THE
BUTTERCUP CREEK
KARST
--
TRAVIS AND WILLIAMSON COUNTRIES, TEXAS
--

GEOLOGY, BIOLOGY, AND LAND DEVELOPMENT

Report Prepared For

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at
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by

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Introduction

Recent explorations in the Buttercup Creek Karst west of Cedar Park have yielded several large caves inhabited by a unique assemblage of animals, both vertebrate and invertebrate. This report summarizes the geological and biological information on this area and recommends a strategy to protect the caves and their inhabitants as development proceeds in the Cedar Park area. This study also evaluates the hydrologic contribution to the cave system of each local area to determine the degree of protection necessary.

This information has become especially significant, since the caves were discovered at about the same time the real estate industry in the Austin Area started its recovery from the eighties. Now, new subdivisions are again being established. These subdivisions face a new and more restrictive development environment, emphasizing protection of unique habitats. Many of the present problems in subdivision planning are due to uncertainty about what is required and a lack of financing for desirable mitigation measures.

A specific problem emerging is how to allocate costs and promote cooperation while protecting natural features that are distributed unequally among various areas to be developed. Large subdivisions, such as the Circle C Ranch in south Austin, can set aside extensive parks and greenbelts from land within the subdivision, since they are large enough to contain their share of natural features. In contrast, smaller developments must cooperate to preserve local features.

This report was commissioned by the University Speleological Society, a chapter of the National Speleological Society at the University of Texas, to bring together the scattered information on the Buttercup Creek Karst and to begin a detailed geologic and hydrologic study of this unique area. Much of the detailed information necessary to protect the Buttercup Creek Karst is summarized in this report, but the implementation of its recommendations will require cooperation of developers, biologists, geologists, as well as federal, state, county and local officials.

The material in this report has been compiled from numerous sources and errors and omissions and are almost inevitable. Corrections, comments, and especially suggestions for further research are welcome, and should be addressed to:

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General Description

Location
The Buttercup Creek Karst occupies an area about 5 miles from north to south and 4 miles wide along the Travis-Williamson County line between Cedar Park and Mansfield Dam (Figure 1). The south boundary of the study area is the Volente Highway (FM 2769); the Jonestown Highway (FM 1431) crosses the north end of the karst. The area extends from near Highway 183 on the east, across the Colorado River-Brazos River divide, into the Cypress and Lime Creek drainages to the west. Most of the area is in the United States Geological Survey (USGS) Jollyville and Leander Quadrangles, but the extreme western part of the area extends into the Nameless and Mansfield Dam Quadrangles. The area of this study is essentially the same as the Cedar Park Area of Reddell (1991), and the Cedar Park Karst Fauna Area of Elliott and O'Donnell (U.S. Fish and Wildlife Service, 1993), except that the emphasis of the present report is on the Buttercup Creek Basin -- the surrounding areas are not treated in the same detail. When the term "Buttercup Creek Karst" is used, it refers only to the Buttercup Creek Drainage, unless the entire area is clearly indicated.

Physiography
The section of the Buttercup Creek Karst east of the Colorado River divide is a gently rolling plain that slopes gradually toward Highway 183. To the south, drainage is into Buttercup Creek, and, to the north, into Cluck Creek. Elevations range from 1060 feet mean sea level (msl) along the Colorado River divide to below 900 feet msl along Highway 183. The drainages tend to have wide, poorly-defined channels, and are usually dry except for the extreme downstream parts of Buttercup and Cluck Creek, just before they join to form South Brushy Creek. This drainage then flows east, eventually into the Brazos River.

The western part of the area consists of a relatively flat upland bisected by steep canyons draining south and west into Lake Travis and the Colorado River. The uplands along Lime Creek Road rise to 1080 feet, before dropping steeply to the west into the Colorado River basin. Cypress Creek, Long Hollow Creek, and Lime Creek have cut deep canyons into the flat uplands.

Principal Features
The Buttercup Creek Karst contains numerous karst features. (See the listing and description of individual features in this report.) However, despite the large number of features the Buttercup Creek Karst has relatively little surface expression with no large sinkholes or spectacular rock outcrops. The hidden nature of this karst meant that, until technical investigations were undertaken in the area, it was not realized there was significant karst development in the Buttercup Creek Basin.

The first major cave to be discovered was Ilex Cave on the Nelson Ranch in 1986. A drain below a small sinkhole leads to a pit that drops into a flowing stream inhabited by unique salamanders with only partially-developed eyes. Then, in 1988, the inconspicuous sinkhole was found that lead into Testudo Tube, a complex meandering tube that carried surface drainage to a drop into an extensive stream passage.

The entrance to Buttercup Creek Cave was discovered in 1989. This cave, the deepest and second longest in Williamson County, is developed along fractures produced by the Cedar Park Fault. It has been explored for over 3000 feet following a flowing stream with numerous salamanders. The cave continues to where fracturing was strong enough to allow groundwater to...
break though normally impervious rocks to reach the Bull Creek Limestone. The largest of these breakthroughs forms the spectacular Texas Chamber. Below the Texas Chamber, the cave is presently blocked by large boulders at a depth of 140 feet. Airflow indicates more cave.

Like many Texas karst areas, the Buttercup Creek Karst area would be classified as a "cave karst," characterized by White (1988, pg. 116) as "regions where limestones or other soluble rocks crop out at the surface, where there are caves and a well developed underground drainage, with little surface expression in the form of closed depressions or other karst land forms."

_Gator Hole Passage in Buttercup Creek Cave_  
-Typical of the tubular passages that act like storm drains and transmit the flood pulses that distribute organic debris throughout the cave system._
Figure 1
Location of the Buttercup Creek Karst
Importance

The Buttercup Creek Karst is a significant Texas natural area. The karst is developed on a specific sequence of rock exposed in the Cedar Park Area: the soft, porous, fossiliferous limestones of the Cedar Park and Whitestone Members of the Walnut Formation. The water storage and transmission characteristics of the rocks have created an unusual underground habitat, where animals have been able to flourish uninterrupted by drought since the Pleistocene. Water from the area contributes to the base flow of several creeks: Cypress, Lime, Cluck, Buttercup, and probably even Bull Creek. The base flow of springs from the Buttercup Creek Karst is essential in maintaining the aquatic communities in and around the creeks.

The deepest and some of the most extensive caves in Williamson County are developed in the Buttercup Creek Karst. This cave development is controlled by fractures related to the Balcones Fault Zone. Most of this fracturing is along the trend of Cedar Park Fault, concentrating the caves in a narrow zone that will allow most of the karst, along with much of the underground habitat, to be preserved without encumbering large areas of land.
Geology

Stratigraphy

Along the Travis-Williamson County line, west of Cedar Park, lies a complex arrangement of soft fossiliferous limestones and interbedded marls. These rocks are of Fredricksburg age and were deposited at the same time as the lowermost Edwards Limestone and Walnut Formation were being deposited to the south. The exact extent of the various formations and stratigraphic correlations have been discussed in several papers; for an overview see Rose (1972).

Rock types exposed in the area represent depositional environments in shallow basins of limited extent. These basins migrated laterally over geologic time, carrying the rock types with them. Thus the rocks of the area resemble a classical reef sequence, in which rock type is related more to depositional environment than to age of deposition.

Several geologic interpretations have been applied to rocks in the Buttercup Creek Area. Just to the south, the Edwards Limestone is thick and underlain by the distinctive Walnut Formation. To the north of the Buttercup Creek Area, the Walnut and much of the lower Edwards is replaced by a different sequence of rocks. This northern sequence has been divided into several more restricted, relatively thin rock units. These unit names are used in this report since they provide the most detailed information.

The more familiar term, "Edwards Limestone," is not useful as a mapping unit in the Buttercup Creek Area, since the name "Edwards" has been so loosely used. The name now only indicates that the unit is a hard limestone that can be traced south into the main body of the Edwards. All of the hard, resistant limestones exposed in the Buttercup Creek area have been mapped as Edwards by some geologists, especially the Whitestone and the Comanche Peak. However, solutionally-etched exposures in caves are sensitive to variations in lithology, and none of the limestone exposed in the Buttercup Creek caves resembles the typical cherty, crystalline Edwards to the south.

The rocks present in the Buttercup Creek Area are considered in this report to be five members of the Walnut Formation, overlain by the Comanche Peak Limestone. The lowermost member is the Bull Creek Limestone, a widespread, fossiliferous limestone, overlying the dolomites of the Glen Rose Formation. The Bull Creek Limestone is, in places, composed largely of fossil shell fragments. This unit is medium- to thick-bedded, frequently with several prominent, thick, resistant ledges alternating with more recessive ledges. Rogers (1969, p. 6) reports that "the limestone and marl beds of the Bull Creek are lithologically quite variable even over small areas." At the type locality along City Park Road, west of FM 2222, the unit measures 32.6 feet thick. The Bull Creek Limestone was measured at 30.2 feet by Moore (1964) in his Section 7 along the South San Gabriel River, just northeast of the Buttercup Creek Area.

Overlying the Bull Creek Limestone is the Bee Cave Marl. At the type locality along Bee Cave Road just northeast of Austin, the unit consists of 10.8 feet of extensively burrowed, nodular limestone and marl. Further west in Bull Creek Valley, Rogers (1969, p. 7) observed that the unit has a probable thickness of 30 feet, and the combined thickness (about 60-70 feet) of the Bull Creek and the Bee Cave remains fairly constant. Moore (1964), in his Section 7, measured the unit at 33 feet northwest of the Buttercup Creek Area.

Above the Bee Cave Marl is the principal cave-forming member in the area, the Cedar Park Limestone. In the restricted sense used by Moore (1964), this is a generally massive, soft, fossiliferous limestone, 30- to 40-feet thick, sometimes with a nodular appearance due to abundant...
Generalized Stratigraphic Section in the Buttercup Creek Area

Figure 2
borings. The Cedar Park limestone of this report includes the sequence from the base of a distinctive 20-foot thick massive bed, up through 5 to 10 feet of medium-bedded limestones; it includes an upper massive bed, 6- to 8-feet thick. Moore (1964) included this upper massive bed as part of the Cedar Park Limestone in his Dies (now Milburn) Ranch section, but appears to include it in the Whitestone in his Jollyville Section. Rogers (1969, p. 8) reports that the Cedar Park thins to about 15 feet in the southeast corner of the Jollyville Quadrangle along Bull Creek.

The Cedar Park is well exposed in Hammett Hollow just north of Whitestone Boulevard in the northwestern part of the area. Hammett Shelter is developed in the medium-bedded, generally more soluble middle member, with the thick-bedded upper member forming the roof. Beneath Hammett Shelter and below the lower massive member of the Cedar Park, a shallow shelter has developed in the Bee Cave Marl.

In Buttercup Creek Cave, 55 feet of indistinctly bedded marl overlies the Bull Creek Limestone. This sequence appears to represent the lower 18 feet of the Cedar Park, shown on Moore's Section 7 as marl transitional to the Bee Cave, and combined with the Bee Cave to form a distinctive sub-surface unit. Minor divisions in the Bee Cave are also important. Moore's Section 7 indicates that the lower Bee Cave has a higher clay content than the upper part of the unit, enabling cave passages to develop at the base of the upper member, since further downward solution is blocked by the impervious clay.

In the western part of the area along and just east of Lime Creek Road, the Cedar Park Limestone is overlain by the Whitestone Formation. The name Whitestone is used by Moore (1964) to include the soft, fossiliferous, thin- to medium-bedded limestones that form a lenticular unit along the Williamson-Travis County line in the Buttercup Creek Area, and which reportedly extend north and west into Burnet County. The southeastern edge of this fossiliferous mound extends across the Buttercup Creek Karst. The Whitestone thins from about 40 feet along Lime Creek Road to become a few feet of thick-bedded limestone 2000 feet to the southeast.

To the south, east and northeast, the Whitestone grades into the Keys Valley Marl, a 30-foot thick unit of marl and nodular limestone. Much of this relatively soft rock has been removed from the Buttercup Creek Area, leaving a stripped surface developed on the top of the Cedar Park and Whitestone. The areal extent of the Whitestone may be locally limited. Testudo Tube appears to be developed in the Whitestone, but to the south along Cypress Creek, the unit thins and does not extend to the Volente Highway. Crumley's Cave, just north of Whitestone Boulevard, appears to be developed in the Cedar Park. If this is the case, the Whitestone Formation extends less than a mile to the north of the type locality. The unit may well be a series of similar, but discontinuous, patch reefs developed above the Cedar Park Limestone, and surrounded by the softer Keys Valley Marl.

Above the Keys Valley is the Comanche Peak Limestone. In the Buttercup Creek Area, this unit consists of about 40 feet of soft, white, massive- to thick-bedded, somewhat chalky limestone exposed along the south and east edge of the study area along Highway 620 and in the LakeLine Area. Many authors, including Moore, have mapped most of the Comanche Peak of this report as Edwards Limestone, but this unit is quite different from the more dense crystalline Edwards to the south.
Figure 3

Geologic Cross Section: Buttercup Creek Valley to Bull Creek Valley

Sources: Buttercup Creek Valley: Fieldwork 1989-1992
Bull Creek Valley: Rogers (1969)
Structure

Rocks in the northern part of the Buttercup Creek Area dip gently to the southeast and east about 20 feet per mile, but there is a distinct steepening of the dip in and just west of the Buttercup Creek Subdivision along the trend of the Cedar Park Fault. The Cedar Park Fault dies out just to the north of the subdivision, and has been replaced by a monocline that diminishes toward the southwest, having little expression south of the Buttercup Creek drainage. In the Buttercup Basin dips appear to be up to about 60 feet per mile to the southeast, though some of this apparent dip might be displacement along minor faults. Rogers (1969) reports that the Cedar Park Fault has a maximum displacement of about 65 feet north of the City of Cedar Park, but only 10 to 15 feet in the Jollyville Quadrangle. Fracturing parallel to this faulting controls the direction of most cave passage in the Buttercup Creek Valley.

To the south along Cypress Creek, dips are much less, about ten feet per mile to the east, there is less fracturing and fewer caves. No actual faulting has been observed in the Buttercup Creek area, but abrupt changes in soil cover and vegetation aligned along the north-northeast trend of the jointing may indicate several minor faults along the trend of the Cedar Park Fault.
Hydrology

Recharge
The gentle slopes and poorly developed drainage channels in the Buttercup Creek area allow large amounts of rainfall to be recharged into the karst aquifer. Shallow sheets of water flow relatively slowly over the surface, even after major storms. Runoff from the steeper slopes and locally impervious areas flows into the drainage channels, but, except during the most heavy rainfall, this runoff is absorbed within a few hundred feet. Some of the water appears to be entering the massive member of the Cedar Park Limestone, not through fractures, as in the Edwards Limestone, but by absorption into the porous limestone. The limestone acts like a sponge: water is absorbed into its entire thickness, then slowly permeates towards the base of the formation, finally moving laterally toward a series of tubular passages developed along the base of the Cedar Park. Thus the Buttercup Creek Karst tends to be characterized by large amounts of recharge with few point recharge features.
The section of Buttercup Creek just downstream from the junction with the Jamail Branch has been examined in detail. There is a relatively high infiltration rate in this section of the creek not due to the underlying geology, but due to storm runoff from the Jamail Branch. This creek is for several hundred feet upstream from the main channel of Buttercup Creek, developed on a marl zone just above the Cedar Park Limestone, where the Keys Valley interfingers with the Whitestone. This water enters the main channel of Buttercup Creek, which has cut through the marl and is developed on the top of the Cedar Park. Water entering the main channel gradually sinks into the bed of the creek, seldom flowing for more than a few hundred feet on the surface.

The creek channel in this area is directly above the main passage of Buttercup Creek Cave. The cave below, there is no indication of water-conducting fractures, sinkholes or collapse structures. The soft limestone walls of the cave are undisturbed, except where the surface is covered by clusters of unusual formations, the Buttercup Barnacles, hollow spherical shells, generally about one centimeter in diameter, apparently are caused by the emergence of water seeping through the limestone.

**Underground Flow**

Water flow in Buttercup Creek Cave has been observed in relative detail, and is probably typical of caves in the area. Most of the water flowing through the cave enters the system from the south, probably from many sources, but including a series of sinkholes southwest of Ilex Cave, most important being the Nelson Ranch Sink, source of much of the flood water entering the system. These flows combine to then flow north through Ilex Cave and follow a mostly water-filled passage to emerge in the south end of the main passage of Buttercup Creek Cave. It is possible that recharge on the Milburn-Cypress Creek Ranch just south of the Buttercup Creek Basin in Travis County contributes somewhat to the base flow of the cave stream, but the most of the stream flow originates from recharge and storage within the Buttercup Creek Basin. Other caves, notably Marigold and Hideaway, have streams that drain other areas to the north and west.

To the south, the groundwater divide in the Cedar Park Aquifer appears to be near the surface divide, with the water to the south of the divide flowing into surface springs that feed Cypress Creek. To the north, the water flows into the Buttercup Creek Basin. However, during periods of heavy rainfall, recharge from areas along Lime Creek Road might raise the water level along the Cypress Creek divide, and the well-developed underground conduits extending south from the Buttercup Creek Basin would divert some of this recharge through the Buttercup Creek Cave System. In karst areas, underground floodwaters can take a much different course than the normal low-flow routes.

Water observed in cave passages over a wide area flows toward the Texas Chamber, a large room that forms the downstream end of exploration in Buttercup Creek Cave. The Texas Chamber is located just north of Buttercup Creek, just west of the present end of Buttercup Boulevard. Water flow at relatively high elevations in western part of the karst is generally to the east and northeast. This water flow is developed on impervious beds in the Whitestone. East of the Whitestone outcrop, flow along passages developed at the base of the Cedar Park Limestone is to the east northeast through the Ilex-Buttercup Creek Cave System to the vicinity of the Texas Chamber where this water drops through the Bee Cave Marl down into the underlying Bull Creek Limestone. Water flow in Hideaway Cave, located about 0.3 mile west of the Texas Chamber, generally south and southeast toward the Texas Chamber.

Some of the water entering the Bull Creek Limestone in the vicinity of the Texas Chamber probably comes from more distant sources. Water entering Crumley's Cave, a major recharge feature in the Bed of Cluck Creek just upstream from Whitestone Boulevard, a mile and a half...
of the Texas Chamber, is reported to flow south toward the Buttercup Creek Area (Texas Speleological Survey files). The Marigold Cave stream also flows toward the Texas Chamber, and appears to originate from a section of the Cluck Creek drainage northeast of the Texas Chamber. This stream is developed in the Bee Cave Marl, near the base of the formation, but above the Bull Creek Limestone. The area of the Bee Cave Marl that is a pure enough limestone to allow cave formation is apparently limited. Further exploration along Buttercup Boulevard will help to delineate the area of cave formation in the Bee Cave Marl.

As soon as possible, detailed studies should be undertaken to measure the water quality and quantity in the cave streams. Activated charcoal detectors could be analyzed for impurities, and bottles placed at intervals above the cave stream could provide an inexpensive method of sampling a flood pulse. If the stream hydrograph could be recorded, much additional information could be obtained. For example, in the Marigold Cave stream, a rapid rise in water level after a rain event would indicate that the water enters the cave from a near-by sinkhole.

Resurgence

Considerable amounts of water enter the Buttercup Creek Karst, but the ultimate fate of this water is still not certain. Possible resurgences for this water range from springs that flow into South Brushy Creek east of Highway 183; to springs to the south across the divide in Colorado River drainage that form the headwaters of Bull Creek. The Bull Creek Valley is at an elevation below 800 feet msl, 6 miles to the south of the Buttercup Creek area; the cave-forming limestones of the Buttercup Creek Area dip generally to the east and southeast to their outcrop along Bull Creek. These formations could channel water under the Jollyville Plateau into the Bull Creek drainage (see Figure 3).

Wells in the Shenandoah Subdivision (a mile west of Highway 183 and north of RM 620) have a water surface about 200 feet below the land surface, at an elevation of a little under 800 feet, also an indication of possible underground water flow to the south. The water level in the abandoned windmill on the Nelson Ranch southeast of Testudo Tube was 167 feet below the surface on September 12, 1991 (or at an elevation of about 823 feet msl). Buttercup Creek Cave has been explored down to an elevation of 820 feet msl without reaching the water table. It is four miles east to lower elevations along Brushy Creek, and only five miles south to even lower elevations along Bull Creek. Since the Bull Creek Limestone is not exposed to the east, it would seem more likely the water would follow fractures along the strike to the south rather than migrate stratigraphically upward to reach springs to the east. The springs along the lower reaches of Cluck and Buttercup Creek do not seem large enough to account for much of the recharge observed. Smaller springs with only local catchment areas exist along all the west flowing creeks.

If water from the Buttercup Creek Area does flow south into Bull Creek, the most likely resurgence is Spicewood Springs, located about three miles east-northeast of Four Points in the Bull Creek Valley near the confluence of two main branches of Bull Creek, at an elevation of 750 feet msl. This large spring is estimated by Raymond Slade, Jr. (of the United States Geological Survey) to normally flow about 1 to 3 million gallons per day (personal communication, 1991). While much of the spring flow originates from the several square miles of Edwards and other limestones that outcrop upstream from the springs, the spring appears to flow from the Walnut, indicating that the Walnut is locally capable of transmitting water, and that some of the flow could originate from the Buttercup Creek area. According to Rogers (1969), the top of the Cedar Park in the vicinity of the spring is at an elevation of 840 feet, placing the spring 90 feet below the top of the Cedar Park Limestone, probably in the Bull Creek Limestone member. Spicewood Spring flows from openings in the bed of the creek, along a stretch of several hundred yards. Raymond Slade, Jr., also points out that this spring is the largest spring in the Austin Area after Barton Springs that is not covered by a man made lake, and thus deserves special attention. This spring
should not be confused with the other, much smaller, Spicewood Springs just west of the Mopac Expressway in north Austin.

A study should be conducted to determine where the water in the Buttercup Creek Karst eventually reaches the surface. Several types of non-toxic tracers (including florescent dyes, optical brighteners, and dyed spores) have been found to be effective in karst terrains. A combination of tracers should be selected so that several tests can be conducted simultaneously. The tracers should be placed in the major cave streams, with detectors located along South Brushy Bull, Cypress, Long Hollow, and Lime Creeks, and in Spicewood Springs. The same tests should be repeated under conditions of high and low flow.
Speleogenesis

The same chalky, porous limestone that allows water percolation through the entire rock unit tends to discourage the development of open fractures, and, in the long term, the development of caves. Water flowing through the entire mass of the limestone is saturated with calcium carbonate after a few feet, and so does not form cave passages. In addition, this soft rock does not fracture readily, even when stressed by nearby folding and faulting. Fractures in the Buttercup Creek area are widely spaced, and, even when present, are frequently discontinuous; they do not transmit water. In general, caves are relatively rare in chalk, and in the Cedar Park Limestone, caves typically occur in the few areas of strong local fracturing.

That fracturing is the important controlling factor in cave development in the Buttercup Creek Karst is evident from a cursory glance at the distribution of the known caves (Figure 6). They are clustered in a relatively small area along and near the end of the Cedar Park Fault. As the intensity of fracturing decreases away from the end of the fault, the number of caves declines.

In the Edwards Limestone to the south, solution is widespread, with relatively large amounts of limestone removed, perhaps up to 5 percent of the entire formation. Commonly, there are several laterally-extensive solution zones 5 to 20 feet thick where most of the original bedrock has been removed, leaving deposits of chert, clay, and other insoluble residue. Throughout the Upper Edwards, there are solutionally-widened joints and streaks of red clay.

Solution in the Buttercup Creek Karst is much more limited, being confined to a few local areas, both geographically and stratigraphically. In places, there is some red clay and other evidence of general solution in the upper part of the Cedar Park. In a few areas, quarrying in the Whitestone has exposed filled sinks, but these are relatively rare. Caves large enough to be explored are developed in the Cedar Park Limestone mostly along the base of the formation, and, in the Whitestone, along joints above some of the more impervious members. Cave development is similar in both formations, though the Whitestone outcrop is further from the Cedar Park Fault, so both joints and caves are not as numerous. In both the Whitestone and the Cedar Park Limestones, the overall cave trends are controlled by fracturing. However, the individual passages in both formations are frequently sinuous tubes with little apparent joint control.

Some passages can be followed to where they break through resistant beds to a lower level in pits formed along a strong fracture. Most of the water appears to eventually flow down through a locally soluble facies of the Bee Cave Marl, and end up in the Bull Creek Limestone. Cave development in the Bull Creek has not yet been studied, but extensive cave passages must have developed in this formation.

Surface water entering the limestone is concentrated along the base of permeable sections and follows fractures and other zones of low resistance downdip, eventually forming a somewhat dendritic pattern of tubular passages. These tubes generally enlarge downstream and can carry large amounts of water after heavy rains. Most of the presently accessible caves were initially developed below the water table by slowly flowing water. Evidence of this stage of development is the delicate solutional features like the Filigree Wall in Dollar Pit in Buttercup Creek Cave. Then, climatic change or downcutting by surface streams lowered the water table, draining the cave passages. Free-flowing streams of almost saturated water then occupied many of the passages, forming numerous travertine dams throughout these tube systems. Then the water table rose, flow velocity was greatly lowered, and many of the tubes were filled with red clay. The water table has now fallen again, and surface water is eroding the red clay and old travertine deposits. The most likely cause for the rise of the water table was the wetter climate during the Pleistocene. Then, as now, the water had to flow a long distance before reaching a surface spring, and the increased rainfall forced more water through the long, probably somewhat constricted passages, raising the
The Filigree Wall in Dollar Pit, Buttercup Creek Cave
-Delicate structures such as this wall indicate that most of the cave was initially enlarged by slow moving groundwater in water-filled passages.
water level in the Buttercup Creek Area. This chronology also provides a source for the red clay: it was formed on the surface in the more humid climate.

A similar history of cave development has been proposed by George Veni for Honey Creek Cave (1992). He found evidence of calcite deposition in cave passages prior to flooding at the onset of the last Ice Age, about 115,000 years ago. Water levels in the Honey Creek area dropped about 25,000 years ago.

Several specific factors have combined to form a significant localized karst in the Buttercup Creek Area. The Cedar Park Limestone Member of the Walnut is exposed over much of the area and enables large amounts of surface water to enter the karst. The fracturing of this limestone along the trend of the Cedar Park Fault provided numerous pathways for this water. In the most strongly fractured zone along Buttercup Boulevard, the fracturing was strong enough to initiate cave development in the Bee Cave Marl. In Buttercup Creek Cave, a significant groundwater conduit, solution has cut entirely through the normally impervious Bee Cave to reach the underlying Bull Creek Limestone, providing a drain for the area and allowing rapid development of solution features. In Marigold, Hideaway, Cedar Elm, and Boulevard Caves, stream passages have developed on impervious beds in the Bee Cave Marl. Stream passages in Hideaway and Treehouse Caves are developed on or near the base of the Cedar Park Limestone. All these streams appear to flow toward the Texas Chamber.
Favorable conditions exist for the development of cave passages in the Bull Creek Limestone that could carry water south into the Bull Creek drainage. Rogers (1969) indicates a rectilinear grid of minor faults that extend from the Buttercup Creek area, trending south-southwest and east-southeast into the Bull Creek Valley. This faulting and the relatively steep dips to the northeast, along the south edge of the Bull Creek Valley, produced a depressed area in the resistant Edwards that was easily eroded to form a surface valley that channeled water to the east from the structural high near Four Points at the intersection of FM 620 and RR 2222. The present east-flowing branch of Bull Creek follows this structural low. The south-flowing ancestral Bull Creek was able to capture this east-flowing drainage, greatly enlarging the Bull Creek drainage area and enabling it to cut a deep valley far into the Jollyville Plateau. This valley provides a potential a drain for water entering the Bull Creek Limestone several miles to the north.

Passage development, Tally-Ho Tube, Buttercup Creek Cave
-The half-tube in the ceiling is part of an old upper level. The now-eroded travertine dams were likely formed under much different climatic and soil conditions than exist at present, and well before the arrival of cattle in the area led to the erosion of much of the soil and changed the amount and type of recharge.
Biology

Introduction

The cave-adapted animals that live in the Buttercup Creek Karst generally are relict populations, survivors from now-extinct surface populations. Among the species living on the surface at any given time, there are generally some that are preadapted to the cave environment. They are small, can eat the type of food available in caves, and do not require large amounts of energy. A few members of these preadapted species will enter the cave environment and live there, but since the vast bulk of the population still lives on the surface, and since animals enter and leave the cave, the genetic makeup of the population will be controlled by the surface population. However, if, due to climatic change or other factors, the surface population is eliminated, the few remaining individuals living in the caves are able to adapt to the underground environment since there is no large population of surface animals to dominate the genetic makeup.

The ancestors of the salamanders now living in the cave streams were once widespread on the surface across Central Texas, but, with the gradual drying of the area, the surface population retreated to the east, leaving isolated groups behind in caves and springs. These relict populations were then free to develop into the type of animal that could best survive in their new environment. The sudden change from the sunlit, food-rich, surface environment to the dark scarcity of the cave induced relatively rapid genetic change. Eyes and protective coloration were no longer needed. The metamorphosis to a sexually mature adult that hunted food on dry land was no longer advantageous, since there was more accessible food in the aquatic environment. The salamanders presently inhabiting the Buttercup Creek Karst have lost their eyes, pigment, and ability to metamorphose, and may have developed into a distinct new species (personal communication 1991, Paul Chippendale, University of Texas at Austin).

Across Texas, almost enough time has passed since the surface salamanders moved away for the now isolated populations of *Eurycea* to evolve into separate, distinctive species. The present is also unfortunately the time of maximum taxonomic confusion for the salamander genus *Eurycea* in the Texas caves. The first genetic changes in the genus, occurring relatively rapidly, are the loss of eyes and pigment to create a distinctive salamander, quite different in casual appearance from their surface ancestors. At this point, a biologic examination of these animals will find many genetically similar, but isolated, populations. They are still similar because, except for the loss of eyes and pigment, they have not changed much, from their surface relatives. Yet they are not interbreeding populations because they are trapped in each isolated cave system. The taxonomic status of these populations is difficult to determine, since many biologists disagree about the exact differences necessary for isolated populations to qualify as a separate species. At the same time, modern molecular biology has made possible much more precise determination of the actual genetic differences.

The life history of many of the other cave-inhabiting animals is similar to the salamanders. The removal of the surface population due to climatic change, elimination by a more successful competitor, or other reason, has left the surviving cave populations free to evolve. Some of these animals have adapted so well to the underground that they have been able to utilize the entire underground, not just living in small groups around entrances. While most of the population is still clustered around food sources, some of the animals are able to find food far away from the large entrances and colonize new habitats. The small beetles are particularly able to spread throughout large areas. The types of animals inhabiting caves also include many animals that more properly should be considered a soil fauna, they live mostly in dirt-filled cracks and only enter caves when the cave environment is moist and similar to their soil habitat.
The unique sequence of limestones exposed in Buttercup Creek Karst creates a special habitat, unique in Texas. The area, less than five miles north to south and perhaps four miles wide, cannot be considered an isolated ecosystem, yet at the same time it is not large enough to escape being affected by individual events. The aquatic habitat, especially, is unlike any other area in Texas. The porous nature of the rock allows the relatively small area to store large amounts of groundwater and provides reliable flow to numerous small streams. These streams are frequent, freely flowing along a cave passage, very similar to surface streams, and completely different from the deep, water-filled solution zones of the Edwards Aquifer to the south. Water in the Edwards solution zones moves very slowly, unlike the swiftly moving water common in the Buttercup Creek Area.

The salamanders presumably feed primarily on crustacea, relying on amphipods as a prime food source since they are the most abundant type of crustacea. Few amphipods are seen in salamander accessible areas, but in small isolated pools they are numerous. Amphipods are detritus feeders who convert energy in the form of leaf particles and other surface debris to food the salamanders can utilize. Interruptions in this supply of organic material, or in the periodic floods that distribute the food throughout the system, will endanger the entire aquatic community.

Endangered and Threatened Species

A study of endangered cave invertebrates in the Austin area (Reddell, 1991) contains a checklist by Elliott and Reddell that lists ten caves in the Buttercup Creek Area from which endangered species have been identified. Since that publication, four additional caves have been found to contain endangered species.

The small beetle that somewhat resembles a large red ant, Rhadine persephone, was identified from ten caves in the Buttercup Creek Area: Broken Arrow Cave, Good Friday Cave, Hideaway Cave, LakeLine Cave, Marigold Cave, Raccoon Cave, Testudo Tube, T.W.A.S.A Cave, and is now known from recent collections in Boulevard Cave, Cedar Elm Sink, Bluewater Pit, Treehouse Cave, and Harvestman Cave, a small cave just across the pipeline road from T.W.A.S.A Cave. In addition, LakeLine and Underline Caves contain the protected harvestman Texella reyesi, which is protected because animals of this new species were originally included in the new species Texella reddelli, a federally-listed species. Further studies of Texella with additional collections indicated there were two distinct species. More revisions might be expected in the list of endangered species, since many of the species are known from only a few individuals.

Even though Rhadine persephone is the 'most common' endangered species (in that it has been found in the most localities), it is still rarely encountered, and is not present in all caves. This beetle appears to inhabit the near subsurface, areas where organic material from the surface is present, but not plentiful enough for surface beetles. Thus, this animal is found in many relative small caves, and is absent in some of the larger caves. Additional collecting over a period of time will probably locate this beetle in more caves, and give an idea of its actual distribution in the underground. This animal is especially susceptible to general disruption of the surface, since it appears to be confined to depths of less than thirty feet. This is also the endangered species most likely to be adversely affected by the imported fire ant since its entire range is open to invasion. This species is known only from the Buttercup Creek Area and the Jollyville Plateau just to the south.

The factors that confine Rhadine persephone to the near-surface are not well understood. This makes it difficult to determine the best measures to protect the animal and the size of the preserves needed. This near-surface zone is characterized by variations in temperature and humidity, combined with relatively large amounts of organic material, in the form of roots and organic particles in a substrate of black clay derived from surface soil. Below this zone, almost exclusively inhabited by R. persephone, is a zone inhabited by R. subtierranea. This lower zone...
has smaller variations in temperature and humidity with only a few concentrations of organic material on a substrate of damp red clay. *R. persephone* could be confined to the near-surface by the availability of food, in that it can find food faster, but less efficiently, than the more cave-adapted *R. subterranea*, or it might feed on an entirely different food, not present in the lower zone. Even if both species eat the same food in the same concentrations, the more cave-adapted animals might not be able to survive the temperature changes and the low and variable humidity of the near-surface, especially during and after storm events. Since the energy inputs to the near-surface are exclusively local, relatively small preserves might be adequate to protect *R. persephone*. However, it is essential to understand the factors controlling the distribution of the species before establishing management practices, since many apparently suitable habitats have no *R. persephone*.

The other endangered species reported from the Buttercup Creek karst is a new species of harvestman. This animal, in the genus *Texella*, is much more cave-adapted and is usually found in relatively food-poor areas. The species ranges from Georgetown in the north to Austin in the south, and, like most of the endangered species, is nowhere very numerous. It is possible that this animal is able to colonize distant areas through underground dispersal, since all of the reported localities for this species are in a geographically and geologically contiguous area. The only potential barriers crossing their range are Brushy Creek and the North and South Forks of the San Gabriel River. Brushy Creek is above the water table through parts of Round Rock, but the San Gabriel River appears to be a more formidable barrier, and might indicate that the surface ancestors of *Texella* initially colonized several caves.

It appears likely that the salamanders present in caves in the Buttercup Creek area are a unique species and will be listed as an endangered species due to their limited habitat and susceptibility to outside influences (personal communication 1991 and 1992, Paul Chippendale, University of Texas at Austin). Salamanders are particularly threatened, since they are at the top of the food chain and will concentrate pollutants. They are especially affected by heavy metals, since they have become adapted to the cave environment which has heretofore been free of this type of contamination. Small applications of copper sulfate applied to the surface for control of algal growth, for example, could eliminate much of the population (personal communication, 1960, Bryce Brown, Baylor University). These cave-adapted salamanders have been collected from Ilex Cave, Buttercup Creek Cave, T.W.A.S.A Cave, and Treehouse Cave, and are present in Salamander Squeeze, Two-Holer Cave, Buttercup Drain, Whitewater Cave and Hideaway Cave.

Paul Chippendale reports (personal communication, 1992) that the salamanders in Testudo Tube appear less cave-adapted than salamanders from other caves in the area. Testudo Tube salamanders appear similar to populations existing in nearby springs — the closest locality is a spring on the Audubon Preserve about a mile to the southwest, probably Stewart Spring. The Testudo Tube stream derives its flow from a shallow aquifer, perched on impervious beds in the Whitestone Formation. Water apparently also flows south from this aquifer into the Cypress Creek drainage, providing the flow for small springs. The springs actually flow from the base of the Cedar Park Limestone, but receive water from the overlying Whitestone. Spring salamanders have been able to colonize this shallow aquifer, and the presumably more efficient cave-adapted salamanders in the lower caves have not yet been able to reach this relatively isolated system.

It is obviously the best strategy to consider the salamanders as an endangered species, since they are under active study, and at present appear to be endangered. If plans were developed that did not consider the salamanders possible endangered or threatened status, these plans would have to be revised if the salamanders were later listed as an endangered species.

**Other Species**

The cave fauna that are not classified as endangered include a wide variety of forms. Cave crickets of the genus *Ceuthophilus* are common, frequently clustered around cave entrances in
large groups. Harvestmen frequently form interlocking masses just inside entrances. Both groups mostly feed outside caves, and their droppings are an important source of energy input into the cave. However, cave crickets also do well in the underground and are found throughout most caves. Springtails, a tiny white animal less than a tenth of an inch in length, from the base of most of the in-cave food chain, and are widely distributed and very numerous where organic matter accumulates. Spiders of the genus *Cicurina* are common, feeding on the springtails and other small invertebrates. Both of the common central Texas genera of cave-adapted millipedes, *Camb* and *Speodesmus*, are found in the Buttercup Creek Area. A number of cave-adapted beetles have been collected in the area. A *Rhadine* beetle, probably *Rhadine subterranea*, is relatively common in many of the caves.

Silverfish and terrestrial isopods are present, as well. No troglobitic scorpions have been seen in the Buttercup Creek area, even though many of the caves seem to be ideal habitat and scorpions are frequent in nearby caves. The aquatic isopod *Stygobromus russelli* is common in pools that do not contain salamanders. The imported fire ant is a recent inhabitant of many of the cave entrances, one which tends to eliminate other forms of life where it is common. The distribution of fire ants tends to be limited to entrance areas where there is organic surface dirt and relatively high energy input. They do not appear, in general, to enter caves through small cracks away from known entrances. Isolated colonies have not been found, even in shallow caves, away from the humanly traversable entrances. This might just be a temporary condition, since the fire ants appear to be generally increasing their presence in caves.
Land Development

Introduction
Residential land development has taken many forms in the Greater Austin area, with variations in density and impervious cover resulting both from regulatory strategies and economic factors. In the last few years, there has been an increasing amount of environmental legislation in an attempt to protect especially unique and sensitive habitats. Legislation that prohibits or limits developments on steep slopes and in flood plains has generally been accepted, but the establishment of greenbelts, and protection of natural areas has been more controversial, and present attempts to regulate land use to prevent destruction of the habit of endangered species have been the most controversial and conceptually difficult of all proposed measures.

While there are some potential economic benefits from the establishment of protected natural areas, these benefits accrue mostly to future property owners in increased values of adjacent property, while the expense and loss of revenue falls mostly on the present developer. To preserve the large areas deemed necessary for the protection of endangered species (especially for bird habitats), two methods have been proposed, essentially purchase and zoning. However, without the power to zone land for conservation use, it will be difficult to raise funds sufficient to purchase large areas. For smaller natural areas, greenbelts, community parks, and perhaps even cave preserves, it should be possible to arrange some type of allocation plan so all can share in the cost and benefits. Before large sums of money and many acres of land are dedicated to environmental protection, detailed surveys (such as this study) should be conducted to insure that the proper areas are protected.

A figure (#9) in a previous study, The Status and Range of Five Endangered Arthropods from Caves in the Austin, Texas, Region, by Elliott and Reddell (revised Dec. 1989), indicates that the entire area from the present edge of development (just west of Marigold Cave) west into Travis County should be part of the "a habitat protection plan area," but notes that "specific boundaries can only be determined after a detailed study is conducted by a karst hydrogeologist." The protected area originally proposed was about 2000 feet wide and 7000 feet long, or about 320 acres. The Balcones Habitat Conservation Plan (then BCHP, now BCCP for "Balcones Canyonland Conservation Plan") further refined the protected area to enclose all the known caves, with the idea that it could later be amended. The present study, based on detailed examination of the caves, indicates that these early estimates were remarkably accurate. The major change recommended by this report is to include within the preserve much of the upstream Buttercup Creek drainage. Impervious cover in this area would produce runoff that would cross the entire karst area. The caves in the Buttercup Creek Karst are like a series of storm drains, and street runoff would quickly spread throughout the system. However, the Chuck Creek drainage does not seem as sensitive, since much of the surface drainage soon leaves the karst. Nonetheless, there are sensitive areas within the Chuck Creek drainage that should be protected, especially around Marigold Cave, and upstream from Crumley's Cave, both important groundwater conduits.

It would be desirable to protect the entire surface of the karst in the Buttercup Creek Area, a procedure which would give maximum assurance that the caves and their ecology would remain viable. Still, a considerable degree of protection can be given the karst by protecting the Buttercup Creek Basin upstream from known significant features, combined with much smaller preserves around outlying features.

One major problem with development over a karst aquifer is that, even if most urban runoff can be channeled away from the karst, widespread seepage of fertilizers, pesticides and other
contaminants from non-point sources in subdivisions could damage the underground ecology. Even if the maximum recommended area is protected, this area will be surrounded by developments, and large amounts of pollutants will still enter the subsurface. Given this reality and economic reality, the best strategy is to use the resources available to totally protect only the watersheds that drain directly into the cave systems. Buffer areas would still be required around isolated caves and sinkholes. This plan would be similar to those in Austin's 1969 Comprehenssive Watershed Ordinance, with additional protection of core karst areas.

This report also outlines an especially sensitive Confluence Area, (Figure 5) comprising approximately 45 acres around Buttercup Creek Cave, that should be carefully preserved since it overlies or drains directly into known cave systems. Runoff entering this area and essential road crossing this area should be carefully controlled.

Fieldwork has found that cave development in the Buttercup Creek area is strongly controlled by fracturing, which has concentrated much of the cave development in a narrow band extending from the present end of Buttercup Boulevard west-northwest across Buttercup Creek almost to Travis County. The surface expression of this trend is a line of sinkholes that show strong evidence of fracturing. In the subsurface, these sinkholes are connected by cave passages that carry the drainage down into the lowest cave levels. To preserve only the surface above this highly integrated drainage system will require a zone averaging 500 feet wide and about 4000 feet long, about 45 acres. These 45 acres include surface drainage areas that feed the underground streams and will insure that a large part of the Buttercup Creek Karst is functioning in its natural state.

Recommendations
Since the different physiographic areas require different degrees of protection, the Buttercup Creek Karst has been divided into several areas (see Figure 4) and the protection appropriate for each area is discussed in the following section.

Area 1 is the Buttercup Creek Drainage Basin upstream from the Confluence Area. The Buttercup Creek Basin has been divided into two physiographic areas: Area 1A, the relatively fluvial land along the Colorado River Divide; and area 1B, the Buttercup Creek Basin, a more steeply sloping region directly upstream from the Confluence Area. Area 1A is underlain mostly by the Whitestone Formation and produces relatively little runoff, except after infrequent heavy rains, resulting in poorly developed and widely spaced drainage channels. Runoff is limited due to the low slopes, which have relatively thick soil and are covered with vegetation. Development in this area would greatly increase the impervious cover and result in large amounts of potentially pollutant runoff from streets and buildings. It might be possible to mitigate some of the effects of this runoff through well-designed and well-maintained structural controls. However, even with structural controls, the runoff produced will greatly exceed the current runoff, both in volume and in concentration of pollutants. Structural controls also do not affect direct groundwater recharge from yards and drainage ditches upstream from the control structures. The total effect of all pollutants entering the underground environment must thus be considered. It is likely, for
example, that stress from unfamiliar contaminants in the surface recharge from sinkholes would reduce an animal's ability to cope with pesticides seeping directly from yards. It is recommended that development in area 1A be limited to residential development with conservative structural controls.

Area 1B is the central Buttercup Basin just upstream from the Confluence Area. It is developed in the transition zone between the Whitestone Formation and the Keys Valley Marl. Drainage channels are relatively well developed, and slopes are steeper. Hydrologic studies in this report indicate that the water flowing through Buttercup Creek Cave originates almost entirely within the Buttercup Creek Basin upstream from the cave. If the entire upstream area is developed, surface runoff over the cave area will greatly increase. For extended periods, all the recharge to the cave would be from urban runoff, and the water in the cave streams would be almost entirely surface runoff. Measurements of the water quality in the Marigold Cave stream should give some indication of the water quality achievable after development. Until long-term studies demonstrate the ability of cave animals to survive in the water quality actually achievable, Area 1B should be left undeveloped to provide a buffer from urban runoff.

Area 2 is the westernmost Buttercup Creek Subdivision, extending from the presently developed area west to the quarry along Lime Creek Road. This area has a relatively smooth surface with few drainage channels. Midway through this section is a broad valley north of the present end of Buttercup Boulevard. Much of the runoff flowing toward Buttercup Creek is absorbed in this valley, which appears to be partly solutional in origin. Large amounts of water did not flow from this valley and cross the extension of Buttercup Creek Boulevard even after heavy rains of December, 1991. Very little surface water from this area ever reached Buttercup Creek. The fractured surface, the relatively large number of solution features, the vegetative cover, and deep soil in the valley area reduce runoff and encourage recharge. The drainage ditch extending from the end of Buttercup Boulevard cuts through about 6 feet of bedrock, exposing much red clay and many solutional openings. Holes in the bottom of this ditch absorb all the flow along the ditch. This is probably a typical substrate in the southeastern part of the area. Area 2 is in close proximity to the Buttercup Creek Cave System, and drainage from this area undoubtedly reaches the cave system. The quality of water recharged from this area should not be endangered. Development in Area 2 should be limited to essential connecting streets.

Area 3 is the Jamail Branch drainage located just to the west of the Confluence Area and comprises most of the area of direct drainage into the Jamail Branch of Buttercup Creek. This area is separated from the general Buttercup Creek drainage due to its special sensitivity. Water entering the Jamail Branch flows over a major point recharge feature and into Buttercup Creek, just upstream from Buttercup Creek Cave. Some short segments of the Jamail Branch are developed on the impervious beds in the Keys Valley Marl and have little recharge, but much of the channel is developed on the fractured Whitestone Limestone, and so there is probably considerable recharge in these sections. Urban runoff should be prevented from reaching the Jamail Branch. Development in this area should be limited to essential connecting streets.

Area 4 is the Buttercup Basin just downstream from the Confluence Area. This area has only a few surface karst features, but infiltration probably enters the cave system somewhere below the presently explorable parts of the system. A group of sinks in this area extends into the Bee Cave Marl, indicating that water is reaching the deeper cave system. During the study period, surface runoff was seldom observed to reach the main channel of Buttercup Creek even after heavy rains. Drainage from areas of limestone pavement would flow several hundred feet and sink into loose material. At a minimum, the area around the Bluewater Sink should be protected and urban runoff channeled downstream as far as possible.
Area 5 is a relatively flat area south of the Confluence Area on the Jamail Ranch. This area probably deserves the same high level of protection as the Confluence Area, since much of its drainage enters sinkholes just upstream from the Ilex-Buttercup Creek Cave System. It is likely that further exploration and dye tests will extend the main cave system under this area. At that time, this area should be added to the Confluence Area. The sinkholes in this area provide direct input into the cave system and need protection. It is recommended that no development occur in this area.

Key to Features

1. Buttercup Creek Cave
2. Ilex Cave
3. Boulevard Cave
4. Hideaway Cave Area
5. T.W.A.S.A Cave Area
6. Cedar Elm Sink Area
7. Good Friday Cave / Salamander Squeeze Area
8. Two Holer Cave Area
9. Flesh and Blood Cave / Link's Cave Area
10. Testudo Tube Preserve
11. Buttercup Drain
12. Hunters' Lane Cave / Discovery Well Area
13. Nelson Ranch Sink
14. Bluewater Pit Area
15. Crumley's Cave Area
16. Hammett Hollow Cave
17. Marigold Cave
18. Treehouse Cave
BUTTERCUP CREEK KARST AREAS RECOMMENDED FOR ENVIRONMENTAL PROTECTION

WILLIAMSON CO., TEXAS
Compiled by William Russell - June 1993

Figure 4

SYMBOLOGY

DRAINAGE
FENCING
STREET
MAJOR STREET
TOPOGRAPHIC BREAK

WHTSTONE BOULEVARD
CEDAR PARK

BUTTERCUP CREEK BLVD.

Buttercup Creek Subdivision

CONFLUENCE AREA

OUTLINE OF SENSITIVE AREA

CYPRESS CREEK RD

POSS 1990
Summary of Recommendations

The area recommended for preservation is outlined in Figure 4. This area is essentially the Buttercup Creek drainage upstream from Buttercup Creek Cave. Limiting development in this area will protect the drainage into the cave system. The entire area is important for the survival of the underground ecology. The caves of the Buttercup Creek Area are essentially a series of conduits that carry groundwater toward a geological drain formed below Buttercup Creek Cave. Poor quality runoff entering the drainage channels upstream of the caves will quickly sink into the limestone and spread through the entire system with little change in quality. The karst will be especially affected, since there is at present little runoff, except after major storms, from much of the relatively flat area along the Colorado River divide. After development with the greatly increased amount of impervious cover, considerable runoff will be generated even after minor storm events. This additional runoff will be of very poor quality and will seriously impact the downstream karst.

The especially sensitive Confluence Area should be protected as soon as practicable. Other areas can then be added, as resources are available. This critical Confluence Area begins as a zone about 200 feet wide that extends west form the present end of Buttercup Boulevard. The north boundary of this area extends west southwest to intersect the Nelson Ranch boundary fence at a gate where the fence turns north-northwest. The boundary then jogs south to Buttercup Creek at its junction with the Jamail Branch, then follows the Jamail Branch Southwest to the south boundary of the Nelson ranch. The boundary then turns east following the Nelson Ranch south boundary to just east of Ilex Cave, then north-northeast to cross Buttercup Creek about 600 feet downstream from the Jamail Branch, continuing to the Nelson Ranch North boundary, then east-northeast to the Buttercup Creek Subdivision, and then north to the end of Buttercup Boulevard (Figure 5).

An obvious problem is the extension of Buttercup Boulevard to the west to connect with LakeLine Boulevard or any other major arterial. The initial part of any extension will have to extend across some of the most sensitive karst, where fractures and sinkholes lead directly into the underlying cave systems. Any extension of Buttercup Boulevard would presumably curve south to cross Buttercup Creek and then trend west to the south of the karst. Detailed studies would be necessary to establish if there is an acceptable route through the karst, and what methods of mitigation would be necessary.

Buttercup Boulevard drainage, along with any other drainage crossing the fracture trend west of the present end of Buttercup Boulevard, should be in a drainage pipe or concrete channel from a few hundred feet upstream from Buttercup Boulevard to the Nelson Ranch Boundary, to prevent relatively large amounts of street runoff from entering the karst after storm events.
Conclusions

The proposed Buttercup Creek Karst Preserve, comprising much of the Buttercup Creek drainage upstream from Buttercup Creek Cave combined with setbacks around sinkholes and caves outside the Buttercup Creek drainage, together with structural controls, should provide adequate protection to the unique ecological system that underlies the surface channel of Buttercup Creek. This detailed study was undertaken to outline the most critical areas of the karst, so that the maximum amount of protection could be obtained for the least cost. It was found that the Buttercup Creek Karst was arranged so that protecting the drainage area upstream from Buttercup Cave can give a considerable degree of protection to the entire underground life support system.

The exact boundary of this area will require further studies, but it should include the area south of Ilex Cave that drains into the Nelson Ranch Sink. Floodwaters entering this sink are the major source of organic material entering the Buttercup Creek Cave system, and are responsible for the relatively high population density of cave animals.

The cave habitat is unique and characterized by extreme consistency. This makes it especially valuable for scientific study, with its low population density, relatively few species, and only very slow changes in the environment. Unfortunately for the cave animals, this lack of environmental diversity has lead to the loss of the animals' ability to cope with chemical and physical changes. In many cases cave animals have lost their ability to survive in conditions that could be easily tolerated by surface animals. The type of event that causes local "fish kills" in surface waters will endanger the entire cave ecology.

However, this protection will require the cooperation of several landowners. The protection only works if the entire preserve is established. The southernmost part of the proposed preserve protects the drainage area that supplies the food directly into the cave system; the central part protects the main cave stream; and the northern and western sections protect groundwater inputs.

The future is uncertain, but planning can reduce these uncertainties. Everybody, except perhaps lawyers, benefits from rational, planned development. Nature is protected, developments can proceed without interruption, and the public is provided with affordable housing without undue damage to the environment.
Acknowledgments

I would like to acknowledge first of all Bill Larson, whose interest in the caves of the Buttercup Creek area has made this report possible. The cooperation of the University of Texas Grotto and of its individual officers and members is greatly appreciated. The Texas Speleological Survey provided much invaluable data on the area. And without the encouragement and support of Pat Larson, many of the trips to the Buttercup Creek Karst would not have been possible.

Special thanks go to Mike Warton for sharing his familiarity with the karst and his historical observations. James Reddell, Bill Elliott, and Paul Chippendale gave generously of their time to discuss the cave biology. Without the continued efforts of James Reddell of the Texas Memorial Museum in the cataloging of biological collections from caves, there would be much less known of the animals inhabiting the caves of the Buttercup Creek Karst (as well as many other areas). Many individual cave explorers helped to map and explore the caves of the area and without them this report would not be possible. Katie Arens' editorial and computer skills have made the preparation of this report possible. Appreciation is also extended to Helen Besse and Michael Grimm for their editorial comments. The suggestions and assistance of Susan Lasko and Peter Sprouse were helpful in layout and photography.
References


The descriptions in the following list are complete up to about July, 1992. For more recent information, contact the Texas Speleological Society or cavers active in the area. Several additional features have been investigated by Mike Warton and Associates since these descriptions were prepared, including a large shallow sink north of Caliche Sink and a new endangered species locality, a small cave named Harvestman Cave, just east of T.W.A.S.A Cave. Several smaller features on the Jamail Ranch west of Testudo Tube, including Persimmon Well and Root Cave, are not included in this report since no accurate locations or descriptions were available. Little Fern Sink, described by James Reddell and located across Lime Creek Road (possibly on the BCCP property), is also not included.
Description of Karst Features

Huntsch Creek Karst

Williamstown, Texas

Canyon County

Williamson Hills

July 1987
Introduction

The features described are arranged alphabetically. To find a feature when only the location is known consult the area location map (Figure 6) to find the number of the feature, then look-up the name in the numerical listing. The location map is not intended to be sufficiently detailed to insure that the features can be easily visited. Many of the features are small and far from identifiable landmarks on flat brushy terrain, and without a guide, they are difficult to find. All features described are located on Figure 6, except Railroad Sink, which lies just off the southeast corner of the map.

To further help identify the features, the Buttercup Creek Karst has been divided into several local geographic areas. These areas are listed in the descriptions immediately after the name of the feature. The following areas (from north to south) have been found to be convenient geographic divisions:

WHITESTONE BOULEVARD AREA: Includes features along FM 1431 in the northern part of the karst on both sides of the Colorado River divide.

LIME CREEK ROAD AREA: Includes features along Lime Creek Road on both sides of the Colorado River divide along the Travis-Williamson County Line in the western part of the karst.

BUTTERCUP CREEK AREA: Includes features in the Buttercup Creek Subdivision, both the developed and undeveloped parts.

NELSON RANCH AREA: Includes features on the Nelson Ranch between Lime Creek Road and Cypress Creek Road along the headwaters of Buttercup Creek.

JAMAIL RANCH AREA: Includes features on the Jamail Ranch, located east of Lime Creek Road and north of the Cypress Creek drainage. Partly in Travis County. This ranch has recently been purchased by the Milburn interests, but is still considered a separate geographic area.

LONG HOLLOW AREA: Includes caves in the southwestern part of the karst west of the Cypress Creek Ranch, south of Lime Creek Road, and north of the Volente Highway (FM 2769).

MILBURN RANCH AREA: Includes features on the Milburn Cypress Creek Ranch along the headwaters of Cypress Creek.

LAKELINE AREA: Includes features in the southeast section of the area north and north west of the Highway 183-620 intersection.

The first item listed for each feature is the feature number, then the name, the local area (Buttercup Creek, LakeLine, etc.). Following the area is the type of feature (sinkhole, spring, shelter, etc.). The next line begins with the county, followed by the USGS Quadrangle, the UTM coordinates north, and then east; then the elevation of the feature in feet, the length in feet (total traverse length, if a cave; the longest diameter, if a sinkhole; and the width of the entrance, if a shelter). Following the length is the depth in feet, and the volume in cubic feet.

The UTM coordinates were determined by locating most features on a 100 feet to the inch compass and tape map of the area, then by establishing four UTM control points: the intersection of Buttercup Boulevard and Brookmeadow Trail (3373915N, 611380E), the Jamail Branch of Buttercup Creek crossing the south boundary of the Nelson Ranch (3373430N, 610368E), the southeast corner of the quarry property along the Nelson Ranch fence (3374500N, 610250E), and the southwest corner of the Nelson Ranch on Lime Creek Road (3373990N, 609615E). The taped
distances agreed well with distances measured from the topographic map, so adjustments are relatively minor, but the given coordinates are not absolutely accurate.

**Alphabetical List of Features**

The number by the name can be used to locate the feature on the area map. The first letter gives the Quadrangle (J=Jollyville, L=Leander, M=Mansfield Dam and N=Nameless), the second figure is the approximate north-south location on the quadrangle with zero being along the bottom south edge and nine being along the north border. The third digit gives the approximate location from west to east, with zero along the west edge and nine along the east side. The features in each local area are then given letters to designate individual features. Thus cave L09C is in the bottom right (southeast) corner of the Leander Quadrangle.

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Figure 6
Karst Features of the Buttercup Creek Study Area
Descriptions

**J70B Adobe Spring**

Travis Jollyville [3371030N/608260E] EL925/ L-/- D-/ V-

Adobe Spring flows into a shallow pool just back from the east edge of Long Hollow. The spring flows form the base of the Cedar Park Limestone that caps the uplands to the north and east and provides a local source for the recharge. The water flow is perched on the underlying Bee Creek Marl. This shallow muddy pool might have provided a source of material for adobe bricks.

**J70C Adobe Spring Cave**

Travis Jollyville [3370980N/608260E] EL920/L50/D31/V3500

The entrance to Adobe Springs Cave is located in brush 177 feet south of Adobe Spring, and 50 feet northwest of a steeplehead on the east side of Long Hollow Canyon (Elliott and Reddell, 1991). The cave is described in Elliott and Reddell as having a 5 by 3 foot entrance that drops 13 feet to a sloping ledge, then another 16 feet into a room. The elliptical room at the bottom is 27 feet long and 19 feet wide. On the west wall of the room are massive white stalactites and flowstone. The northern half of the cave floor is covered with shallow rimstone pools with amphipods and cave pearls. Calcite-encased leaves, twigs, snails, and seeds are found in the pools. The rate of encrustation is very high, and in one corner under the water spray there are hundreds of encrusted leaves. A knotted ski rope hanging in the entrance had a crust of calcite on the lower few feet of rope.

Adobe Springs was first brought to the attention of cavers by the owner of the Schultz Ranch who directed Bill Russell and John Porter to the cave in October of 1964. Since that time the landowners changed and the old pasture roads had overgrown, so it required considerable searching by James Reddell, Bill Elliott, and Marcelino Reyes to relocate the cave. They were finally successful and the cave was mapped by them on the 29 of May 1989.

The cave is biologically interesting, but the most thorough collection was done in May of 1968, when the air and water temperature were 66°F. Collections during a warmer but wet time might find more cave adapted species that did not like the cold. Despite the cold, cave-adapted flatworms, ostracods, amphipods, spiders, millipedes, a beetle of the genus *Rhadine*, and a rattlesnake were all collected. The cave is also geologically interesting, since it is formed in the Lower Walnut (Bull Creek) below springs developed at the base of the Cedar Park Limestone.

**J92N Animal Sink**

Williamson Jollyville [3374470N/610990E] EL990/ L10/ D4/ V200

A shallow sink in a grove of trees 350 feet northeast of Two Hole Cave. The sink was originally a mostly dirt-floored depression about two feet deep, 10 feet long, and 4 feet wide. Off the east end of the sink a low dirt-floored opening 3 feet wide and a few inches high led east toward a small hole about 15 feet away. An animal burrow led down to the north. In July of 1991, Bill Russell cleaned about a foot of dirt from the sink, uncovering a dirt-filled elliptical depression (about 4 by 10 feet) in bedrock that appeared to expand into a dirt- and rock-filled room about 3 feet below the surface. Later digging by Bill Larson verified the presence of a dirt-filled room, but there was no obvious way to continue. There might be a cave at this locality, but it is likely blocked by a large amount of washed-in rock and dirt.

**J81F B.A.B.E. Pit**

Travis Jollyville [3372600N/610100E] EL980/ L50/ D45/ V300

This pit is located east-northeast of Dies Ranch Treasure Cave, about halfway to the north boundary of the Milburn Ranch. The entrance is about 2 feet in diameter under a small tree with no
obvious sink, though it takes some water. Immediately inside, the pit opens to a 3-foot in
diameter, 20-foot high climbable drop to a 70 degree slope that drops another 8 feet to a 5-foot drop
to a 5-foot climbdown to a tight squeeze. The squeeze enlarges to 3 x 4 feet, ending in a small hole
through which an additional drop of 10 to 15 feet to a pool can be seen. This hole could be
enlarged with an hour's or so work. The pit, at least at times, contains bad air, so care should be
exercised in entering. The name of the pit is an acronym for Bad Air Both Ends. The pit had no air
flow and a dead cow in it when first discovered in the summer of 1988.

N19E Backpackers' Bane Whitestone Boulevard Cave
Travis Nameless [33770000N/607400E] EL1050/L40/D35/V500
This pit is slightly south of the hollow leading west from Trammel Shelter, about 1000 feet west of
the shelter cave in a locally karsted area. The entrance to the pit is 3 x 2 feet, but the pit
immediately enlarges to 4 x 6 feet and drops 20 feet to an offset, and then drops vertically for 15
feet as a shaft 4 feet in diameter. A backpack was found in the bottom of the pit when it was first
located by Bill Larson.

J92G Bad Air Fissure Buttercup Creek Cave
Williamson Jollyville [3373855N/611295E] EL950/ L30/ D25/ V300
This cave was dug into by Bill Larson around 1987 or 1988, and is located east of Whitestone Pit
in the shallow valley between the pit and Buttercup Boulevard. The entrance is an artificially
enlarged sloping pit through rocks and dirt down to a depth of about 6 feet. At the bottom is a
small breakdown-floored room about 10 feet long and 6 feet wide; the floor slopes down so the
room is 6 feet high at the far end. From the end of this room is a walk-down fissure about 6 feet
high at first, but the floor continues steeply downward until the ceiling is about 15 feet high. Then
the fissure narrows, and only a crawlway at floor level is passable. This crawlway soon becomes
very narrow and takes a sharp bend, forming the effective end of the cave. The cave has no air
flow, and the air at times appears to have a high carbon dioxide content.

J93A Bev's Grotto Buttercup Creek Cave
Williamson Jollyville [3374460N/612210E] EL1940/ L50/ D6/ V600
This is one of the most well-known caves in the area, being located only about 200 feet south of
Buttercup Boulevard. The entrance was a surface sink 3 feet in diameter that dropped vertically
about 6 feet into a low passage initially almost completely filled with black surface dirt. The cave
was dug out in 1985 by members of the Cedar Park Volunteer Fire Department and various cavers
coordinated by Mike Warton. At times the dig resembled a disaster site, with several fire
department and rescue vehicles parked near the entrance. Passers-by would stop and offer to
assist. The main passage was excavated to the east for about 50 feet by removing black dirt in
buckets and coffee cans until they reached a low room about 40 feet in diameter. In places it was
possible to sit up. The mostly filled cave continued to the east, and it appeared that the cave would
eventually connect with Riverwood Sink, a shallow dirt-filled sink about 100 feet further east.
There did not appear to be much likelihood of large cave in between, though, and so digging was
abandoned. The cave was gated, but about 1989, the entrance was bulldozed, and the property
offered for sale.

J92U Bluewater Pit Nelson Ranch Cave
Williamson Jollyville [3373260N/611520E] EL940/ L75/ D50/ V400
Bluewater Pit is the largest of the three small features located to the southeast of the main group of
caves in the Buttercup Creek Basin. The entrance is a small hole in the bottom of shallow sink that
drops 3 feet to a slope that extends down 10 feet to breakdown wedged in the top of a 35 foot pit.
About 10 feet down this pit is a natural bridge and at this level two horizontal crawlways enter the
One crawlway can be followed for about 15 feet and one for about 10 feet. The longest appears to come from Filter Sink, about 200 feet to the west. At bottom the pit is about 6 by 10 feet, ending in a flat dirt floor with an 8 x 6 inch drain. Up the hill to the south is Bluewater II Pit. Located by Bill Larson.

**J92V Bluewater II Pit**
Williamson Jollyville [3373170N/611490E] EL945/ L50/ D45/ V250

A nasty slide-in entrance over breakdown leads to the top of a 20 foot deep fissure, narrow at the top but opening to a 6 x 4 foot pit that ends in a squeeze into a constricted cross slot that drops into a narrow fissure 6 feet long, 20 feet deep, and 1 foot wide. At the bottom is a small drain that appears to lead north toward Bluewater Pit. Located by Bill Larson.

**J92W Boulevard Cave Buttercup Creek Significant Cave**
Williamson Jollyville [3373800N/611295E] EL965/ L318/ D56/ V4000

This cave located just to the south of the present end of pavement on Buttercup Creek Boulevard, behind several piles of rock and fill. The entrance is in the southwest end of a shallow sink, now mostly filled with large rocks and dirt from subdivision development. The remaining sink is a depressed area 30 feet long, 20 feet wide, and 2 feet deep at the west edge, where originally a 1 by 2 foot slot, 2 feet deep, took considerable drainage. Vapor was observed coming from this opening by Bill Larson in the winter of 1986. The dig looked promising, but everyone agreed it would be a serious project. By 1991 the drain was completely plugged with mud and leaves, but with large cave discovered not too far away, the dig began to look more promising. In the beginning of July, 1991, Bill Larson began to dig, and by the 21st, he had cleared back 9 feet through leaves, dirt, and small rocks. At this point he was back under a solid roof, with good air flow coming up from loose rocks along the wall. Bill Russell helped remove some obstructing rocks and then, about noon on the 14 of August, after clearing loose rocks from a slot in the floor, Bill Larson was able to push aside the remaining debris and slide forward into a room 25 feet long, 15 feet wide, and 6 feet high. From the far end of this room a brief dig through loose rocks under the far wall led to a where he could see down through a narrow slot into a 15 foot deep, 12 foot in diameter climbable pit.

Larson returned the next Saturday with Bill Russell, when they enlarged the slot and descended the pit (Flowstone Pit) to find at the bottom a roughly north-south crawlway developed along the base of the Cedar Park Limestone. The crawlway extended north, 3 feet high and 2 to 3 feet wide, for about 120 feet, crossing several shallow pits. The deepest is a 14-foot pit where the crawlway leaves Flowstone Pit. This pit ends in a small drain above a dirt floor. The next pit is also 14 feet deep, and was too narrow to enter, but had air flow and could be seen to enlarge to a clean rock floor. The crawlway finally ends in clay fill after crossing two more shallow, apparently clay-filled pits.

What appears to be an extension of the same crawlway also extends to the south from Flowstone Pit. Just as the crawlway leaves Flowstone Pit, there is a 19-foot pit that then drops 2 feet to a body-sized drain that might be possible to push, if a caver was small and didn't mind abrasions. Beyond the 19-foot pit, the crawlway goes south for 45 feet to where it ends in clay fill. However, 20 feet from Flowstone Pit, a squeeze to the southeast leads to the top of Butterstone Well, a spacious pit 6 to 8 feet in diameter that drops 25.8 feet vertically and then slopes down to a joint-controlled triangular crawlway that will be passable with some digging.

The airflow pit in the north crawlway was dug into to reveal that the air came from a small hole about three feet above the bottom of the pit which takes considerable water and at times has good air flow. After several trips to remove clay from this body-size hole, the dig was abandoned in early 1992, and the cave entrance was filled with large rocks to keep children out of the cave.
BOULEVARD CAVE
Buttercup Creek
Williamson County, Tx
Suunto and tape survey
Bill Larson
Bill Russell
Drafted by Bill Russell
TSS
1991

Length 318 feet
Depth 56 feet
L01A Broken Arrow Cave Lime Creek Road Cave
Travis Leander [3374720N/609360N] EL1030/ L58/ D24/ V200
Reported by James Reddell in the Horizon Lime Creek Road Biological Study, and described in Reddell (1991) as follows: "The entrance to Broken Arrow Cave is a 2 foot in diameter opening at the base of a large hackberry tree. A short drop and sloping crawlerway extends down to about 6 feet below the surface where a wide low bedding-plane passage extends ahead for about 10 feet before becoming too small. A 2 foot in diameter crawler descends to the top and side of an elongated chamber about 10 feet long and 3 to 4 feet wide. The drop into the room is about 15 feet with a ledge about 5 feet down. A drainage conduit from the bottom of this passage is 23.5 feet below the surface, but is too small to negotiate. A broken arrow[head] was found on the floor of the room near a fossilized [buffalo] vertebra.

Biology: The cave was studied on 25 January 1991 by James Reddell and Marcelino Reyes. Most specimens, including all the troglobites, were found at the bottom of the inner pit." Collections included Cambala speobia, a troglobitic millipede, and two Rhadine beetles -- Rhadine persephone and possibly Rhadine subterranea.

J93D Buttercup Blowhole Buttercup Creek Cave
Williamson Jollyville [3374200N/611560E] EL960/ L40/ D25/ V300
Located about 150 feet north of Buttercup Boulevard, about half a block west of Nelson Ranch Road. The small entrance is hidden by brush. The cave was dug out by Bill Larson who was excited by the amount of air flow. Even though the cave is generally constricted, and serious digging was required in places, it is a promising cave, having good air flow and being near the main fracture trend. The entrance is a 6-foot drop to a 7-foot long belly crawl that ends in a 4-foot drop to another low passage. This passage leads 12 feet to a slot dropping 3 feet down and 5 feet horizontally into a narrow area that extends to the top of a 12-foot pit. This pit is 5 feet in diameter at the bottom, where there is a small pool leading to a water scoured drain just too small to follow. Total depth: 25 feet; total length: 40 feet.

J92S Buttercup Creek Cave Nelson Ranch Major Cave
Williamson Jollyville [3373500N/610840E] EL960/L3000/ D140/ V30000
What eventually proved to be the entrance to Buttercup Creek Cave was discovered in early 1989 by Bill Larson as he returned from a trip to Convolute Canyon Cave with Keith Heuss. Bill Larson noticed that a small, otherwise insignificant, floodwater drainage seemed to lose most of its flow crossing a few feet of leaf-covered rocks. Even though there was no surface depression, and not even a defined stream channel, Bill Larson decided a dig might be worthwhile. He started a small hole and soon found loose rocks with air flow, a rare commodity in the Buttercup Karst. Encouraged, he continued digging down a 2-foot wide fissure, sometimes blocked by rocks too large to break with a hammer in the confined space. After about 8 feet, and four months of off-and-on digging, he encountered a low room inhabited by relatively docile ants that gave off a sour acidic musty smell when disturbed. Squeezing through breakdown at the end of this room lead to a crawlway over breakdown that ended in a 6-foot pit. From the bottom, a crawlway continued 10 feet to the top of a spacious 15 foot pit, now named Dollar Pit. Dollar Pit was climable, and ahead an irregular hole lead through a thin wall to a clay-floored room 10 feet high and 15 feet long, where another hole in a thin wall lead to a crawlway that soon dropped into a 4-foot in diameter tube extending in both directions. Bill Larson turned right, and after about 100 feet of sinuous tube with a few squeezes, he came to a 2-foot drop into a stream passage about 4 feet high and wide. Realizing he had a potentially large cave and the beginning of the water crawl was a good place to stop, he returned to the entrance.
Bill Larson returned with Bill Russell for a longer trip. They soon reached the water passage, and Bill Russell explored upstream and Bill Larson checked downstream. They both returned to report the passage continued and was enlarging. Upstream the passage was a 3-foot high, 4-foot wide
Entrance Room in Buttercup Creek Cave
-Looking across the surface of the Knob Hall bed, toward the White Jaws of Death.

crawl in shallow water that lead through a narrow squeeze around a formation to the Upstream Junction where the stream intersects the left fork from just beyond Dollar Pit. From this junction the passage continues first as a stoopway for 70 feet, then as a formation-lined walking passage, finally ending in a partial formation block with passage visible ahead. However, about 40 feet before the block, there was a connection at floor level with a parallel stream crawlway. The low stream crawl rejoined the upper passage past the formation blockage to form larger section of passage, about 5 feet high and wide, that extended to the present end of exploration in deep water with low ceiling, about 200 feet east of Ilex Cave. Air flows from the passage ahead, indicating that (with luck) a connection can be made.

Downstream from the initial discovery point, now known as The Downstream Junction, the stream passage continues as a crawl in water. The passage is generally about 4 feet high and the water depth varies from 4 feet to only a trickle over bare rock. Several small travertine dams in this section are bypassed by small drains, so that during high flow the water level is about a foot...
Figure 9
Buttercup Creek Cave Profiles
From surveys by Bill Larson and Bill Russell
Drafted by Bill Russell

Extended Profile of Entrance Area

Extended Profile of Texas Chamber Area

Depth below entrance in feet

Elevation above msl in feet

-140 -120 -100 -80 -60 -40 -20 0
0 20 40 Feet

-120 -100 -80 -60 -40 -20 0

-920 -900 -880 -860 -840 -820

Entrance
White Jaws of Death
Ten Cent Pit
Dollar Pit
Filligree Wall
clay
Junction with floodwater overflow tube
Overflow tube splits
Junction - overflow tube and stream tube rejoin
Gator Hole water
travetine dam

Depth below entrance in feet

Elevation above msl in feet

-140 -120 -100 -80 -60 -40 -20 0
0 20 40 Feet

-120 -100 -80 -60 -40 -20 0

-920 -900 -880 -860 -840 -820

Depth below entrance in feet

Elevation above msl in feet

-140 -120 -100 -80 -60 -40 -20 0
0 20 40 Feet

-120 -100 -80 -60 -40 -20 0

-920 -900 -880 -860 -840 -820

Depth below entrance in feet

Elevation above msl in feet

-140 -120 -100 -80 -60 -40 -20 0
0 20 40 Feet

-120 -100 -80 -60 -40 -20 0

-920 -900 -880 -860 -840 -820
higher, which makes the cave more sporting. Three hundred feet from the Downstream Junction the passage enlarges, goes over a travertine dam and becomes about 6 feet high as it passes the infeeder crawlyway that leads from Convulated Canyon Cave. It is not possible to reach Convulated Canyon Cave, since a section of the tube is filled with clay to within about 6 inches of the ceiling. Downstream for the next 200 feet, the main stream passage is composed of a tube (Tally-Ho Tube), 4 feet in diameter with a sinuous channel in the ceiling forming a comfortable walking space. The floor is solid, scoured limestone. At the end of this section, the ceiling channel ends, and a small infeeder tube about 6 inches high enters from the west. Water flow from this passage generally doubles the flow of the cave stream.

Beyond this infeeder, a straight section of passage leads to a high formation filled mud floorered room, developed where the Passage of Pearls joins the stream passage. By climbing up 10 feet on a muddy clay bank, it is possible to reach this highly decorated walking passage. For the first 80 feet, the passage is about 5 feet high with numerous stalactites and soda straws; then it changes into a narrow sinuous fissure about 6 feet high that extends 140 feet to end in breakdown from above.

Downstream from the Passage of Pearls Junction, the main passage briefly lowers beneath a formation-filled ceiling and continues for 150 feet to Harmony Falls, where the water flows over a travertine dam sculptured by erosion into several delicate natural bridges. Below the falls, the water disappears into several small tubes. An overflow route through formations leads to a hole in flowstone that drops 6 feet into a lower stream passage. It is also possible to continue ahead over old massive travertine dams for 50 feet to a climb into the lower level, where the upper level ends. The lower level continues as a muddy crawl about 10 feet wide and 4 feet high to a small drain where the normal flow of the stream gurgles down into eroded limestone.

A wide, low floodwater overflow route continues on ahead over clay and eroded travertine dams. A side lead that takes floodwater, the Briar Patch Passage, extends parallel to the main passage for about 50 feet to where it becomes too small. Several trips were spent trying to extend the Briar Patch but the efforts were abandoned after clearing about 50 feet of mostly small passage. The Briar Patch ends in a clean-scoured tube about a foot in diameter. Just past the Briar Patch, the main passage enlarges to form the Foam Booth where most of the floodwater is lost into flowstone blocked fissures, leaving piles of organic foam that last for several days after major floods.

Another overflow route continues ahead, becomes low and partially blocked by travertine dams, then widens when it passes a pit on the left that takes the last of the floodwater. Ahead, a low squeeze through sticky mud had to be enlarged to permit passage. At first this section, named the Tar Babies for its extreme stickiness, was almost impassable, but continued digging and compacting the clay has now made it only miserable. A place to sit up and a squeeze over a travertine dam separates the first Tar Baby from the second. The second Tar Baby ends in a travertine dam that blocked the passage. Looking over the dam, the first explorers could see a drop ahead, so Bill Larson resolved to returned and chisel a few inches from the dam.

Bill Larson returned with Alvis Hill to attempt to cross the travertine dam. They expected, at best, a continuation of the stream passage, and were not prepared for the Texas Chamber, a room 70 feet long 40 feet wide and 40 feet high. There trip is recounted in the May 1991 Maverick Bull (as cited in "Ray's Review," NSS News [February 1992]:52). The drop into the room is 30 feet, at first along flowstone draperies, and then into the room, landing in an upper alcove overlooking the main section of the chamber. The alcove is well-decorated with formations and travertine dams, and a steep slope of breakdown and travertine extends down to the far wall of the chamber. Ahead an archway leads into a passage that soon ends, but before it ends, an infeeder that carries considerable floodwater enters from 10 feet up on the wall. Holes in breakdown along the south wall of the room lead down into the breakdown for at least 30 feet to where the way is blocked by breakdown; nonetheless, digging following the air flow appears promising.

The Texas Chamber is formed where the main stream passage, developed on the base of the Cedar Park Limestone, drops through the Bee Cave Marl into the underlying Bull Creek Limestone. Collapse of the less competent Bee Cave Marl has shaped the present room with a flat ceiling near the base of the Cedar Park and a floor of collapse material. However, by working down under the south wall, a more solid section is reached where the boulders are smooth blocks of Bull Creek Limestone. Air flow through this section indicates that the cave continues, probably as horizontal
passage, since the cave is already near the base of the Bull Creek Limestone. It is a long distance to any surface resurgence, so there could be considerable cave ahead, and if the cave goes south, Buttercup Creek Cave could be one of the more extensive caves in Texas. The lower part of the Texas Chamber fills at times with water, as evidenced by a coating of mud, but this is probably due to a general rise in the water level, since no matter where the water eventually resurges, it is several miles away and not much lower. (Profile above; for map, see Figure 5: Karst Features of the Confluence Area.)

**J92R Buttercup Drain Nelson Ranch Cave**
Williamson Jollyville [3373580N/610690E] EL955/ L75/ D24/ 300
The small inconspicuous entrance to this cave is located in the bed of the Jamail Branch of Buttercup Creek, 500 feet upstream from the junction with the main Buttercup Creek. The cave entrance, frequently choked with flood debris, is under a clump of vine-covered brush, on the northwest side of the channel. An elliptical sink about 4 feet in diameter, but partly blocked by rocks, drops 5 feet to a ledge that opens into a small room about 6 feet in diameter. The floor of this room is 10 feet below the surface. At floor level, a slot about 4 feet wide and 2 feet high extends 5 feet to the top of a pit 12 foot deep pit. This pit is from 3 to 5 feet in diameter and is developed in a massive burrowed bed that forms a complex honeycomb surface with numerous small holes and projections. From the base of this pit, a crawlway leads 5 feet to a dome, then continues 30 feet, past a squeeze, and around a corner to where it intersects a branch to the left. At this junction a tube 1.5 feet in diameter develops 2 feet below the floor of the passage. After about 10 feet, the barely passable upper level joined the lower level, but formations blocked the view ahead.

The cave was first located in about 1987 by Bill Larson, who dug into the 12-foot pit which initially blocked by numerous ledges and rock projections. Warton and friends finished cleaning out the pit, but did not pursue the crawlway, and soon the pit was almost filled with leaves. Floods by early 1990 had washed the pit clean, and Bill Russell returned to dig out 30 feet of crawlway, to a crack leading to the lower tube. Three pounds of Kinepack allowed progress for 8 feet, to where the upper level was again passable. An 8-foot squeeze allows one to look down a small hole into the tube. Digging appeared hopeless at this point, but the rains of December 1991 scoured this area, and what appeared to be flowstone was apparently clay, only thinly covered by flowstone: the cave now ends in a spacious three foot drop into a pool. High water prevents further exploration. (See map, next page.)

**J91H Caliche Sink Nelson Ranch Sink**
Williamson Jollyville [3374000N/610525E] EL985/ L19/ D4/ V300
This sink is located between the West Windmill and Buttercup Windmill, west of the Buttercup Windmill, about 200 feet west of a small draw, just west of where the incised channel ends. An unusual depression 19 feet long, 11 feet wide and 4 feet deep, developed in chalky caliche. The east end of the sink is vertical with a growth of ferns at the bottom. The sink takes little drainage.
clay bank—now mostly removed by floodwater

**BUTTERCUP DRAIN**
Williamson County, Texas

Suunto and tape

Bill Russell
1991

TSS

Length 80 Depth 24

**PLAN**

- dome
- pit
- entrance
- artificially enlarged
- **Jamal Branch of Buttercup Creek**

**EXTENDED PROFILE**

- entrance
- rock partly blocks entrance
- water
The surface expression of Cedar Elm Sink consists of three features aligned along a major joint trending S48W and inclined 20 degrees from the vertical. All three features are in a shallow bedrock basin about 120 feet long and 60 feet wide. The main surface sink is an easily climbable fissure 15 feet long, 7 feet wide, and at one time up to 15 feet deep. Scratched into the soft limestone, along the west edge of the fissure, and apparently old, are the inscriptions "FS 1909," "WS 1903," "1904," and a "W" with a "D" carved on one side.

Most of the fissure is now filled with loose rocks and dirt to within 6 feet of the surface, and a depression through the fill in the northwest corner of the fissure is all that is left of a dig that once extended down 9 feet deeper. Mike Warton, Bill Larson, and Bill Russell have all dug here, but the main sink appears blocked with debris, even though considerable water enters the sink during heavy rains. Rocks dumped in the main sink have reduced the current maximum depth to about 10 feet.

To the north of the main fissure is a hole among the roots of a large tree. Just to the south of the main sink is a shallow, dirt-floored, brush-covered depression 12 feet long, and 5 feet wide. In early 1988 Bill Larson observed "steam" from the south dirt floored sink and dug through into a series of attractive pits. This entrance should be kept carefully covered with rocks since the cave is not suitable for exploration by children with flashlights.

This entrance, at times impassable due to fire ants, is 4 feet long and 2 feet wide, narrowing to a small triangular hole about 4 feet down, and then enlarging along a major fracture until it is up to 3 feet wide and 10 feet long where it ends, 10 feet below the surface in a dirt and rock fill. An opening in the side of the fissure at floor level leads down through an awkward squeeze into a lower room. The floor of this lower room, actually a dome that extends up almost to the surface, is about 5 feet below the opening, and the slide down is hindered by sharp projections and the necessity of assuming awkward positions. From the bottom of the dome room there are openings in several directions. To the north a small hole connects to the main sink. The largest passage is a 2 foot high by 1 foot wide tube at floor level that had to be enlarged to passable size. This tube extends horizontally for 5 feet to a vertical squeeze leading into the top of a complex dome. Extruding from the tube, the explorers' feet land on the top of a narrow partition of rock that separates two pits. One side drops 22 feet into Isopropyl Pit, and the other side overhangs the floor of Larson's Pit, 36 feet down. With careful maneuvering it is possible to climb down the Isopropyl Pit side of the thin partition to an opening that connects the pits. From the opening one can climb down ten feet to the bottom of Isopropyl Pit or step through the window to a ledge that overlooks Larson's Pit and also extends south to Lithic Pit, a high dome, the bottom of which is about 8 feet below the ledge. The bottom of Isopropyl Pit connects to a lower ledge where the drain from Lithic Pit enters. From this ledge, it is possible to chimney down 13 feet into the bottom of Larson's Pit, a clean, water-scoured floor. The floor slopes slightly down to a body-sized drain at floor level along the main fissure.

The upper part of Cedar Elm Sink is developed in the Cedar Park Limestone, but the cave extends down into the Bee Creek Formation. This unit is usually a marl, but in the Buttercup Creek Area there is a facies change, and the lower parts of Marigold, Boulevard, and Buttercup Creek Caves, as well as Cedar Elm Sink, have developed in a relatively pure limestone facies of the Bee Creek. The cave has a rich biota, with the dirt-filled upper fissures and a low clay-floored room extending south from Isopropyl Pit being especially rich in cave adapted animals. A Rhadine beetle, identified as the endangered species *Rhadine persephone*, has been collected from the cave.

Cedar Elm Sink has the most vigorous air flow of any of the Buttercup Creek Caves. Airflow through the drain at the bottom of Larson's Pit is frequently enough to wiggle the root hairs. This drain can be seen to continue as a tight body sized squeeze for about 5 feet to where the view is blocked by projections. A travertine deposit on the north wall is partially blocking the opening, and dark stains on the lower few feet of the pit indicate the floor of the pit floods occasionally, and the drain is not scoured clean. Perhaps there is a large rock or some other partial block ahead. A dig here would be time-consuming, but probably very productive. (See map, next page.)
Cedar Elm Sink
Williamson County, Texas

Dale Henry
Bill Russell
Mary Standifer

Suunto and Tape Survey
March 26, 1992
UTG
Drafted by Bill Russell

Larson's Pit
depth below entrance in feet

COMPOSIT PROFILE

Lithic Pit
Isopropyl Pit

dome

lower clay-floored room

upper room

solid rock surface

air

drain

North Sink
树

Main Sink

南沉

North Sink

南沉

Entrance

Larson's Pit

低粘土房

固结岩表面

SURFACE FEATURES
Convoluted Canyon Cave was located by Bill Larson about 1988 when he noticed a small depression in a local drainage. Nearby was another small depression, and here he dug down 5 feet through roots, dirt, and loose rocks to encounter a low dirt floored room about 15 feet in diameter and 2 to 3 feet high. One end of the room extended back beneath the sink in the drainage and the water from this sink crossed the room and entered a small hole choked with loose rocks and dirt. Bill Larson began digging in this hole aided by Bill Russell and finally broke through into the end of a narrow canyon passage about 6 feet high and mostly too narrow to follow except for a crawlway at the bottom, about 10 feet below the room level. Holes in the floor extend further down but are too small to follow. After 10 feet the crawlway drops three feet to the top of a 7-foot dome. From the bottom of this dome, a 3-foot high arch leads to the base of another dome, and ahead a 10 inch squeeze over clay enters the bottom of the largest dome in the cave, about 6 feet long and 5 feet wide and narrowing upward, but apparently about 12 feet high. Ahead the cave continues as a narrow canyon and descends a few more feet where the high narrow canyon ends after about 15 feet in a small clay-floored tube at floor level.

This tube continues for about 10 feet to a left turn and then becomes almost body size. Bill Larson was able to follow this tube for about 100 feet by occasionally digging in constricted areas, but was finally forced to abandon the tube even though it has at times good airflow. The tube could be seen to continue but there was no place to put the excavated clay, and movement through the tube was so difficult that it would take several hours of hard work to clear even a few feet. There was a turnaround dome near the end, which made the passage a little more friendly.

During the survey of Buttercup Creek Cave, an infeeder crawlway that enters the main stream passage at the upstream end of a sudden passage enlargement was mapped to within a hundred feet of the end of exploration in Convoluted Canyon Cave. This passage ended as just too small to follow clay-floored tube with airflow. Bill Larson's conviction that the Convoluted Canyon tube lead to large cave was confirmed, though not quite the way he envisioned.

Convoluted Canyon Cave initially consisted of at least two sinks in a small local drainage that dropped into a small room in the bedded member of the Cedar Park Limestone, and a narrow sinuous passage leading to a pit dropping through the massive member, ending in a horizontal tube developed along the base of the Cedar Park Limestone. Over time, water flowing through the system downcut the passage upstream from the original pit, in places forming a series of domes, and in other areas downcutting to form a narrow meandering canyon, made even more convoluted by numerous projections of solutionally honeycombed limestone.
surface sink, to a funnel that drops 6 feet to a floor of washed-in dirt, rocks and organic debris. Digging at this point by Bill Larson reached clean washed breakdown with a strong air flow (high carbon dioxide) after about 5 feet, but recent floods have refilled the lower part of the funnel with dirt, plastic bags and logs. Before the main entrance was filled sometime before 1963, the cave was reported to be "fairly long" (Reddell 1963). Floods at the end of 1991 enlarged a small hole at the bottom of the entrance that appears to lead south, and this might be an easier dig, but it is small and has no air flow.

The geology of this cave will determine, at least locally, the areal extent of the Whitestone. The cave is just north of the Whitestone type locality and is developed in the uppermost resistant limestone, overlain by the soft Keys Valley Marl. If this limestone is the Cedar Park as suggested by the massive ten foot upper ledge above a solution zone, the areal extent of the Whitestone is locally very limited, occupying only a small area south of Whitestone Boulevard and north of Cypress Creek.

**J81E Cypress Creek Sink Milburn Ranch Sink**
Travis Jollyville [3372550N/610010E] EL980/ L20/ D4/ V500

This bowl-shaped sink takes considerable water and was about 20 feet in diameter and 4 feet when first located. The water enters large breakdown, but a dig following the water lead only to a 4 foot drop to crawlway too small to follow. A new dig was started through bread box sized breakdown but an open passage has not yet been found. With effort this could likely be a large cave. Located about 1000 feet north-northeast of Dies Ranch Treasure Cave and 1000 feet from Cypress Creek.

**J81C Dies Ranch Treasure Cave Milburn Ranch Cave**
Travis Jollyville [3372200N/609960E] EL965/ L60/ D40/ V8000

The cave is located just east of Cypress Creek about 0.6 mile south of the headwater spring, about 100 feet east of a ranch road that parallels the creek. The entrance, probably the most impressive in the Buttercup Creek Area, is an oval opening in flat ground about 20 by 30 feet that drops vertically for about 25 feet. Much of the east wall of the sink is composed of red clay and solution fragments. The sink is easily entered by climbing down the south side and around a large ledge on the west, and then down a slope to the southeast. At the bottom a 4-foot drop leads into a narrow sinuous passage about 15 feet long, 1 to 2 feet wide and 6 feet high, but very constricted due to protrusions and sharp turns. At the end of this passage, it is possible to squeeze down and forward a few feet over clean washed cobbles that soon block the passage. Digging would be difficult, as there is no place to put the rocks and they would have to be laboriously transported back to the entrance.

Dies Ranch Cave is has been the sight of extensive old diggings, presumably for treasure. Considerable material was removed from the cave entrance (one of the reasons why it appears so large for the area), and a shaft, about 8 feet square and at least 50 feet deep, was dug about 30 feet south of the cave. The shaft intersected the water table at about 50 feet, but was filled by the Milburn Ranch in 1987, and no measurements of actual depth are available. The tailings piles support small trees and bushes and were extensively weathered, giving the impression of dating back to the early part of the twentieth century.

Some local drainage enters the cave, and is lost in the cobbles at the end of the cave. The passage appears to head roughly toward the shaft, and it seems likely that whoever dug in the shaft thought it was easier to find more cave by digging down from the surface than by trying to dig at the end of the cave. It is not known if the shaft intersected a cave. A rather complicated solutional history is evident in the large clay-filled areas exposed in the sink walls, and the vadose drain at the bottom of the sink.
J91A Discovery Well Jamail Ranch Cave
Williamson Jollyville [3373260N/610105E] EL990/ L50/ D25/ V300
The entrance to this cave is located in the center of a shallow depression about 15 feet in diameter in a mostly bedrock surface. In the center of the depression is an oval hole 4 by 5 feet, mostly blocked by trash and loose rocks. When first discovered, the hole was covered with a pile of rancid discards that filled the entire sink and extended about 5 feet above the surface as a heap of old wire, fence poles, pieces of tin and assorted bottles and cans. There is bailing wire, chicken wire, barbed wire, and hog wire, all piled in a tangled heap surrounded by pieces of tin, buckets, bottles and oil blowers. It was possible to push the wire aside and reach a trash-filled area beneath the wire cover. Five feet of trash were excavated by Bill Larson starting in 1990, and aided at times by Bill Russell, and by December 1991 digging had reached a depth of about 12 feet following an elliptical sink about 4 by 3 feet, filled with small loose rocks. The sink drain is initially is developed along an inclined fracture that trends N50E toward Hunters' Lane Sink 150 feet to the north. The rains of December 1991 produced considerable runoff into this sink. Bill Larson visited the sink in January, 1992, and discovered that the dig had washed out and it was possible to continue, but the way was blocked by a very dead raccoon lodged in a constriction. On a return trip, Bill was able to clear a steeply sloping crawlway downward for 15 to 20 feet to the bottom of a small dome. Ahead, a little bitty squeeze leads into a small bedrock-floor passage that makes two 180 degree turns, then an 80 degree turn, into an 18 in high, 1-foot wide passage that extends 6 feet to a pit. To pass this corner safely, some digging will be required. Good air flow.

J92C Drain Side Sink Nelson Ranch Cave
Williamson Jollyville [3373470N/610810E] EL960/ L15/ D8/ V150
This cave was originally a small inconspicuous sink on the north edge of a drainage channel. It was dug out by Bill Larson in 1987. The small entrance drops about 6 feet into a low room with a possible downstream? crawlway. Considerable digging would be required to progress further. This feature was mostly filled in 1990.

J92T Filter Sink Nelson Ranch Sink
Williamson Jollyville [3373300N/611405N] EL940 L25/ D3/ V500
Filter Sink is a shallow sink located in a clump of trees about 300 feet west of Bluewater Pit. The sink is about 25 feet in diameter and only a few feet deep and generally receives drainage only from a small surrounding area, though there is very little relief in the area and after heavy rains this sink could contribute significant amounts of water. The drainage from this sink apparently flows through a small passage to enter the upper part of Bluewater Sink.

J91F Flesh and Blood Pit Nelson Ranch Cave
Williamson Jollyville [3373715N/610240E] EL985/ L45/ D25/ V300
Located 250 feet north-northeast of the now abandoned Nelson Ranch west windmill, this cave was dug into by Bill Larson in 1987. The shallow sink, within sight of the old windmill, takes drainage from a small surrounding area. Bill Larson dug through loose rocks for about 6 feet to a narrow crawlway that extends 10 feet to two holes in the floor, one of which is large enough to squeeze through. From the bottom of the 4-foot deep hole, a passage leads beneath a small dome to a narrow awkward squeeze into the top of a 6-foot pit. An even narrower and more awkward squeeze leads to the top of what appeared to be an unclimbable pit. Bill Larson was stopped here by lack of equipment. He later returned with equipment to climb the pit, and discovered the pit was climbable, but the passage at the bottom was too small. The squeezes are small, narrow and vertical, the walls are rough -- hence the name.
J75A Garden-of-Sinks Cave  LakeLine Cave
Williamson  Jollyville  [3371250N/614650E] EL950/ L28/ D10/ V200
The entrance is an oval-shaped sink, 6 feet by 4 feet, near the center of the LakeLine tract on what
once was a cedar-covered surface of very low relief. The climbable sink drops 8.5 feet to a dirt
floor. A passage 1.4 feet high leads north and soon lowers, but it can be followed for 14 feet to
where it is blocked by debris below a surface sink. This second sink is a 4 foot in diameter
solutional hole 17 feet to the northwest. This sink is blocked by breakdown and two large trees.
From the entrance sink, a drain only a few inches high leads east. The cave was mapped by

J92I Good Friday Cave  Buttercup Creek Cave
Williamson  Jollyville  [3374280N/611160E] EL980/ L50/ D25/ V400
This 15-foot pit was dug open on Good Friday 1988 by Bill Larson, John Spence, Nathan
Torkelson, and John Gunter. This cave is located about 500 feet northwest of Cedar Elm Sink.
The entrance is about 4 feet in diameter and is presently covered by cedar logs. The upper part of
the pit is developed in relatively loose material but is climbable. About 10 feet down, the pit
divides into two narrow tubes that soon rejoin. At the bottom is a small room developed in a
honeycomb zone with two additional domes. Along the north side the room slopes down to a
crawlway. To the left (upstream) the crawlway extends about 20 feet to where it slopes up and is
blocked by debris below a surface depression. To the right the floor of the passage develops into a
narrow fissure, but the upper crawlway continues for about 10 feet to where the entire passage
becomes too narrow to follow without serious effort.
The endangered beetle, *Rhadinus persephone*, has been collected from this cave and several studies
on the effect and density of fire ants were undertaken by Bill Elliott in the cave and on the surface
above. This cave is typical *Rhadinus persephone* habitat, organic rich dirt not far below the surface,
and potentially accessible to fire ants.
There is a long shallow sink-like depression extending to the southeast of the cave that appears to
funnel water into the cave system. Near the end of this surface channel is a depression in dirt about
3 feet in diameter and a foot deep over the upstream end of the lower crawlway. Good Friday Cave
is located in the approximate center of an area of exposed broken and fractured bedrock about 100
feet in diameter. The 3-foot in diameter entrance to Salamander Squeeze is located 65 feet to the
northeast at the edge of the limestone outcrop. The cave was mapped by William Elliott and

J91C Grassy Grove Sink  Jamail Ranch Sink
Williamson  Jollyville  [3373290N/610270E] EL980/ L60/ D4/ V500
A large, for the Buttercup Creek Area, oval depression 60 feet long and 40 feet wide slopes into a
drain mostly plugged with dirt. Receives considerable drainage, but would be a labor intensive dig
as there is much washed in dirt that supports a growth of grass on the sink floor and no noticeable
air flow. Located about 500 feet west of a well, old cement tank and hunters' cabin, one of a rough
line of sinks that extends from Discovery Well and Hunters’ Lane Sink north-northeast toward Ilex
Cave. First reported by Bill Larson.

J91J Grimace Cave  Nelson Ranch Cave
Williamson  Jollyville  [3373960N/609950E] EL1000/ L50/ D33/ V500
Grimace Cave was described in Elliott and Reddell (1989) as "a narrow sloping fissure about 33
feet deep and 50 feet long." The cave was discovered by Mike Warton and others and named after
Mike Grimm and the confined nature of the cave. Reported in the study for the Austin Regional
Habitat Conservation Plan by William R. Elliott and James R. Reddell.
J71B  Grove Sinks Cave  Long Hollow Area  Cave  Travis  Jollyville  [3371560N/609470E]  EL950/  L70/  D18/  V500
This cave was described in Elliott and Reddell (1989) as follows: "Grove Sinks Cave has two entrances about 4 feet in diameter and 15 feet apart. The main entrance drops about 6 feet to a crawl, which extends a few feet to a 15-foot wide, 30-foot long, 1- to 2-foot high passage with loose breakdown floor. At the end a squeeze goes up to the left for a few feet to an 8-foot high dome. A 2-foot long, 8-inch wide slot in the floor drops 8 to 10 feet before becoming too tight to continue. The other way from the entrance goes into an enlarged bedding plane about 30 feet that extends about 20 feet to where it is blocked by fill from the other entrance. The cave was discovered by James Reddell and Marcelino Reyes while searching the Adobe Springs area.

J61A  Header Spring  Milburn Ranch  Spring  Travis  Jollyville  [3370250N/610350E]  EL870/  L/-  D/-  V/-
This spring is reported on the Milburn Ranch at the west end of a small side canyon about one mile northwest of the Volente Highway-Dies Ranch Road intersection.

This cave is located in the approximate center of a shallow dirt-floored sink about 50 feet long and 30 wide. The sink takes runoff from the surrounding area, especially to the north, but there is no obvious main drain. Bill Larson dug in several small rock-filled depressions before deciding that the center of the sink was the place to dig. He dug down through dirt and breakdown for about 5 feet to reach the entrance of a crawlway extending back into solid rock for 10 feet to a 20-foot-wide passage about 15 feet in diameter, offset from the bottom of the surface sink. The pit could be climbed using handholds below the entrance crawlway, though a cable ladder is helpful, as the first step up from the bottom is a stretch. The bottom of the pit is a mud-, gravel- and flowstone-filled area about 15 feet in diameter with a shallow pool inhabited by salamanders along the east wall. From the bottom of the pit there was an upstream and a downstream passage, both originally too small to enter. After a little work with a hammer, the upstream passage was explored for 40 feet through shallow pools of water to a junction. A low passage leads to the left, and to the right, over a travertine dam, a hands and knees crawlway in water extended for over a hundred feet and continued as far as a light would shine.

Serious effort was required to enter the downstream crawl, since the entrance was mostly blocked by flowstone and a travertine dam. After about 20 feet the passage enlarged, becoming 2 to 3 feet high and wide for the next 100 feet, through constricted in places by travertine dams. The water was generally shallow for the first 100 feet, but for the next fifty feet it deepens to about 2 feet and covers several submerged travertine dams. This deep water section ends in a curious place. Ahead the passage appears to end but just before the end a narrow slot in the right wall, about 1 foot above floor level, opens into the top of a constricted pit about 6 feet deep. Hammer work enlarged the slot and the pit was entered by Bill Larson, on a trip with Bill Russell, in early 1991. Beyond this pit a sinuous and convoluted passage almost blocked by projections leads 10 feet to a 6 foot drop almost blocked by flowstone. Russell and Larson, accompanied by Nathan Torkelson, entered the cave on 27 July 1991, to remove this blockage, and returned next weekend -- with Nathan, who had sworn-off caves that were both small and wet. The drop was descended 6 feet into a pool about 3 feet deep. A passage almost full of water leads southwest at 220 degrees for about 50 feet to a massive travertine dam that extends to within a few inches of the ceiling just before another small drop.

The downstream passage has good air flow, and while it changes direction every few feet, it is trending toward Buttercup Creek Cave about 1200 feet away and 30 feet below the end of the cave. There is no obvious connection in Buttercup Creek Cave. If the caves connect, the junction is likely beyond the explored section of Buttercup Creek Cave. An endangered species Rhadine perspic. has been collected from this cave, along with several other invertebrates. Salamanders and flatworms have been observed in the cave stream. (See map, next page.)
Hideaway Cave
Buttercup Creek Karst
Williamson County, Texas
Suunto and tape survey
Bill Larson and Bill Russell
Drafted by Bill Russell

Depth below entrance in feet

-40
-30
-20
-10
0

Plan

Extended profile

Rhadine River

Continues as crawlway in water to travetine dam that blocks passage
J91D Hole in the Draw Jamail Ranch Feature
Williamson Jollyville [3373310N/610290E] EL975/ L6/ D6/ V5
A crack about 1 foot wide and 3 feet long in the bed of a shallow draw drops about 6 feet to an apparent dirt floor. The crack was at one time neatly covered by small rocks. This feature must take water after heavy rains. Located about 70 feet north of Grassy Grove Sink, roughly along a line of sinks extending from Discovery Well through Hunters' Lane Sink, Grassy Grove Sink, and on to Nelson Ranch Sink and Ilex Cave.

J920 Honeycomb Cave Buttercup Creek Cave
Williamson Jollyville [3374045N/611085E] EL980/ L50/ D40/ V350
Honeycomb Cave is entered through a narrow fissure in a clump of bush about 10 feet north of the rough road by Cedar Elm Sink. Two small slots connect to a fissure barely large enough to squeeze through. A cable ladder is helpful to provide handholds in negotiating the squeeze. At the bottom of the fissure, about 10 feet below the surface, a sometimes constricted horizontal squeeze leads 30 feet to a pit. The pit is about 30 feet deep and only 2 feet in diameter at the top, but bells out toward the bottom and requires equipment. The cave was first discovered by Bill Larson's wife, Pat, about 1986 and informally called Pat's Buttercup Fissure; the cave was rediscovered by Warton, Elliott, Reddell and Reyes in 1989 and included in their survey of caves for the Austin Regional Habitat Plan.

J91B Hunters' Lane Cave Jamail Ranch Cave
Williamson Jollyville [3373200N/610200E] EL990/ L35/ D25/ V800
When originally reported by Bill Larson, this feature was a trash-floored basin 15 feet wide, 30 feet long and 4 feet deep. The sink was developed along a set of fractures trending N50E, the same fractures exposed in Discovery Well 150 feet to the northwest. Hunters' Lane Sink has received its share of refuse: the bottom of the sink was covered with cans, bottles, and solidified sacks of cement. Though the sink is not in a drainage channel, the surrounding land is flat, and after heavy rains considerable local runoff enters the sink. The fracturing and the solid rock exposed along the south edge of the sink indicated digging might be profitable, and in 1990, a small test pit about 2 feet deep revealed only trash continuing down as far as could be seen.
Toward the end of 1991 Mike Warton conducted a serious dig in this sink, excavating about 4 feet of trash and loose rocks to reveal a dirt-floored basin about 15 feet long and ten feet wide and up to 8 feet deep, sloping down to a 2 foot in diameter hole in the north end of the sink. Below this hole a passage slopes steeply down over small rocks and dirt for 10 feet vertically to a short horizontal passage that extends 4 feet to the base of a small dome that opens into an unexpected room developed below the north end of the sink. The floor of this room is about 12 feet below the opening, and an old wire ladder is attached to a bar wedged in the base of the opening. The ladder does not have to be used, since it is easy to chimney across the room and climb down the far side. The room is about 6 feet wide, 15 feet long and extends back slightly under the entrance passage. Across the room at the ceiling level, a narrow infeeder canyon enters. An alcove in the west wall of the room slopes down into a drain that leads back under the room. Initially, this drain is about 2 feet high and wide but the ceiling soon lowers and the passage continues as a very low squeeze in shallow water with airflow. An old pick lying on the floor of the main room is further evidence of early visits.

J92B Ilex Cave Nelson Ranch Major Cave
Williamson Jollyville [3373395N/610650E] EL975/ D35/ L350/ V3500
The small sink containing the entrance to Ilex Cave is located directly beneath the Nelson Ranch cross fence that crosses Buttercup Creek just downstream from the intersection with the Jamail
Branch of Buttercup Creek. The entrance sink was located in the fall of 1987 by Bill Larson who had to move several feet of dirt and loose rocks to enter the cave.

The cave proper is entered through a narrow, 6-foot deep slot offset a few feet from the bottom of the sink. This slot was originally less than a foot wide and 3 feet long, and was slightly curved making passage difficult. From the base of the slot, a breakdown slope leads down a few feet to a crack that drops 10 feet into a horizontal passage extending 20 feet to a 20-foot pit. This pit, about 4 x 10 feet, can be climbed by chimneying out over the drop and descending using projections on the far side. The bottom of the pit opens into a horizontal passage that contains a flowing stream.

The stream passage at the base of the pit is about 3 feet high and 4 feet wide. The water is only a few inches deep and there is a small travertine dam that allows a rough estimate of the flow as about 2 gpm during a dry period in October 1987. Downstream the water deepens and the passage almost siphons after about 50 feet in a pool over 6 feet deep, with the passage continuing.

Upstream the passage has been followed by Bill Larson, crawling and stoopwalking for about 250 feet to a duckunder. The passage varies from 3 to 5 feet high and 3 to 4 feet wide, and the floor is covered with water, mostly shallow. The cave is almost walking size just before the duckunder, and air-filled cave can be seen a few feet ahead.

The drainage area for the cave stream is presumably the flat uplands that extends to the southwest across the county line into Travis County. The cave is developed in the Cedar Park Limestone along joints following the trend of the Cedar Park Fault. The water in the cave flows to the east northeast, to emerge into Buttercup Creek Cave a few hundred feet to the northeast. The water level in a now filled shaft near Dies Ranch Treasure Cave 0.9 of a mile to the south, was about 915 feet. Simple geometry would indicate a water divide somewhere along the County Line, since the stream in Ilex is at about 940 feet. However, since the limestone dips to the east and the headwater section of Cypress Creek flows north-south, any rainfall entering the aquifer south of Cypress Creek could be channeled east into the Buttercup Creek Drainage.

The cave received much attention from cavers after it was reported to be a "miniature Honey Creek Cave," and the narrow entrance slot was enlarged. To preserve the cave and maintain relations, the owners of the Nelson Ranch were contacted and they sealed the entrance to the cave in late 1990 with a concrete and steel slab. It is likely that the cave could be connected to Buttercup Creek Cave a few hundred feet to the southeast as there is air flow between the caves, but the ceiling lowers to only a few inches above deep water. Visitors to the cave should check for the presence of any large salamanders. James Reddell reports collecting a salamander much larger than any so far collected, but it failed to make it to the lab in usable form.

**J76A Jug Cave**

**LakeLine Cave**

Jug Cave is located just east of US 183 about one half mile north of the intersection with RR 620. The entrance to the cave was a hole just east of the Highway 183 right-of-way about 5 feet square, and lined with railroad ties; it dropped 8 feet to the top of a small talus mound in the center of a clay floored room 40 feet in diameter and 4 to 8 feet high. Water at times appeared to cross the room and a clay-filled depression on the southwest side of the room. A small crawly way led north and could be traversed with digging, but there was no airflow. Biological collecting was poor due to the relatively large entrance that allowed considerable air flow, reducing the humidity, and driving the cave adapted animals back into unreachable recesses. The cave has geological interest in that the shallow water depositional environment is well-displayed with obvious channel deposits and undulating bedding planes.

The entrance to the cave was filled during 1990 in preparation for development. Ironically, it might be worthwhile to dig back into the cave leaving only a small hole, since biological collecting would be probably much improved if the cave had only a small entrance. The cave is only a half mile from LakeLine Cave and likely contains the same fauna. The cave has long been known, and was mapped by Paul Fambro, Rodney Leist, and R. Lass in 1985, and remapped by Bill Russell and Julie Jenkins in 1989. (See map, next page.)
JUG CAVE
Williamson County, Texas
Suunto and tape
Julie Jenkins
Bill Russell
September 23, 1988
TSS

Entrance
8 foot drop

North
Railroad tie
South

Plan
Length 55 feet Depth 12 feet

Profile looking northwest

stream channel from inlet passage

Entrance
inlet passage

debris cone below entrance

Sump -12 feet

Plan
Kamikaze Crack Cave is described in Elliott and Reddell (1989) as: “The entrance is a 2 by 3 ft sink dropping about 6 feet to the floor of a 1.5-foot wide, sinuous crawlway oriented east-west. The crawl extends 15 feet to the west before becoming too small. The 1-foot high crawl extends 12 feet to the east to a 2 foot dropoff. The passage, now 4 feet high and 2 to 3 wide, comes to 'The Squeeze' between flowstone after another 15 feet after which one enters the 'Millipede Dome,' which is about 8 feet in diameter and 9 feet high. At the center of this room is a large stalagmite.' This cave is about 200-250 feet south of Grimace Cave. The cave was surveyed on September 26, 1988, by Mike Grimm, Eli Grimm, and Mike Warton. A biological collection was made on April, 16 1988, by James Reddell and Marcelino Reyes. Reported in study for the Austin Regional Habitat Conservation Plan by William R. Elliott and James R. Reddell.

King Spring is located about 30 feet above the valley floor, on the southwest side of a major tributary to Cypress Creek about two miles north of the Volente Highway, and about 1000 feet downstream from the Audubon Preserve. The spring flows from the base of the Cedar Park Limestone.

LakeLine Cave was discovered by Bill Russell on the way back to the highway from flagging Garden-of-Sinks Cave for the developers of the proposed LakeLine Mall. They had not been able to find this small cave reported on their property, but wanted to visit the cave to see if it would be an environmental problem, so Bill Russell agreed to place flagging tape on trees near the cave so it would be easy to find. The history of the mall might have been quite different if the developers had been able to find Garden-of-Sinks Cave.

When first located, the entrance to LakeLine Cave was a trash- and barbed-wire-filled sink that looked only marginally promising, but easy digging. The sink was cleared, and after a rock was removed, Bill Russell and Erika Heinen were able to slide into the cave along a low clay floored crawlway to emerge into a small room or fissure, 6 feet high, 15 feet long, and only a few feet wide, except at floor level. Ahead the passage split, continuing as a very low squeeze at floor level and as an upper level crawlway. The crawlway soon became too small and Bill Russell began to dig, but Erika was able to squeeze through on the lower level and help him from the other side, much to his initial surprise. After the dig, the upper level widens into the Formation Room, an enlarged bedding plane that connects through a small pit to the lower level. The cave might continue, but would require serious digging. The cave was mapped on 6 February 1986 by Laurence Parent and Bill Russell.

The first biological collections in LakeLine Cave were made by Dale Pate in December of 1985. Further collections were made by James Reddell and others on several trips. Fauna collected in the cave included two endangered species, the Tooth Cave ground beetle (Rhadine persephone) and a harvestman of the genus Texallia. The cave also contains six other cave-adapted species, a pseudoscorpion, a spider, an isopod, a silverfish, a beetle, and two species of millipedes. The cave is an ideal cave to study the underground environment, since the entrance is small, maintaining high humidity levels, and the cave is shallow, so about the right amount of organic material enters the cave, not enough to allow surface animals to invade the cave, but enough so the cave animals are numerous. The cave has been gated and will be left in a small preserve when the mall is constructed in an attempt to maintain the cave life. (See map, next page.)
The entrance to Link's Cave is located in a shallow sink 400 feet northeast of the now-abandoned Nelson Ranch West Windmill, east of Testudo Tube, and not far from Flesh and Blood Cave. The cave receives minor local drainage. To enter the cave one climbs down between the bedrock and a wall of stacked rocks. About 6 feet below the surface a passage extends horizontally for about 10 feet to the top of an 8-foot pit developed along a cross joint. This climbable pit enlarges to about 6 x 4 feet at the bottom. A small drain in the honeycomb rock at the base of the pit leads down for a foot or two but is much too small to follow. Just inside the entrance, a dome has formed along another cross joint. These joints trend toward Flesh and Blood Cave and Testudo Tube. The cave was dug open by Mike Warton, probably about 1987. Named for Aase Link, who helped dig out the cave.

This conspicuous sink above this cave is located off Marigold Street near the north boundary of the Buttercup Creek Subdivision. The main sink is a bowl-shaped depression in solid rock about 50 feet in diameter, crossed by a solutionally-enlarged fissure about 2 feet wide. Much of the sink and all of the fissure was filled with material dumped in during the development of the subdivision. Bill Larson dug in the sink and attempted to clear the crack during 1987, but his digs were refilled with dumped rocks. After observing airflow from two small holes about 60 feet west of the main sink, he began cleaning out these holes.

Digging was difficult, as the holes averaged only about 2 feet in diameter. After several trips, helped at times by John Gunter and Nathan Torkelson, Bill returned to clear away debris on Memorial Day, 1988, and was able to crawl into a low, wide knobby-floored room extending to the north and east. Near the entrance, another dome, too small for human access, extends to the surface. From the entrance room, "Knob Hall," the cave turns sharply to the right and drops a few feet into another low, wide room that extends to the south and east. Near this climbdown a major fracture crosses the cave. When Bill Larson first reached this point, he could see down into two deep pits that were developed along the fracture, but he was unable to reach the pits due to several constrictions in the upper part of the fracture. He returned with Bill Russell and dug open an extension of the fissure about 6 feet toward the entrance from the first pit and was then able to squeeze through into the top of the first pit and cross to a second pit of about the same depth. Water could be heard flowing at the bottom of the first pit, named Blue Moon Pit (Pits like this are found once in a . . .). The next day, Bill Larson returned with two Waco cavers, Dawn Burrow (now Hill-Burrow), and Alvis Hill, and rappelled into the pits, finding no leads, though the stream passage might be pushed with difficulty.

Blue Moon Pit is truly an exceptional shaft for the area, widening into a spacious shaft just below the entrance, and dropping 48 feet to a gravel floor 12 x 20 feet. From the top of Blue Moon Pit, it is possible to cross over Pit Number 2, almost as deep as Blue Moon Pit, but narrower, to reach a low, wide horizontal passage that soon splits. To the right, it ends after about 100 feet in dirt and tree roots. To the left is the Flat Room, a low room about 25 feet in diameter formed over a large slab of breakdown. Beyond the Flat Room the passage becomes too low for exploration. The cave was mapped by Peter Sprouse, Susie Lasko, and John Fogerty on 18 September 1988. Biological collections have been made by Peter Sprouse and James Reddell. The owner has set aside the entrance lot as a cave preserve, containing the surface sink and overlying much of the cave. The upper level of the cave is developed in the Cedar Park Limestone. The upper member forms the ceiling, and Knob Hall is developed in the middle-bedded member of the Cedar Park. The scalloped knobby surface of one of the beds is so distinctive, it has been informally referred to as the "Knob Hall Bed." The pits are developed in the massive member of the Cedar Park and extend down into the Keys Valley Marl. The cave stream is flowing on impervious beds in the lower Keys Valley. Two fracture trends are evident in the cave: the area-wide trend at 222 degrees that
follows the trend of the Cedar Park Fault, and a cross joint at 273 that passes through both pits. What appears to be a third pit, as yet unentered, is visible through a small window in the second pit. The stream has about the same flow as the stream in Illex Cave, several gallons per minute, and in the small area visible in the cave stream flows west (228), away from US 183 and the most obvious resurgence, a lake on Buttercup Creek just east of Highway 183 at an elevation of about 870 feet. The map of the cave was published in the April, 1989, Texas Caver in an article by Peter Sprouse (Sprouse 1989), who reports that Blue Moon Pit was actually discovered on a Blue Moon (the second full moon in a month).

In early 1992, Mike Warton and crew excavated the main surface sink and installed a gate on the cave. In the process, a new passage was discovered with two more pits that dropped into a stream passage. This stream passage had a strong flow of water, and could be followed upstream for at least several hundred feet. The downstream passage required digging. This stream could be the same stream that crosses Blue Moon Pit or a separate flow that joins the Blue Moon Pit stream just downstream from the pit.

J82A McBonnet Cave Nelson Ranch Cave
Williamson Jollyville [3372600N/611500E] EL940/ L25/ D16/ V250
The information on this cave is from The Caves of Williamson County (Reddell and Finch, 1963). This small cave has not been relocated and is in the vicinity of housing developments, so it has quite possibly been filled. The entrance is a 3-foot in diameter hole dropping about 10 feet to a floor of small rocks. From here a 6-foot drop leads to a 12-foot long perpendicular passage ending in silt. Total length about 25 feet. Owner was given as Niven in 1963. The entrance coordinates and elevation are those of the McBonnet Cave "X" on the small county location map.

J92A Nelson Ranch Sink Nelson Ranch Cave
Williamson Jollyville [3373350N/610550E] EL950/ L60/ D12/ V400
The main entrance to this cave is a smooth oval opening about 4 feet in diameter developed in a flat rock surface, about 300 feet southwest of Illex Cave. Below the entrance, the cave enlarges slightly, and when first located, it dropped 10 feet to a floor of loose rock. The entrance is in the center of a clean rock surface, scoured by the considerable drainage entering this sink from the south. This sink is undoubtedly the source for much of the organic material in Illex Cave that provides food for the aquatic community. After heavy rains there are new deposits of whole leaves and small sticks along the walls in Illex Cave, that must come from a local source. Much of the drainage into the cave comes from a solid rock surface of low relief that extends to the south for over 1000 feet, an important source of good quality water to the system. The sink was first located by Bill Larson in the fall of 1987. Somewhat later, Bill Russell dug down about 5 feet in the bottom of the sink, until no more depth could be attained without removing rocks from the entrance. The entrance was filled by the rancher at the same time Illex Cave was sealed.

In April, 1991, Mike Warton dug out the entrance sink to a depth of 20 feet, where a horizontal crawlway extended north toward Illex Cave and a pit just too small to enter extended on down. The crawlway ended after about 75 feet in a blind 20-foot pit. However, just before the end another pit was dug open that dropped 20 feet to a narrow drain with airflow. This drain and the pit below the entrance both probably connect to upstream Illex Cave.

A smaller entrance to the system, about 40 feet southwest of the main entrance, was dug out by Bill Larson. This barely body-size opening drops about 6 feet and then extends horizontally past a low opening that connects to the main sink. Beyond the connection was a second short drop, after which the air became too poor for further exploration. This also might connect into upstream Illex Cave and should be checked during winter.
J91N Nelson Ranch West Windmill  Nelson Ranch  Well
Williamson  Jollyville  [3373600N/610200E]  EL985/  L-  D167/  V-
This now abandoned windmill is located about 1400 feet east of Testudo Tube, about 150 feet north of the Nelson Ranch South boundary fence. Nearby to the northeast are Link's Cave and Flesh and Blood Cave. The well blows air at times and after rains water can be heard running down the well shaft. The water level was measured at 167 feet below the land surface on September 12, 1991. The well was drilled through the impervious beds in the White Stone that prevented the Testudo Tube stream from reaching the Cedar Park Limestone, and water from this zone is now able to flow down the well shaft through the Cedar Park and Bee Cave Formations and enter the Bull Creek Limestone.

J81D Northside Sink  Milburn Ranch  Feature
Travis  Jollyville  [3372980N/609920E]  EL990/  L14/  D9/  V150
Northside Sink is located on the flat divide between Cypress Creek and Buttercup Creek, just south of the Travis-Williamson County line. The sink is about 300 feet south of the Milburn Ranch north fence and about 1000 feet west of a cattle guard on the road that parallels the fence, just west of an old deer stand.

The entrance to the sink is a bedrock oval, 2.5 by 3 feet, in the center of a depression about 20 feet in diameter and 3 feet deep. Bushes surround the opening and a 1-foot diameter tree grows from the entrance, making the sink difficult to locate. Just beneath the entrance, the sink enlarges to 5 feet wide and 10 feet long. The floor, sloping steeply to the east, is 5 feet beneath the entrance, and just east of the entrance drops 4 feet down over breakdown to the bottom of sink, a area about 4 feet in diameter floored with dirt and small rocks.

The sink was located in 1986 by Bill Russell. At this time, he and Mike Warton dug in the bottom, but there is no obvious drainage channel, and so a continuation does not seem likely.

J92L Pat's Pit  Buttercup Creek  Cave
Williamson  Jollyville  [3374280N/611310]  EL965/ L22/ D20/ V400
Pat's Pit is located 700 feet east of Good Friday Sink, just uphill from the edge of the woods. The entrance is an artificially-enlarged basin 2.5 feet deep and about 3 feet in diameter. On the north side of the basin a 1-foot high space beneath an overhanging ledge opens into a pit that drops 5.7 feet to a floor of dirt and loose rock. A hole edged with sharp projections and about 1.5 foot in diameter continues almost vertically downward for about 20 feet, enlarging to a crack 5 feet long and 2 feet wide. Named for Pat Larson, who was on the discovery trip.

J29H Pearl Harbor Pit  Buttercup Creek  Feature
Williamson  Jollyville  [3374200N/610950E]  EL985/ L20/ D20/ V200
Pearl Harbor Pit, located about 300 feet north of Honeycomb Cave in a clump of persimmon bushes, is entered through a crack 2.5 feet long and about 1 foot wide that soon opens into a roughly circular pit 5 feet in diameter at the bottom, originally 13 feet below the surface. The floor is black surface clay with no continuation. This cave was excavated by Warton and crew on Pearl Harbor Day of 1991. They reached a depth of about 20 feet but no cave was found. The cave holds water for several weeks after heavy rains.

L03B Pebble Brook Pit  Buttercup Creek  Cave
Williamson  Leander  [3374700N/611880E]  EL953/ L35/ D15/ V250
This pit is located just east of Pebble Brook Street just south of the Marigold Street intersection about 300 feet east of Marigold Cave. The pit was excavated to depth of about 15 feet by Mike Warton who broke into a low room about 20 feet long and 15 feet wide at approximately the same
level as the upper level in Marigold Cave. There was some airflow toward Marigold, but the passage was much too small to follow.

J72A  Plateau Spring  Milburn Ranch  Spring  Travis  Jollyville  [3370500N/610600E]  EL890/ L-/-  D/-/  V-/
This spring was reported on the Milburn Ranch at the head of a hollow, just west of the Dies Ranch Road along the east side of the Milburn Ranch.

J93B  Primrose Sink  Buttercup Creek  Feature  Williamson  Jollyville  [3374390N/612150E]  EL945/ L8/  D8/  V80
This small sink, now partly covered by a rock, is located about 150 feet southwest of Bev's Grotto in a field just south of Buttercup Creek Drive. The entrance to the sink is 5 by 3 feet. A large rock and some loose material was removed to reach a depth of 8 feet. At this depth, a low wide area almost filled with black dirt and small rocks extends to the north, but is too low to enter.

J85A  Raccoon Cave  LakeLine  Cave  Williamson  Jollyville  [3372400N/615040E]  EL960/ L39/  D9/  V200
This cave is located in a prominent sink about 200 yards east of Highway 183 and 200 feet north of LakeLine Boulevard. Along the east side of the surface sink a 4 foot in diameter hole drops 4 feet into a low passage that extends west to a drop into a lower level. The lower level consists mainly of a room about 10 feet in diameter and up to 10 feet high. A pile of breakdown in this room slopes up to a second smaller entrance. At the lowest level is a lead that might be dug. Several low bedding-plane passages extend from the main cave but do not appear promising. The cave was mapped by Charley Savvas and Mike Warton on 18 June 1991. A description and map of the cave appeared in Reddell (1991). The cave is normally dry due to air circulation between the entrances, and since cave-adapted animals require a high humidity, the fauna is relatively poor. Despite this, the endangered ground beetle Rhadine persephone has been collected in the cave.

J88A  Railroad Sink  LakeLine  Sink  Williamson  Jollyville  [3372330N/617930E]  EL895/ L5/  D5/  V75
This sink is located about 20 feet south of the Austin and Northwestern Railroad, about a half mile northwest of Highway 620, just west of a small county road that crosses the tracks. The sink is an opening, 5 feet in diameter, that drops 2 to 3 feet, and then slopes down to the south under a ledge. Sticks and railroad ties are jammed into the entrance to a low passage, but the passage becomes too low to follow after about 3 feet. There is no noticeable airflow. This sink receives drainage from a considerable area. Since several thousand feet of railroad right of way drain into the sink, concern has been expressed that a chemical spill could seriously contaminate the groundwater. The cave is on the Austin and Northwestern Railroad right-of-way. The Austin and Northwestern Railroad is owned by the City of Austin.

J93C  Riverwood Sink  Buttercup Creek  Sink  Williamson  Jollyville  [3374490N/612260E]  EL945/ L12/  D4/  V300
This sink, located on lot 28, section 2, of the Buttercup Creek Subdivision was 40 feet long, 16 feet wide and up to 4.5 feet deep. An opening about 1 foot high extended for 8 feet from the north end of the sink, and a low passage 1 to 2 feet high mostly filled with rocks and dirt extends west for 12 feet from the south end of the sink towards Bev's Grotto, about 200 feet to the west. Surveyed and cores drilled by Mike Warton before a house was built covering the sink.
Rolling Rock Cave was reported by James Reddell in his report on the biology of the Lime Creek Road area as follows: "A collection was made on 15 February by James Reddell and Marcelino Reyes. The troglobites were all found in the first inner room of the cave, some troglophiles were taken at the bottom of the entrance drop. An attempt to gain access to a reported inner room was not successful. Reyes was able to reach the top of an estimated 8-foot deep bell-shaped pit, but since Reddell could not join him, it was decided to postpone exploration until a slight excavation near the beginning of the crawlway would allow two people to make the exploration. Air temperature in the cave was 63° F. This is unusually cold for Travis County caves and may help to explain the limited fauna of the cave." Species collected include a *Trichoniscid* isopod (troglobite), two *Cicurina* spiders, both *Cambala* and *Speodesmus* millipedes and *Rhodine persephone*, the endangered ground beetle.

This interesting cave 65 feet northeast of Good Friday Cave was opened by Bill Larson. The entrance is a smooth solutional hole about 3 feet in diameter that drops 3 feet to a dirt floor that slopes steeply to a SMALL hole that leads into a tight squeeze extending steeply downward to a low area, where it is possible to slide sidewise for about 10 feet to reach the top of a quite nice pit about 25 feet deep and 4 feet in diameter. At the bottom is a small pool containing salamanders and a drain just too small to traverse.

This feature was first reported by Bill Larson, but it was too constricted to enter; it consists of a crack about 5 feet long, 4 feet deep, but only 6 inches wide. Bill Russell enlarged the crack to passable size in late 1991, but no traversable cave was found at the bottom.

Shady Sink is a potentially promising sink located on the Nelson Ranch about 1500 feet northeast of *Testudo Tube*. The sink was originally a depression beside a large tree, but now has been excavated to a depth of 10 feet ending in loose rock under a steeply sloping headwall.

Stewart Spring is located on the Audubon Preserve just south of Lime Creek Road and west of Cypress Creek at the head of a major hollow draining southeast into Cypress Creek. The spring flows from the base of the Cedar Park Limestone through several small holes partly covered by the roots of two large trees. The spring is about 50 feet downstream from a 15-foot, normally dry waterfall developed where the drainage crosses the base of the Cedar Park Limestone. A few feet upstream from this is a smaller fall over the upper Cedar Park Limestone, and a small natural bridge. During normal flow, the water from this spring sinks and reappears several times before reaching Cypress Creek.
Joint controlled passage
220 degrees following trend of Cedar Park Fault

Entrance
devolved along 220 joint

Project of Entrance Area
Closely spaced passage levels in the Whitestone Formation
J92X Stone Sink  Buttercup Creek  Feature
Williamson Jollyville  [3373970N/611680E] EL970/ L10/ D6/ V40
Located in a grove of trees 50 feet north of Buttercup Boulevard, half a block east of the Buttercup Boulevard - Brookmeadow Trail intersection. This feature is composed of three small sinks along one joint. The main sink was dug out and is now a steeply sloping crawl about 10 foot long extending down to a depth of 6 feet where the dig ends small rocks and dirt. One of the nearby holes had air flow but is only 8 inches in diameter. The other sink was cleaned out to a depth of 4 feet. The main sink is a relatively promising dig, especially since it is located near the prominent fracture trend that follows Buttercup Boulevard.

J91L Testudo Tube  Jamail Ranch  Major Cave
Williamson Jollyville  [3373750N/609740E] EL1000/ L1300/ D30/ V1300
The almost insignificant sinkhole above the entrance to this major cave was discovered in the spring of 1988 by Bill Larson, who after a brief three hour dig, broke through into a small crawlway. This crawlway led 8 feet to two small round holes in the floor that dropped 10 feet into a spacious hands-and-knees crawlway that meandered downstream over a gravel floor to a short drop into a stream passage. Realizing he had found a major cave, he called several cavers, looking for someone help explore this exciting find. John Spence was the only one at home, so Bill and John returned to finish the exploration. They crawled through the normally dry upper section and dropped into the stream passage. This passage was a ruler-straight joint-controlled passage, at first only 2 feet wide and high, with a distinct groove following the joint along the 2-foot wide passages exceeding 70 feet. After a long straight section there would be a slight offset, and then the cave would resume the original heading. About 300 feet downstream, one of the domes along the joint opened into an upper room that could be part of a once extensive, but now clay-filled upper level. About 400 feet downstream the cave intersected a joint at right angles with the north-northeast trend the cave had been following and made an abrupt right turn, at first as a 6-foot high, but very narrow, fissure. Then the cave finally splits into two levels, both of them very constricted in places, until progress is finally no longer possible on either level. Mike Warton dug in the stream level at the previous end of exploration in August, 1991, and (by removing five rock projections) explored somewhat further to a sharp left turn where the passage mostly siphoned. The passage does not appear to be enlarging, and there is no noticeable air flow.

Testudo Tube is part of an extensive drainage network. After heavy rains, the stream passage is filled with over a foot of swiftly-rushing water. Upstream from the drop from the upper level, the stream passage is low, wide and partially blocked by a clay bank. After 20 feet, the passage splits; the right branch ends after 10 feet at a hole only a few inches in diameter. The left branch is only about 1 foot high, and (even during dry times) mostly full of water. The shallow nature of the cave limits water storage in the rocks feeding the cave stream, and during dry periods, flow from the upstream is reduced to a small seep. All of this water enters a small crack below the entrance into the lower level. Downstream there is no flow, only isolated pools, even during the summer of 1991, when there were considerable early summer rains. From the entrance to the end of the stream passage is 1120 feet, and with side passages and upper levels, the total length of the cave stands at about 1300 feet. (See map of entrance area above.)

N19D Trammell Hollow Cave  Whitestone Boulevard Cave
Travis Nameless  [3377150N/607910E] EL1055/ L50/ D30/ V400
A survey from the head of Trammell Hollow places Trammell Hollow Cave 700 feet east-northeast from Trammell Shelter, almost exactly on the boundary between the Nameless and Leander Quadrangles, 50 feet south of a road through the cedar, 200 feet north of a cleared area surrounding a quarry. This cave receives considerable drainage from the cedar-covered flats to the east of the cave, and this water recently has cut a 20-foot long gully leading to the cave entrance. The entrance to the cave is a sink about 10 feet in diameter and 6 feet deep. Just inside the entrance a 3 x 2 foot shaft developed along a prominent joint drops vertically for 14 feet, gradually enlarging to 3.5 by 8
feet, just before it opens into a room 15 feet long and 10 feet wide. The ends of the room are filled with surface dirt, but just off-set from the entrance drop is a cleanly scoured depression in breakdown 7 feet deep and 6 feet in diameter. A passage, 3 feet wide and 1 foot high, extends east from the bottom of the depression for 10 feet, to a 3-foot drop into a lower crawlway extending in two directions.

To the west, the passage is cleanly scoured and from 1 to 2 feet high for 10 feet, to where it is too low to squeeze through, but a few feet ahead it enlarges. A flat rock was used to divert flood runoff into the lower east trending passage, since it was partially filled with dirt. After several floods, this passage is now large enough to follow with a little work. Floods in December of 1991 formed the gully leading into the entrance (probably aided by bulldozing near the cave), and rocks from the gully jammed the entrance to the lower crawlways, blocking it almost completely and forcing water to overflow the entrance sink. The cave was first reported by Bill Larson.

N19A Trammell Shelter (41TV133) Whitestone Boulevard Cave
Travis Nameless [3377120N/607740E] EL1040/L100/D15/V3000
Trammell Shelter is developed in the Cedar Park Limestone, the upper 10-foot thick member forming the roof, the shelter itself being developed in the middle medium-bedded member above the lower massive member. There are good exposures of the entire Walnut section in the vicinity. Trammell Spring is about 200 feet to the west. A shallow shelter has developed below and just north of Trammell Shelter where the softer Bee Cave Marl has been removed. Small caves and shelters are formed in extensive travertine deposits along the canyon wall to the north of the shelter.

The main entrance to Trammell Shelter is 32 feet wide and about 7 feet high, just inside the dripline. The main room of the shelter just inside the entrance is 30 feet wide, 5 to 7 feet high, and extends back 20 feet from the entrance. A passage extends northeast from this room and curves to the east as it passes a small hole that extends out to the cliff face. This passage ends in slabs of breakdown and dirt but appears to be more of a "real" cave passage than usually found in shelters. From the back end of the entrance room a duck-under leads into a dome that extends through a solution hole to the surface, 23 feet back from the cliff face. And from the south end of the entrance room, a passage with evidence of water flow can be followed almost to Trammell Hole, a small solution hole that receives drainage.

Trammell Shelter is developed in the medium-bedded generally more soluble middle member of the Cedar Park Formation, with the massive upper member forming the roof. Beneath Hammett Shelter and below the lower massive member of the Cedar Park a shallow shelter has developed in the Bee Cave marl.

Trammell Shelter lies at the east end of a deep hollow extending west to join Bee Cave Hollow about a mile upstream from where Sandy Creek flows into Lake Travis. This shelter is widely known, especially to collectors of Indian artifacts, since Indians utilized the shelter and camped in the area, leaving a large burnt rock midden on the flat surface just above the shelter. Archeological investigations have been conducted in the shelter (41TV133), and a photograph of the shelter entrance with archaeologists at work appears in *The Caves of Texas*, published by the National Speleological Society in 1948. (See map, next page.)

N19C Trammell Hole Whitestone Boulevard Feature
Travis Nameless [3377110N/607750E] EL1050/L8/D7/V50
This small feature is located 60 feet southeast of the end of Trammell Hollow, in a flat limestone surface about 60 feet behind the fenced yard of subdivision house on the south edge of the artifact diggings. The hole is an elliptical opening 5 feet long and two feet wide that widens upward. The bottom is 7 feet deep below the high west side, and 6 feet below the ground to the east. The pit receives drainage from the east; the water flowing through Trammell Shelter to reach the adjacent hollow.
TRAMMELL SHELTER
Travis County, Texas
N19A 41TV133
3337120N 607740E
Heather Haecker
Bill Russell
Compass Sketch
May, 1992

Trammell Hollow
Side Entrance
Main Entrance
Solution hole to surface
PLAN
Solution Hole
Profile

Trammel Hole -N19C
N19B  Trammell Spring  Whitestone Boulevard  Cave
Travis  Nameless  [3377120N/607720E]  EL1000/  L-/  D-/  V-
This apparently perennial spring is located at the base of a 30-foot cliff about 200 feet west of Trammell Shelter. In the past, this spring was apparently used as a water supply. Two large cement tanks have been constructed to hold spring water, and a pipe still carries water to one of these tanks. A mop was placed in the spring in 1989 but was washed partly out of the opening, and so no invertebrates were recovered. The spring flows from the base of the Cedar Park Limestone.

J93E  Treehouse Cave  Buttercup Creek  Cave
Williamson  Jollyville  [36374380N/611800]  EL945/  L100/  D25/  V4000
This promising cave is located in a sink about 100 yards northwest from the northwest corner of Creekside Park in Buttercup Creek Subdivision. The sink is about 40 feet in diameter and about 3 feet below the general surface. There appears to be drainage entering the sink from the west. Bill Larson and friends dug in the bottom of the sink through loose rocks to a depth of about 6 feet, but their dig was refilled. A more concerted dig by Bill Russell and Bill Larson eventually encountered open cave toward the end of 1992, after digging through about 20 feet of large rocks, roots, and dirt. The dig initially encountered a small crawlway with a narrow crack in the ceiling leading away from the base of the breakdown-filled sink. After about 15 feet, the crawlway is joined by a small stream that flows from a low passage. Here, the passage enlarges to a comfortable crawl which follows the stream to a small pit about four feet in diameter and five feet deep. The water flows from a pool at the bottom of the pit under a ledge and over a travertine dam that reaches almost to the ceiling. This dam will have to be notched to follow the water downstream. On the far side of the small pit, a chimney leads up into the fissure above the crawlway. The fissure extends to a room with a climbdown to a water passage extending in two directions, back toward the small pit and on along the continuation of the fissure-crawlway trend. This water passage is 2 to 3 feet high and wide, but mostly full of water. The cave contains salamanders, amphipods, and two species of rhadine. Named for a treehouse built by children in a large tree by the sink.

J81A  Tributary Spring  Long Hollow  Spring
Travis  Jollyville  [3372200N/609200E]  EL930/  L-/  D-/  V-/ 
This small spring is located on the Audubon Preserve just south of Lime Creek Road in the head of a narrow valley that drains southeast into Cypress Creek. The spring flows from the base of the Cedar Park Limestone.

J92P  T.W.A.S.A Cave  Buttercup Creek  Cave
Williamson  Jollyville  [3374180N/610670E]  EL990/  L88/  D40/  V700
This interesting cave is located at the base of a conspicuous hackberry tree about 100 feet from the Nelson ranch fence in the western undeveloped part of the Buttercup Creek Property. The entrance is 4 foot in diameter hole in a solid ledge of rock with the largest hackberry in the area growing out of it.
Following an initial dig by Bill Larson, Mike Warton and crew dug down through dirt, rocks, and roots to reach a low dirt-floored room 7 feet below the surface. This room is 15 feet wide, 20 feet long, and less than 3 feet high. It was probably larger at one time, as it is partially filled with surface material from the entrance sink. The room slopes down in the center to a low area that extends back under the room for 5 feet beneath a very thin ledge. By squeezing to the left, one can reach two holes in the floor, which in this area is only about 1 inch thick.
Beneath this thin floor is a 20-foot pit, the first 10 feet of which are developed along several holes in a convoluted honeycomb solution zone, but the last 10 feet of which open into an elliptical pit about 6 x 4 feet. Even during dry periods, water seeps into the pit, leaving by a crack too small to follow. A crawlway from near the top of the pit leads back to the beneath the entrance and a light
connection up to the dig. Named by Mike Warton after three of the principle diggers, Tom Thornhill, Mike Warton and Glenn Schneider who excavated the entrance and mapped the cave on 11 January 1987. The map appeared in Elliott and Reddell (1989). Salamanders have been collected from pools in the lower part of the cave along with the amphipod *Stygobromus russelli* and a flatworm, as well as several terrestrial species. The cave is developed in the Cedar Park Limestone on the updip western edge of the monocline off the end of the Cedar Park Fault.

**J92M Two Holer Cave  Buttercup Creek Cave**  
**Williamson Jollyville [3374340N/610920E] EL990/ L145/ D30/ V700**  
The entrance to Two Holer Cave is a triangular opening in a solid ledge of rock, 1.4 by 2.3 feet, on the east edge of a sink 30 feet in diameter and about 4 feet deep in the center. A second hole has developed along the edge of the sink, 11 feet from the first, but is blocked by rocks and dirt at a shallow depth. The entrance drops 12 feet into a low room, 3.5 to 4 feet high and 10 feet long. The lower part of the entrance enlarges along several bedding plains and becomes very convoluted before it reaches the room below. From the far end of the room a crawlway extends 13 feet to a dome that appears to connect with the second hole.

The room and crawlway have developed along one edge of the surface sink, with the side below the sink being dirt and loose rock. A small hole in breakdown on the other side of the room drops 7 feet into a drain that leads away from the sink. Initially, the drain is about 4 feet high and 3 feet wide. Soon a shallow slot develops in the floor and downcuts to reach a favorable bedding plane. About 15 feet from the base of the breakdown pit, this lower drain, much too small to follow, leaves the main passage, which continues as an elliptical tube about 2 x 3 feet. After about 15 feet, the passages rejoin where a travertine dam has developed in the main tube. Ten feet beyond the junction, a crack in the floor only a few inches wide drops 7 feet to a lower level. The passage at the bottom appeared to be passable, but the first 2 feet of the crack were very narrow. Beyond the crack the tube narrows and becomes too small to follow. In the summer of 1988 the crack was enlarged by Bill Larson, and he was able to reach the lower passage, a small body-sized squeeze in water. Several salamanders were observed in the water. The passage is so narrow that one has to back out, but it did not actually end.

**J75C Underline Cave  LakeLine Cave**  
**Williamson Jollyville [3371520N/614780E] EL940/ L132/ D13/ V3000**  
This cave was initially discovered in 1990 by Mike Warton, who cleaned out the 3-foot in diameter, 5-foot deep entrance. The cave is described in Reddell (1991), from which this information is abstracted. From the bottom of the entrance a 5 foot crawl leads to a 5-foot drop into one end of a low, irregular room 60 feet long and 15 to 20 feet wide. This room is silt-floored room and usually less than two feet high. A shallow sink in the floor is the deepest point in the cave, 13 feet below the entrance. Harvestmen of the genus *Texella*, federally listed as endangered, have been collected from this cave. The cave was mapped by Mike and Cindy Warton on 12 February 1991.

**J93F Warton Whirlpool  Buttercup Creek Feature**  
**Williamson Jollyville [3374370N/611950E] EL935/ D2/ L2/ V1**  
This recharge feature, first reported by Bill Larson, is located about 30 feet upstream from Buttercup Boulevard bridge in the bed of the small creek that flows by Creekside Park. A stream of water several inches in diameter is recharged into loose rocks in the bed of the creek. This feature was dug out to a depth of about 2 feet and consists of 6 inch rocks in a clay matrix with several holes between the rocks. No airflow, but an easy dig.
Whitestone Pit

Williamson Jollyville [337950N/611110E] EL975/ L55/ D40/ V600

When Whitestone Pit was first located by Bill Larson in 1987, it was the first karst feature in the Buttercup Creek Area to come to the attention of cavers. The attractiveness of this pit undoubtedly encouraged more work in the area. The entrance is a scoured clean 3 x 5-foot opening developed along a prominent joint. From this entrance the pit drops about 6 feet to a ledge, where there is a slight offset and then drops a further 15 to 20 feet as a shaft, 4 to 5 feet in diameter. At the bottom of this drop is a breakdown floor, actually breakdown blocks jammed in one side of a three way natural bridge. One can go through the breakdown and climb down an additional 10 feet to a hole through breakdown into a narrow fissure. One way ends, and the other is a clean-scoured drain 4 feet high, but only 6 to 8 inches wide, and probably not traversable. Airflow has never been observed, but the cave receives considerable drainage.

Whitewater Cave

Williamson Jollyville [3374290N/610980E] EL995/ L70/ D30/ V400

This cave, located near the northwest corner of the Nelson Ranch, has, for the area, an impressive pit entrance. Especially after viewing the surrounding piles of tailings, one realizes that most, if not all, of the entrance pit was originally filled with loose rocks and dirt. A circular pit about 6 feet in diameter in the bottom of a shallow sink has been excavated to a depth of 15 feet by Mike Warton and friends, to where the dig intersected a fissure tending to the east. The fissure continues down to where it becomes water-filled. Further progress is possible by digging out the fissure above the water. Mike Warton reports that the cave takes considerable water, and that it should be pushed during dry periods. Salamanders have been observed in the water.

Windmill Cave

Travis Jollyville [3371390N/610100E] EL945/ L60/ D25/ V500

This cave is located a few hundred feet east of Cypress Creek, about 200 feet east of a small windmill and just north of a major fence line. The cave is entered through two holes, each about 2 feet in diameter, in a flat ledge of rock. The easternmost hole is lower and receives drainage from a small surrounding area. Both holes lead into an entrance room about 10 feet long and 8 feet high, partly divided by a partition. The cave continues as a low squeeze for about 15 feet, to where small rocks had to be moved to progress. Beyond this constriction, the cave enlarges to a crawlyway that appeared to end. However, a few rocks were moved to uncover a 12-foot pit only 1 x 2.5 feet at the top, but enlarging to 5 feet in diameter at the base. The walls of the pit are strongly sculpted by solution, and the pit is easily climbed. At the bottom, a 12 x 6 inch opening leads to a 6-foot drop into what appears to be a small stream passage. At present, the hole is too small to enter, but it could be enlarged, since there is only a flange of limestone that blocks access. Since this cave receives drainage, it is possible that a stream passage could be followed for some distance, and might contain a rich aquatic fauna.