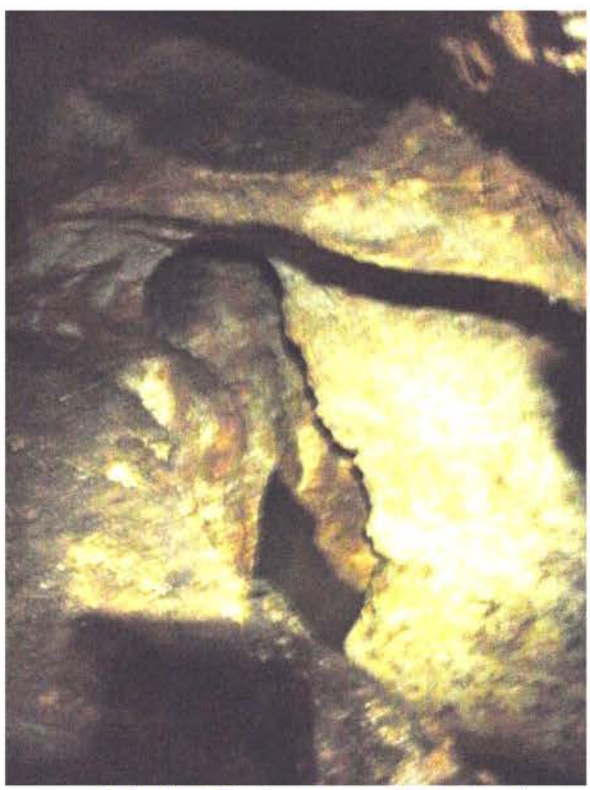
Solution Cavity Beneath Jut Rock



Jut Rock and Crawl

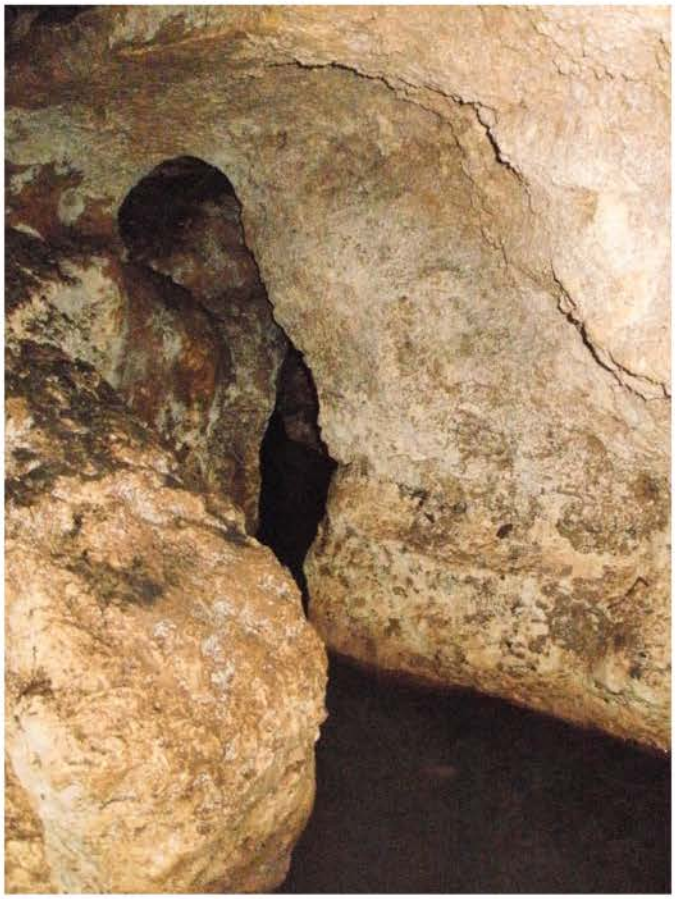


D1 Drip Area



Solution Cavity Beneath Jut Rock

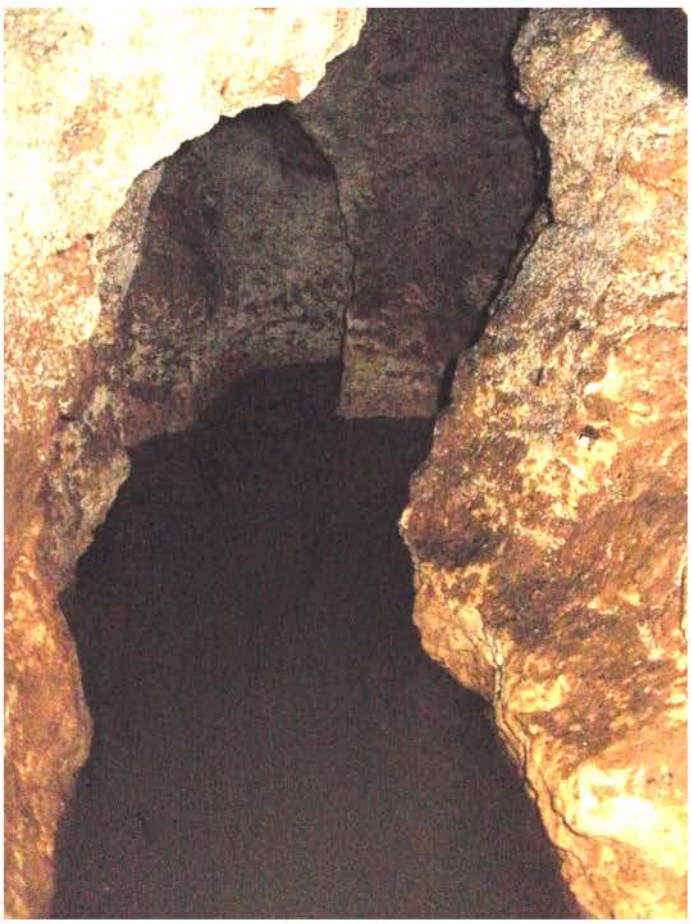
Spanish Wells - Cave Stream Pasage



Entrance to cave stream below entrance near S1



Pool at cave stream entrance near S2



Vewing NW towards S8 jut wall at pool level



View West past S8 to S11

Serpentine Stream Room





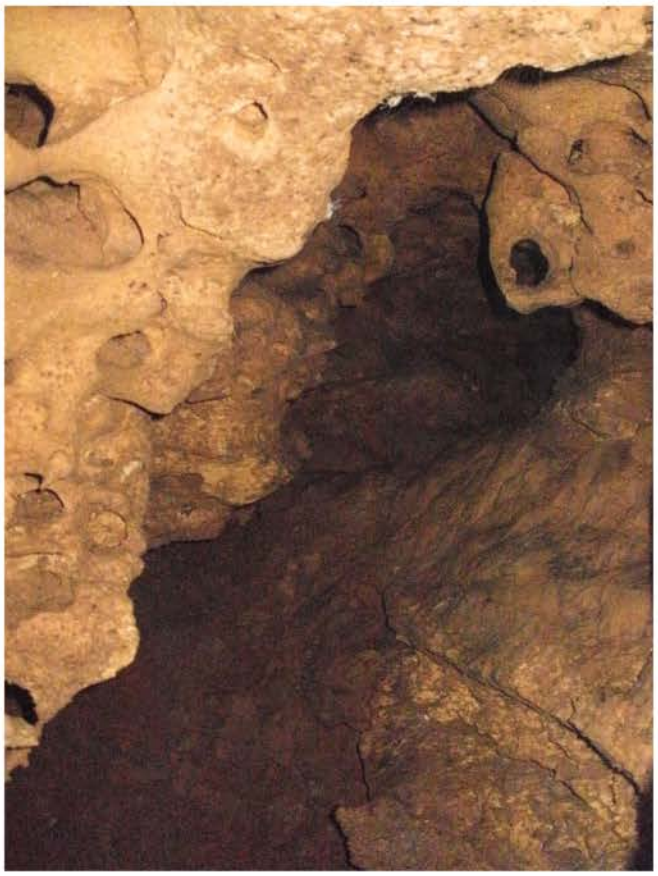








Ghost Owl Crawl





Entrance of Ghost Owl Crawl. (eye hole is S12)





End of passable extent (lead) at S13