

FINAL

PRT-836384

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**Environmental Assessment/Habitat Conservation Plan
for Issuance of an Endangered Species Act section
10(a)(1)(B) permit for the incidental take of the
Tooth Cave ground beetle (*Rhadine persephone*)
during construction and operation of the
Buttercup Creek's Section 4 and Phase V
and extension of Lakeline Boulevard (438 acres),
Williamson County, Texas**

**The United States Fish and Wildlife Service
Ecological Services Field Office
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COVER SHEET

Title for Proposed Action: Issuance of Endangered Species Act Section 10(a)(1)(B) permit for the incidental take of the endangered Tooth Cave ground beetle (*Rhadine persephone*) during construction and operation of a 438-acre mixed use development, Buttercup Creek's Section 4 and Phase V, and extension of Lakeline Boulevard, Williamson County, Texas.

Unit of Fish and Wildlife Service Proposing Action: Regional Director, Region 2,
U.S. Fish and Wildlife Service, Albuquerque, NM.

Legal Mandate for Proposed Action: Endangered Species Act of 1973, as amended,
Section 10(a)(1)(b), as implemented by 50 CFR 17.22.

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1.0 PURPOSE AND NEED FOR ACTION

The purpose of this Environmental Assessment (EA) is to evaluate the environmental impacts of the proposed Section 10(a)(1)(B) permit for the incidental take of the federally listed *Rhadine persephone* during construction and operation of the development of portions of the Buttercup Creek Section 4 and Phase V, and extension of Lakeline Boulevard, Williamson County, Texas. The EA will establish the conditions under which the Applicant will meet the requirements for the Section 10(a)(1)(B) permit under the Endangered Species Act. The need for the permit is so that otherwise lawful development may proceed.

2.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

2.1 Vegetation

The proposed development site is characterized by mixed woodlands (part of the Hill Country region of Texas - white juniper (*Juniperus sp.*) dominates with plants like oak (*Quercus* spp.) and in average canopy coverage of 35%. Other frequent to occasional species include cedar (*Juniperus sp.*), post oak (*Quercus stellata*), Texas persimmon (*Diospyros texana*), yellow pine (*Pinus sp.*), and hackberry (*Celtis sp.*). Common ground cover species include silver cholla (*Cholla arborescens*), little bluestem (*Schizanthus scoparium*), three-awn (*Tripsacum daniellii*), buffalograss (*Bouteloua curtipendula*), and miscellaneous herbs and forbs.

1.0 INTRODUCTION

Lumbermen's Investment Corporation (LIC)(Applicant) has filed an application under 10(a)(1)(B) of the Endangered Species Act (Act) to allow incidental take of listed endangered Tooth Cave ground beetles (TCGB)(*Rhadine persephone*) associated with otherwise lawful construction and occupation of mixed use development with associated streets and utilities on portions of Buttercup Creek's subdivision Section 4 and Phase V, and the extension of Lakeline Boulevard north of the subdivision located in the City of Cedar Park, Williamson County, Texas (Figure 1).

Residential development is planned within the 434.6-acre area (Figure 2). The extension of Lakeline Boulevard northward of the subdivision for about 2,000 feet occupies an additional 3.4 acres. A Habitat Conservation Plan (HCP) has been included in the proposed development that focuses on avoidance of take of listed species or any other species of concern to the extent reasonably possible, and also provides for possibilities of incidental take of species by unexpected encounters with subsurface voids during construction that might contain Tooth Cave ground beetles or other species (Section 6.0). The HCP proposes responsible development practices and karst conservation measures to be utilized by the Applicant in the Buttercup Creek development, augmented by new knowledge gained by geological and biological studies conducted on-site.

2.0 PURPOSE AND NEED FOR ACTION

The purpose of this Environmental Assessment (EA) is to evaluate the environmental impacts of the issuance of a Section 10(a)(1)(B) permit for the preferred alternative and the other alternatives that were considered. The permit would authorize the development of portions of the Buttercup Creek Tract and allow for the incidental take of the federally listed TCGB. The Habitat Conservation Plan (HCP) will establish the conditions under which the Applicant will meet the requirements for a Section 10(a)(1)(B) permit under the Endangered Species Act. The need for the permit is so that otherwise lawful development may proceed.

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Vegetation

The proposed development site is characterized by mixed woodlands typical of the Hill Country region of Texas. Ashe juniper (*Juniperus ashei*) dominates with plateau live oak (*Quercus fusiformis*) with an average canopy coverage of 35%. Other frequent to occasional species include cedar elm (*Ulmus crassifolia*), post oak (*Quercus stellata*), Texas persimmon (*Diospyros texana*), yaupon (*Ilex vomitoria*), and hackberry (*Celtis laevigata*). Common ground cover species include silver bluestem (*Bothriochloa saccharoides*), little bluestem (*Schizachyrium scoparium*), threeawn (*Aristida* sp.), buffalograss (*Buchloe dactyloides*), and miscellaneous herbs and forbs.

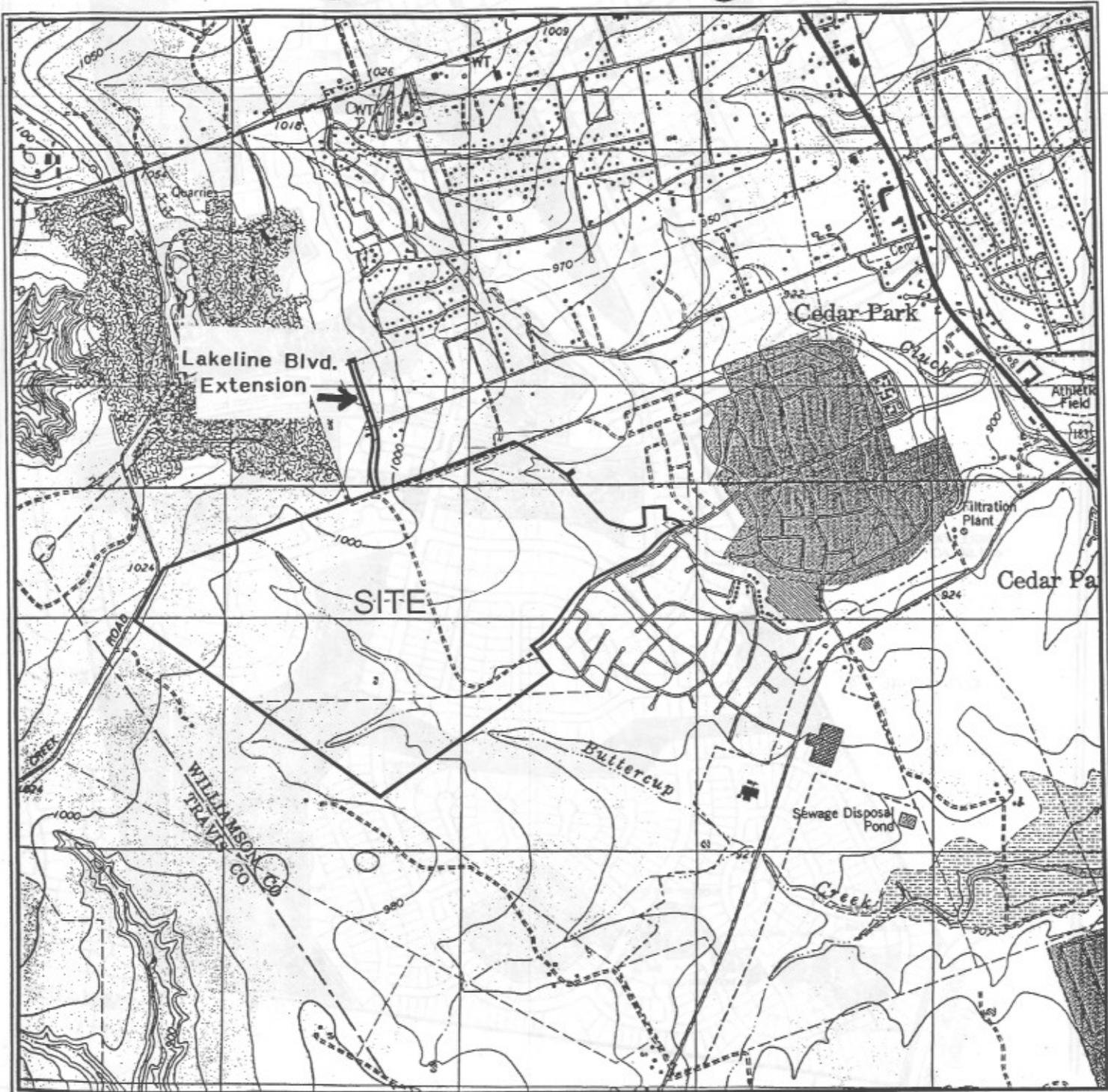


Figure 1: Lumbermen's Investment Corporation site location

3.2 Wildlife

The proposed development site and surrounding area has been used historically for ranching operations. Recently, increased residential development has occurred to the north, east, and south. The area immediately to the north and northwest is currently under development as a limestone quarry. Wildlife on-site is typified by common species of central Texas. Common bird species include northern mockingbird (*Mimus polyglottos*), northern cardinal (*Cardinalis cardinalis*), Carolina chickadee (*Parus carolinensis*), tufted titmouse (*Parus bicolor*), mourning dove (*Zenaidura macroura*) and other common bird species. Common mammals include the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), eastern cottontail (*Sylvilagus floridanus*), and nine-banded armadillo (*Dasypus novemcinctus*). Herpetofauna includes primarily terrestrial reptiles. Common reptiles include the Texas rat snake (*Elaphe obsoleta*), northern fence lizard (*Sceloperus undulatus*), and ground skink (*Scincella lateralis*).

3.3 Listed, Proposed or Candidate Species

Within Williamson County, five vertebrate and invertebrate species of wildlife are listed as endangered by the Service. Two bird species, golden-cheeked warbler (GCW) (*Dendroica chrysoparia*) and black-capped vireo (BCV) (*Vireo atricapilla*) were federally listed in September 1987 and May 1990 respectively. Three karst-dwelling invertebrates (Tooth Cave ground beetle {*Rhadine persephone*}, Bone Cave harvestman {*Texella reyesi*}, and Coffin Cave mold beetles {*Batrissodes texanus*}) have been placed on the federal endangered species list since 1987.

Vegetation on the Buttercup Creek property differs significantly from that in areas where BCVs regularly occur. Onsite habitat assessments and species specific survey efforts have concluded that no habitat typical of BCV use (dense, low, hardwood shrubs) or GCWs (juniper-mixed oak woodland) exists on the subject property. Adjacent property to the west of Buttercup contained golden-cheeked warblers in 1993, but according to spring breeding surveys conducted by DLS Associates since 1993, GCWs have been absent. Spring breeding season surveys were conducted for the two bird species on Buttercup Creek's Section 4 and Phase V in 1994 by Horizon Environmental Services and proved negative for their occurrence due to the lack of suitable vegetation. The juniper species on the property is generally young, less than 10 feet tall and 15 years old with little or no peeling bark. Geological and biological studies conducted by Horizon Environmental Services, Inc. were conducted on properties north of Buttercup Creek to be traversed by the extension of Lakeline Boulevard to FM 1431. No habitat suitable for either the GCW or BCV was identified along the proposed extension route.

Several species of endangered karst invertebrates occur within a karst geologic region known generally as the Fredericksburg Geologic Group in Travis and Williamson counties. The subject site is located within a faulted transition zone between Edwards and Walnut formations, where Walnut Limestone Formation composes subgrade materials/units. Buttercup Creek property contains numerous caves and karst features throughout its extent (Russell, 1993; Mike Warton & Assoc., 1997). Geological and biological surveys were conducted in all identified caves on the site in 1986

(Russell, 1993) and continued in 1991 until present (Mike Warton and Associates 1997). The TCGB has been documented for 25 of the 54 identified karst features within the pre-existing and proposed Buttercup Creek development area (Table 1). Of the 54 identified karst features, 17 are located in existing Buttercup Creek preserve areas, or have been the subject of past consultations with the Service concerning their preservation and protection. These 17 karst features are located in the early phases of the Buttercup Creek subdivision developed in the 1980's and are not included in this permit application.

A new cave, Wilcox Cave, was discovered north of Buttercup Creek and within the initially proposed right-of-way of Lakeline Boulevard (Mike Warton and Associates 1998). This cave exhibited three surface openings with a significant underground void. The Tooth Cave ground beetle and the *Rhadine* n.s.2, an unidentified new species of ground beetle, were found in this cave. Two additional sink features were discovered. One surface sink feature was found just south of Wilcox Cave, but excavation did not produce a subsurface void. The other sink feature occurs in the backyard of a residence. The sink was reported by the resident to have been a cave opening in the past, but had been covered over by the resident many years ago. This feature was not excavated or further investigated at the request of the resident. It is assumed that this feature could be either a fourth opening to Wilcox Cave or a separate cave. Its underground extent is unknown; however, a water line was trenched approximately 100 feet east of the feature several years ago and did not encounter any subsurface extent of the cave. Since LIC did not want to impact Wilcox Cave and the associated sinks, the road was relocated farther east for complete avoidance of all features found. They do not own the property containing Wilcox Cave and are, therefore, not including it in this permit.

The primary threat to the listed karst invertebrates is loss of habitat due to urban development activities. This loss may be direct, such as filling cave entrances or collapse of cave ceilings due to road or building construction and digging for installation of utilities; or indirect, such as alteration of natural drainage patterns, loss or degradation of the surface plant and animal communities, pollution, and increased human visitation. Fire ants (*Solenopsis invicta*) which invade disturbed areas, also pose a significant threat to the listed species and the ecosystems on which they depend.

Water enters the karst ecosystem through infiltration and surface drainage. Because these karst invertebrates depend on air-filled voids with some water infiltration, a reduction in moisture levels can result in elimination of most of the troglobitic (obligate cave dwelling) fauna since they rely on moist air environments. Increased moisture levels can result in flooding and elimination of air-breathing species. Alteration of the quantity or pattern of surface water inflow could also change nutrient inflow. Since troglobitic species rely on nutrients from the surface for their existence, any alteration of inflow can cause an adverse impact. Development activities that result in the alteration of the natural drainage patterns include altering the topography, increasing impervious cover, and installing berms or water collecting devices.

Karst ecosystems are almost entirely dependent on the surface plant and animal community for nutrient input. These ecosystems receive nutrients from the surface in the form of leaf litter and other organic debris that have washed or fallen into the caves, from tree and other vascular plant

TABLE 1: Buttercup Creek Area C Information (Warton, 1997)

EXISTING PRESERVES, AREA CAVES IN DEVELOPED SITES, AND PLUGGED SITES

CAVE NAME	DEPTH	BUFFER	R.p. ¹	R.2 ²	EURYCEA	GATE	CONNECT	RECHARGE	USAGE
Bev's Grotto	9.9	50	NO	NO	NO	YES	NO	NONE	?
Boulevard Cave	56	100	YES	YES	NO	YES	SYSTEM	MEDIUM	?
Bluewater Pit Cave #1	51.3	300	NO	YES	YES	YES	POSSIBLE	MEDIUM	PARK
Bluewater Pit Cave #2	47.5	300	YES	YES	YES	YES	POSSIBLE	MEDIUM	PARK
Doug's Pit Cave	8.5	0	NO	NO	NO	PLUG	NO	MINOR	PLUGGED
Filter Sink	2	300	NO	NO	NO	NO	NO	MEDIUM	?
Forest Trail Cave	28.5	25	NO	NO	NO	YES	POSSIBLE	MEDIUM	?
Header Sink	4.8	0	NO	NO	NO	PLUG	NO	MINOR	PLUGGED
Marigold Cave	71.8	50	YES	YES	NO	YES	SYSTEM	MEDIUM	RESEARCH
Mushroom Pit Cave	10	50	NO	NO	NO	NO	POSSIBLE	MINOR	FLOOD PLAIN
Pebblebrook Pit Cave	16.2	25	NO	YES	NO	YES	SYSTEM	MINOR	?
Primrose Cae	17.5	200	YES	NO	NO	YES	POSSIBLE	MINOR	?
Pomegranete Pit Cave	25	0	N/A	N/A	NO	PLUGGED	NO	NONE	PLUGGED
Riverwood Indian Cave	6	0	N/A	N/A	NO	PLUGGED	NO	NONE	PLUGGED
Skinny Cae	17	0	N/A	N/A	NO	PLUGGED	NO	NONE	PLUGGED
Squeeze Down Pit	11.2	0	N/A	N/A	NO	PLUGGED	NO	NONE	PLUGGED
Warton Whirlpool	?	0	?	?	U	NO	PROBABLE	MAJOR	FLOOD PLAIN

FEATURES IN UNDEVELOPED SECTION 4

Animal Canyon Cave	23.7	300	YES	NO	NO	NO	POSSIBLE	MEDIUM	RESEARCH
Buttercup Blow Hole Cave	29.6	200	YES	YES	POTENTIAL	NO	YES	MEDIUM	RESEARCH
Buttercup Bone Cave	15.2	50	NO	NO	NO	NO	NO	MINOR	RESEARCH
Cedar Elm Sink Cve	59.2	300	YES	YES	NO	NO	YES	MEDIUM	RESEARCH
Good Friday Cave	20.5	200	YES	NO	NO	NO	POSSIBLE	MEDIUM	RESEARCH
May B A Cave	26	200	YES	NO	NO	YES	POSSIBLE	MEDIUM	PARK
Pat's Pit Cave	21.1	200	YES	NO	NO	NO	POSSIBLE	MINOR	RESEARCH
Salamander Squeeze Cave	40.2	200	YES	NO	YES	NO	POSSIBLE	MEDIUM	RESEARCH
Stone Well #1 Cave	77.6	200	YES	NO	POTENTIAL	YES	YES	MEDIUM	RESEARCH
Stone Well #2 Cae	16	200	YES	NO	NO	NO	YES	MINOR	RESEARCH
Tree House Cave	45	200	YES	YES	YES	YES	PROBABLE	MEDIUM	RESEARCH
Two Hole Cave	38.2	200	YES	NO	YES	NO	PROBABLE	MEDIUM	RESEARCH

FEATURES IN UNDEVELOPED PHASE V

Ant Riot Cave	10.2	50	NO	NO	NO	NO	NO	MINOR	PARK
Bad Air Fissure Cave	30	200	NO	YES	NO	NO	POSSIBLE	MEDIUM	PARK
Buttercup Creek Cave	140.1	300	YES	YES	YES	YES	SYSTEM	MAJOR	RESEARCH
Buttercup Dome Cave	8.4	50	NO	NO	NO	NO	NO	MINOR	RESEARCH
Buttercup Drain Cae	28.5	300	NO	NO	U	NO	SYSTEM	MAJOR	RESEARCH
Buttercup Wind Cave	21.3	200	NO	YES	NO	NO	POSSIBLE	MINOR	PARK
Convolute Canyon Cave	27	300	YES	YES	NO	NO	SYSTEM	MAJOR	RESEARCH
Drain Side Sink	14	50	NO	NO	NO	NO	NO	MINOR	RESEARCH
Flesh and Blood Cave	28.4	100	NO	NO	NO	NO	POSSIBLE	MEDIUM	PARK
Godzilla Cave	36.2	300	NO	YES	YES	NO	POSSIBLE	MEDIUM	PARK
Grimace Cave	26	200	YES	NO	NO	NO	POSSIBLE	MEDIUM	PARK
Harvestman Cave	19	200	YES	NO	NO	NO	POSSIBLE	MINOR	RESEARCH
Hideaway Cave	60	300	YES	YES	YES	NO	SYSTEM	MEDIUM	RESEARCH
Honeycomb Cave	35.5	100	NO	NO	U	NO	POSSIBLE	MEDIUM	PARK
Ilex Cave	56	300	YES	YES	U	YES	SYSTEM	MAJOR	RESEARCH
Komakazi Crack Cave	13.4	50	NO	NO	NO	NO	NO	MINOR	PARK
Link's Cave	25.7	200	NO	YES	NO	NO	POSSIBLE	MEDIUM	PARK
Neson Ranch Cave	44.4	300	YES	YES	U	YES	SYSTEM	MAJOR	RESEARCH
Next Door Sink	9.6	50	NO	NO	NO	NO	NO	MINOR	PARK
Pearl Harbor Pit	18.3	50	NO	NO	NO	NO	NO	MINOR	PARK
Pig's Snout Cave	17.6	200	YES	NO	NO	NO	POSSIBLE	MINOR	RESEARCH
Shady Shaft	31.7	50	NO	NO	NO	NO	NO	MINOR	PARK
TWASA Cave	40.6	200	YES	YES	YES	NO	POSSIBLE	MEDIUM	RESEARCH
Whitestone Pit	35.8	200	NO	YES	U	NO	POSSIBLE	MEDIUM	PARK
Whitewater Cave	22	300	YES	NO	YES	NO	SYSTEM	MAJOR	RESEARCH

roots, or through the feces, eggs, or dead bodies of non-troglobitic species (for example, cave crickets, daddy longlegs, harvestmen, or raccoons) that forage outside the cave and bring nutrients into the cave benefitting the troglobitic fauna. Research indicates that cave crickets forage at distances greater than 160 feet from cave openings (Elliott, 1993).

Nutrients are also brought into the subsurface system by water infiltration. These nutrient inflows are considered vital to the survival of the troglobitic fauna. The loss or degradation of the surface community may lead to nutrient depletion and/or the introduction of certain exotics such as fire ants, which may prey upon the listed species and lead to overall decline in species diversity in the karst ecosystem. The surface vegetation also buffers the karst ecosystem from changes in the temperature and moisture regime, pollutants entering from the surface, and sedimentation from soil erosion. Preserving native vegetation will help control certain exotics (such as fire ants) that compete with and/or prey upon the listed species and other karst fauna.

Caves are susceptible to pollution from contaminated water entering the ground, because the honeycombed karstic limestone has little capacity for water purification. Pollutants may be derived from urban runoff; pesticides and fertilizers that are broadcast, sprayed, or fogged; hazardous materials; pipeline and storage tank leaks; power transformer and industrial accidents; leakage from septic systems, landfills, and sewer lines; and other sources. Primary routes of contaminant entry into karst ecosystems include the surface and subsurface drainage basin of a karst ecosystem; air (for airborne contaminants); and disposal of household garbage, construction debris, motor oil, and other materials, directly into cave entrances. The surface and subsurface drainage basin that supplies water to the ecosystem has the greatest potential to carry contaminants into the karst. However, the potential for contaminants to travel through karst systems may be more extensive in some areas. For example, hydrocarbon fumes were detected in three caves up to 1.7 miles northeast of the site of a major oil spill in south Austin in 1987, despite extensive cleanup efforts (Russell, 1987).

Fire ant activity in central Texas appears to have increased dramatically since 1989 (Elliott, 1993). The fire ant is an aggressive predator, and current evidence shows that it has a devastating and long-lasting impact on native ant populations and other arthropod communities (Porter and Savignano, 1990). The relative accessibility of the shallow caves inhabited by the listed invertebrates makes them especially vulnerable to invasion by fire ants and other exotic species. Fire ants have been found in more than 50% of the caves that contain listed karst invertebrates and have been observed preying on several troglobitic species, as well as scorpions, cave crickets, and other karst dwellers (James Reddell, Texas Memorial Museum, *in litt.*, 1993). Even in the unlikely event that fire ants do not prey directly upon the listed invertebrates, their presence in and around karst areas could have a drastic detrimental effect on the karst ecosystem through loss of both surface and subsurface species that are critical links in the karst food chain.

The fire ant occurs in two forms: the single-queen and multiple-queen colonies. Although they appear to be the same species, multiple-queen fire ant colonies occur in very dense concentrations (about 750-5000 mounds per acre) and replace areas previously occupied by the less dense (100-200 mounds per acre) single-queen form (Porter *et al.*, 1991). The multiple-queen form is three times more abundant in Texas than in other parts of its range, and recent surveys indicate it is spreading.

This form appears to have been present in the Austin area since its invasion in the early 1980s (Porter *et al.*, 1991).

Fire ant studies conducted by Porter *et al.* (1988) in Austin indicate that the fire ant invades areas in two phases. In the first phase, fire ant queens invade an area through long-distance dispersal of winged queens or are introduced through imported products such as nursery stock or soil products containing small fire ant colonies. Their invasion is aided by "any disturbance that clears a site of heavy vegetation and disrupts the native ant community", such as clearing for development. Several native ants are known to attack and kill founding fire ant queens. These native ants are especially important in deterring fire ants from colonizing non-infested areas. Once the fire ant becomes established, however, it enters the second phase during which the native ant communities are gradually eliminated and show little resurgence as fire ants slowly expand and increase in number. This phase takes many years to complete (Porter *et al.*, 1991).

The extent to which the karst invertebrate species use small humanly inaccessible voids, referred to as "interstitial spaces" (such as fractures, fissures, cracks, etc.), between or around caves in unknown. Particularly in areas where karst features are extensive, caves may be connected to other subterranean habitats to constitute a single functioning system. Use of interstitial spaces by troglobites has been observed in Japan, Hawaii, and Europe. At the Lakeline Mall site in Williamson County, the TCGB was found in one of six coreholes that were drilled to determine the presence of interstitial fauna. This void was located about 600 feet northwest of Lakeline Cave. The use of interstitial spaces may explain the seasonal distribution of the cave fauna and the apparent paucity of troglobites during periods of dryness or temperature extremes.

The project site lies within the Cedar Park Karst Fauna Region (KFR), one of eight KFRs delineated by George Veni & Associates (1992) that contain listed invertebrates (Figure 3). These regions were delineated based on geologic continuity, hydrology, and the distribution of 38 rare karst-dwelling species. In the Endangered Karst Invertebrates Recovery Plan (USFWS 1994), protection of karst fauna areas (KFA) within KFR are needed for preservation and recovery of the listed species. A KFA is an area known to support one or more locations of a listed species and is geologically, hydrologically, and biologically distinct from other KFAs. According to the Recovery Plan a minimum of three KFAs must be protected in order to consider downlisting the species from endangered to threatened. If less than three areas are known to exist for a species in a karst region within its range, and additional searches do not find any more, then all locations in the region must be preserved. KFAs should be far enough apart so that if a catastrophic event (such as contamination of the water supply) were to destroy one of the areas, that event would not likely destroy any other area of that species.

According to the Recovery Plan, to be considered "protected", a KFA must be sufficiently large to maintain the integrity of the karst ecosystem on which each species depends. These areas will also need management that addresses threats such as fire ants, habitat destruction, and contaminants. Adequate protection includes maintaining moist, humid conditions and stable temperatures in the air-filled voids; maintaining an adequate nutrient supply; preventing contamination of the water entering the ecosystem; preventing or controlling invasion of exotic species, such as fire ants;

allowing for movement of the karst fauna and nutrients through the interstitium both surface and subsurface between karst features; and restricting human visitation, dumping, and vandalism.

To allow for such factors, the Biological Assessment Team (BAT) for the Balcones Canyonlands Conservation Plan (BCCP) (1990), a regional USFWS 10(a) permit for incidental take of endangered species issued to the City of Austin and Travis County, recommended establishing large, contiguous preserves around each cave cluster. One strategy for determining the configuration of karst preserves includes identifying all of the lands, with the exception of existing roads and other structures, within the contour interval that encompasses the bottom of the cave(s).

In addition to *Rhadine persephone*, other rare, but non-listed troglobitic vertebrates and invertebrates have also been documented from specific caves. An additional, as yet unclassified, species of Rhadinid beetle (*Rhadine* n.s.2) have been found in a number of caves within the project area (Table 1). A new species of pseudoscorpion (*Tartarocreagris* n.s.) has been discovered in Buttercup Creek Cave. Another rare arachnid (*Cicurina elliotti*) has been found in Bev's Grotto, Buttercup Creek Cave, TWASA Cave, Two Hole Cave and Good Friday Cave (Reddell, pers. Comm., 1997). At least 15 caves on Buttercup Creek property contain subsurface water conduits that have also been documented to support or exhibit potential to support the Cedar Park salamander (*Eurycea* n.s.) (Table 1).

The Buttercup subdivision is a remnant of the Edwards Plateau Physiographic Province (Veni 1988). The *Eurycea* species found in Buttercup is not yet described and is, therefore, referred to as *Eurycea* new species (n.s.). Andrew Price, through a USFWS Section 6 project (Price 1994), found there are general similarities between the *Eurycea* species that exist, and this new species, such as aquatically obligate eggs and larvae. This genus is morphologically, physiologically, and reproductively adapted to specialized aquatic habitats in semi-arid environments subject to periodic and unpredictable droughts. These adaptations typically lead to neoteny (non-transforming) salamanders in aquatic habitats that are generally devoid of fishes. Neotenic salamanders have the option of moving to deeper portions of an aquifer when surface flow conditions become unreliable.

There are ten caves in the Buttercup Creek subdivision that have identified *Eurycea* n.s.. Two of the caves are in developed areas, three are in caves in undeveloped Section 4 and the remaining five caves are within the undeveloped Phase V. Two caves in Section 4 have the potential to contain *Eurycea* n.s., but have yet to be observed. The presence of *Eurycea* n.s. in five caves in Phase V has not been determined.

3.4 Wetlands

No wetland areas are known to occur on the Buttercup Creek property.

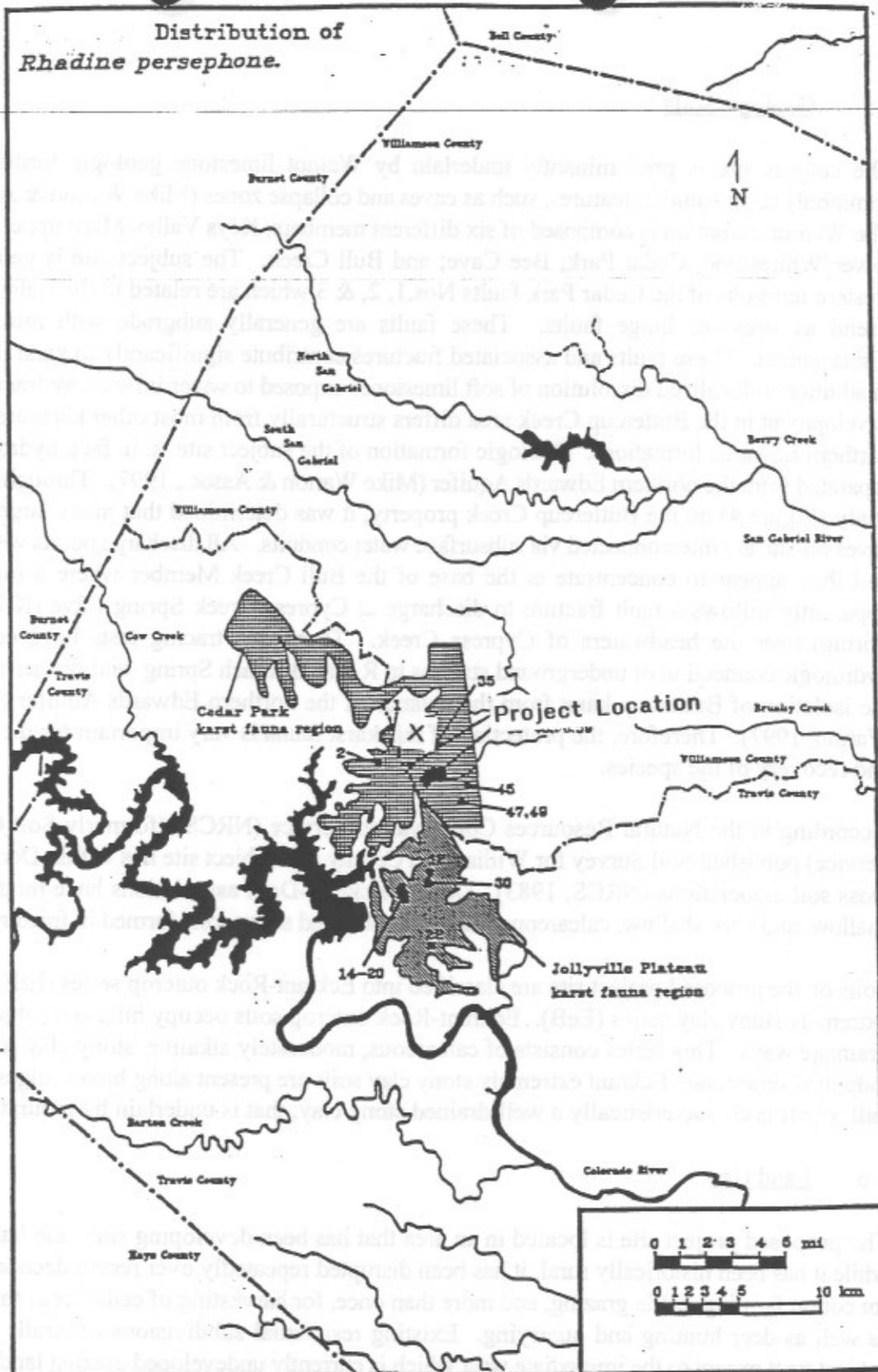


Figure 3: Karst Fauna Regions in Travis and Williamson counties. (Veni, 1992)

3.5 Geology/Soils

The subject site is predominantly underlain by Walnut limestone geologic formations which commonly form solution features, such as caves and collapse zones (Mike Warton & Assoc., 1997). The Walnut formation is composed of six different members: Keys Valley Marl; upper Whitestone; lower Whitestone; Cedar Park; Bee Cave; and Bull Creek. The subject site is generally at the western terminus of the Cedar Park faults Nos. 1, 2, & 3 which are related to the Balcones Primary Trend as stress or hinge faults. These faults are generally subgrade with minimal surface displacement. These faults and associated fractures contribute significantly to karst development, in addition to localized dissolution of soft limestones exposed to water inflows by fracturing. Cave development in the Buttercup Creek area differs structurally from most other karst areas of nearby northern Edwards formations. Geologic formation of the subject site is, in fact, hydrogeologically separated from the northern Edwards Aquifer (Mike Warton & Assoc., 1997). Through a dye tracing study (Figure 4) on the Buttercup Creek property, it was determined that many larger and deeper caves on-site are interconnected via subsurface water conduits. All discharge points were monitored and they appear to concentrate at the base of the Bull Creek Member where a master conduit apparently follows a fault fracture to discharge at Cypress Creek Spring Cave (R-Bar-B Ranch Spring) near the headwaters of Cypress Creek. These dye tracing tests have confirmed the hydrologic connection of underground streams to R-Bar-B Ranch Spring and further demonstrated the isolation of Buttercup karst from the balance of the northern Edwards Aquifer (Hauwert and Warton, 1997). Therefore, the protection of this karst fauna is very important for the preservation and recovery of the species.

According to the Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service) published Soil Survey for Williamson County, the subject site lies within Denton-Eckrant-Doss soil associations (NRCS, 1983). Denton-Eckrant-Doss associations have moderately deep, shallow, and very shallow, calcareous, clayey, cobble and stony soils formed in fractured limestone.

Soils on the proposed project site are classified into Eckrant-Rock outcrop series (ErE) and Eckrant extremely stony clay series (EeB). Eckrant-Rock outcrop soils occupy hills and ridges on sides of drainage ways. This series consists of calcareous, moderately alkaline, stony clay soils overlying indurated limestone. Eckrant extremely stony clay soils are present along broad ridges and shallow valleys. It is characteristically a well-drained stony clay, that is underlain by indurated limestone.

3.6 Land Use

The proposed project site is located in an area that has been developing since the late 1970s, and, while it has been historically rural, it has been disrupted repeatedly over recent decades by clearing for cotton farming, cattle grazing, and more than once, for harvesting of cedar trees for fence posts, as well as deer hunting and quarrying. Existing residential subdivisions generally surround the subject tract except to the immediate west which is currently undeveloped grazing land. An existing limestone quarry borders the site to the northwest.

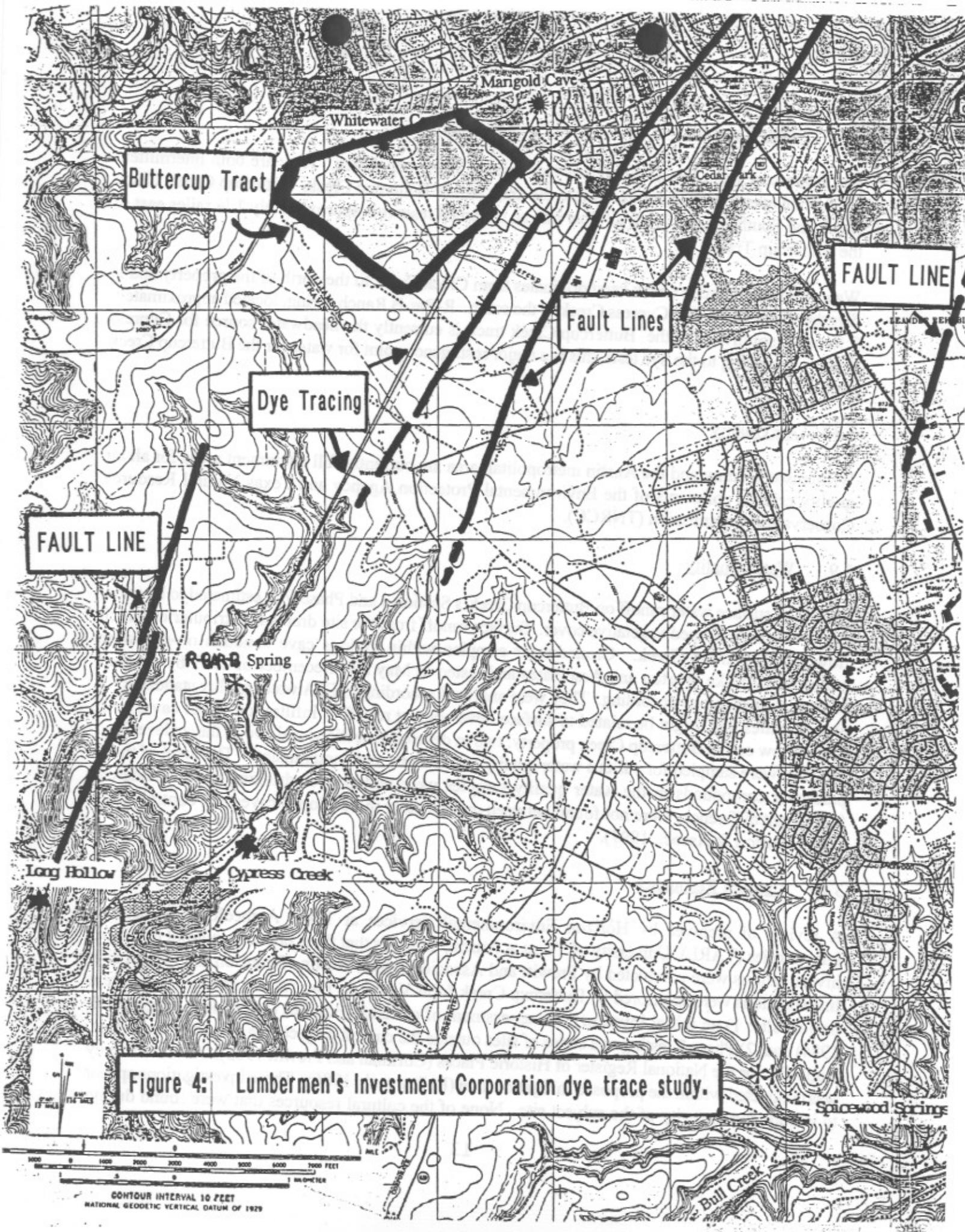


Figure 4: Lumbermen's Investment Corporation dye trace study.

3.7 Water Resources

The Buttercup Tract Phase V contains two arms of Buttercup Creek. They are both intermittent during rain events and drain directly into the main arm of Buttercup Creek. Buttercup Creek, Cluck Creek and South Brushy Creek all flow into an unnamed reservoir approximately 1 ½ miles east of the Buttercup Tract.

Water for the Buttercup Creek karst originates from Cluck Creek to the north of the property and is diverted along faults into Cypress Creek to the south. R-Bar-B Ranch spring, located approximately 3 ½ miles southwest of the Buttercup Creek tract, is currently the headwater source for Cypress Creek. According to the dye tests, this is a major resurgence point for water for the Buttercup Creek karst.

3.8 Air Quality

Williamson County and the Austin metropolitan area are currently full attainment areas for all air quality criteria pollutants of the Environmental Protection Agency and Texas Natural Resource Conservation Commission (TNRCC).

3.9 Water Quality

Quality of surface water runoff on Buttercup Creek's Section 4 and Phase V is estimated to be good, due to a well-developed vegetative cover. Surface runoff from the site drains into tributaries which flow into Buttercup Creek. Groundwater samples within various cave conduits on-site were collected by Mike Warton and Associates and tested in May and December of 1997 by Applied Microbial Technology according. They were analyzed according to EPA water quality standards for abnormalities that might be related to surface development runoff or infiltration. Four caves with stream flow on the Buttercup Creek property, two in developed sections and two in the undeveloped sections, were sampled for various water quality constituents and contaminants. The level of those particular compounds in the water quality samples were within EPA drinking water standards. Significant differences were not found between groundwater in developed caves and control caves (Mike Warton & Assoc., 1997).

3.10 Cultural Resources

A review of archives by Horizon Environmental Services at Texas Archeological Research Laboratories (TARL), University of Texas at Austin, indicates that three previous cultural resources investigations were conducted by Prewitt and Associates, Inc., Austin, Texas, on the subject site. Investigations were sponsored by Buttercup Creek Joint Venture. Two reports concern the current project site: 1) an initial inventory and assessment of cultural resources (Mercado-Allinger et al. 1984) and, 2) Phase 2 testing at a series of sites outside the current project area to assess those sites' eligibility for the National Register of Historic Places (Coffman and Prewitt 1985). Another survey was conducted within the proposed mitigation area (Bailey et al. 1986). These investigations appear to include the majority of the subject site. None of the cultural resources that were found during

these investigations were within the subject site. No further cultural resources investigations are deemed to be required.

3.11 Socioeconomic Resources

The Cedar Park Area is rapidly and steadily growing. From 1990 to 1998 the Cedar Park Area grew 256%. Current population numbers for the area are 18,371 people. Among cities with populations between 10,000 and 50,000 Cedar Park is ranked as the fourth fastest growing in the nation. Currently several large companies are researching moving to the Cedar Park Area. The Buttercup Creek development is adjacent to Cedar Park and is within its extraterritorial jurisdiction.

Cedar Park is at the leading edge of the technology growth corridor that exists along Highway 183, and is only 20 minutes from the Austin Metropolitan Area. Government, service, trade, manufacturing, finance-real estate, and construction are the primary employment sectors according to the Austin Chamber of Commerce. Primary employers in the greater Austin area are the University of Texas at Austin followed closely by high-tech corporations, including Dell Computer Corporation, Motorola Inc., IBM Corporation and Advanced Micro Devices. Non-agricultural employment in the Greater Austin Area during the last decade has grown at a rate of approximately 5.3%. Unemployment currently stands at a low 3.1% in the Greater Austin Area.

The Buttercup Creek Subdivision is located in an area which is being encroached upon by development and population in-migration. New jobs in the high-tech industry that has in recent years been evolving and growing in the Greater Austin and Cedar Park Area attracts new residents every day. With these prospective homeowners comes new housing developments, improvements in infrastructure, and an increased tax base to Williamson County and the city of Cedar Park. The Buttercup Creek Section 4 and Phase V are currently undeveloped, but with the increased demands for housing and employment, the area is being pressured for suburban development.

4.0 **ALTERNATIVES INCLUDING THE PREFERRED ACTION**

This section presents details of the preferred alternative and reasonably practicable alternatives that have been considered. Alternatives include: 1) preferred alternative, 2) modification of site design and layout, and 3) no action. Environmental consequences of the various alternatives are presented in Section 5.0.

4.1 **ALTERNATIVE 1 - PREFERRED ALTERNATIVE**

Development plans for the 438 acres include approximately 750 single-family and two multi-family residential units, a community center, extension of Lakeline Boulevard to FM 1431, associated streets and utilities on 275 acres, and 163 acres of preserve including the karst conservation zones (130 acres) and flood plain greenbelts (33 acres) (Figure 2). Immediate buffers around caves will average greater than 200 feet, and all preserves will retain native vegetation.

This alternative includes the expansion of Lakeline Blvd. from its junction with Buttercup Creek Blvd. to R.M. 1431 along the eastern edge of the quarry. The City of Cedar Park is financing the construction of the expansion from Buttercup Creek Blvd. north to FM 1431 and engineering plans will be submitted to the Service for approval. Water runoff will be diverted away from preserves and into water retention ponds. Animal access tunnels will be installed beneath the road to allow for connection between preserves on opposite sides of Lakeline Blvd. All other streets will be funded by the Applicant and will also divert runoff to water retention ponds.

An HCP has been developed as part of the preferred alternative. Proposed herein is an expansion and continuation of conservation measures and practices which LIC has previously undertaken over the past decade within Buttercup Creek development. These measures are intended to protect sensitive species and their associated habitat, while maintaining EPA standard groundwater quality under developed areas. Included are the following:

- Conservation of 163 acres surrounding caves documented to support Tooth Cave ground beetles (*Rhadine persephone*), *Rhadine* n.s.2, Cedar Park Salamander, *Tartarocreagris* n.s., *Cicurina elliotti*, and other intrinsic karst species. This acreage also includes water quality buffer zones around caves that are significant point recharge features, but are not known to contain any above listed species (Figure 2);
- Gating of entrances of significant caves and limitation of land-use to light recreational activities within certain less-sensitive conservation zones while precluding any use in sensitive zones;
- Maintenance of water quality controls throughout development processes;
- Limitation of impervious cover for development area to less than 30%;
- Construction of all wastewater pipelines to current specifications of the TNRCC Edwards Aquifer pollution prevention guidelines;
- Immediate geological and biological investigation of any subsurface voids encountered during construction appropriate remedial measures;
- Education of residents for proper use and control of lawn and household materials;
- Ongoing monitoring of conserved cave ecosystems.

The HCP is intended to avoid, minimize and mitigate potential impacts to TCGBs, and to aid in recovery of the species as well as conservation of other sensitive species. Greater detail on the HCP is provided in Section 6.0.

4.2 ALTERNATIVE 2 - ALTERNATE SITE DESIGN

This alternative assumes the proposed development could be reduced in scope or rearranged on-site to result in lesser or no impacts to TCGBs. LIC presented initial alternative site plans which provided for higher density development with smaller preserves. However, individual private septic systems would be required since such minimal development could not offset high costs of installing central wastewater infrastructure. Modern central wastewater infrastructure, constructed to TNRCC aquifer pollution abatement guidelines, is much safer at preventing groundwater contamination than private septic systems.

This alternative was submitted to the Service as the proposed development plan for the Buttercup Creek Tract when the Applicant initially applied for a Section 10(a)(1)(B) permit. This plan included approximately 1,000 single family and two multi-family residences (243.6 acres), an elementary school (7.1 acres), a community center (1.7 acres), a commercial tract (5.8 acres), associated streets and utilities (22.1 acres), and karst conservation areas including the flood plain zone (140 acres), but did not include the extension of Lakeline Boulevard to FM 1431. A total of 280.3 acres were to be developed with 140 acres in greenbelt. This alternative was considered less desirable because it was believed likely to result in greater loss of endangered karst invertebrate habitat than the development plan presented as Alternative 1 in this document.

The Service did not believe this alternative provided for appropriate animal access between preserves, and adequate water recharge within catchment basins. Based on these factors, this alternative would not avoid or minimize impacts to the species. Lakeline Blvd. north of Buttercup Creek is platted to pass near Wilcox Cave. In the preferred alternative, the City of Cedar Park and LIC have rerouted the road to the east to avoid all features and supply adequate buffers to the caves. Rationale for rejection of this alternative is provided in Section 5.2.

4.3 ALTERNATIVE 3 - NO ACTION

This alternative would involve abandonment of the proposed project. No changes in existing conditions of the property would occur as a result of this alternative. Rationale for rejection of this alternative is presented in Section 5.3.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 ALTERNATIVE 1 - PREFERRED ALTERNATIVE

5.1.1 On-site Impacts

5.1.1.1 Vegetation

The area of disturbance for development under this alternative would consist of 275-acres within Buttercup Creek's Section 4 and Phase V and extension of Lakeline Blvd. This project would

continue a historical pattern of repeated disruption in recent decades for farming, cattle grazing, and harvest of cedar trees for fence posts.

5.1.1.2 Wildlife

Wildlife would largely be displaced to adjacent areas. Following construction, landscape vegetation will provide habitat for those species of wildlife suited for coexistence with urban development. Promotion of urban wildlife species and human activities associated with planned development may result in negative impacts to certain wildlife species while others may be unaffected or positively affected from this development.

5.1.1.3 Listed, Proposed and Candidate Species

The preferred alternative would allow development and occupation of the subdivision (lots, streets, and utilities) and extension of Lakeline Boulevard within portions of the property that have no documented cave openings or occurrences of TCGBs or other species of concern, but may contain as yet unidentified subsurface voids which may or may not support these species (Figure 2). Past utility construction in other portions of the Buttercup Creek development has disclosed theretofore unknown interstitial voids, but none have produced any *R. persephone* or other sensitive species upon inspection.

The shape and size of each preserve area was designed based on field-determined catchment areas, surface karstification, surface topography, and subsurface extent of each cave. In all cases except for Buttercup Creek Cave, the known extent of underground passage of each cave is included within the cave preserve area. The depth of Buttercup Creek Cave where it passes under proposed development is approximately 140 feet. This significant depth is well insulated from surface activity.

Endangered species surveys conducted on the land surface and within 54 identified caves within Buttercup Creek revealed the presence of one of the five federally listed endangered species that occur in Williamson County. Surveys have been conducted at various times in the past by various researchers including most recent karst studies conducted during 1995 and 1997 on-site (Mike Warton & Assoc., 1997). TCGBs were documented to occur in 25 caves identified on the Buttercup Creek Tract. Several additional sensitive, but currently unlisted species have also been documented to occur in some of the 54 known caves. The other two species of listed cave-adapted invertebrates known from Williamson County have not been detected on-site and are not expected to occur since the site is not within their respective known ranges. Endangered bird surveys were conducted on-site in 1994 by Horizon with negative results due to lack of favorable habitat for either golden-cheeked warbler or black-capped vireo.

Assessment of Take

All such caves will be set aside in conservation zones (as depicted on Figure 2) and protected from disturbance utilizing similar methods, setbacks, and management practices already in use in

previously preserved areas of the Buttercup Creek development. These pre-existing preserves include Bev's grotto, Boulevard Cave, Bluewater Pit Cave #1 and #2, Filter sink, Forest Trail Cave, Marigold Cave, Mushroom Pit Cave, Pebblebrook Pit Cave, Primrose Cave and Warton Whirlpool. Therefore, development (lots, streets, and utilities) including the Lakeline Blvd. extension is not anticipated to result in direct destruction of any currently known caves documented to support Tooth Cave ground beetles or any of the other species of concern.

While extensive surface reconnaissance efforts have been conducted to locate and explore all surface karst features, the possibility exists for the encounter of other subsurface voids during construction activities such as excavation for utility lines and storm drains. Such voids may or may not provide habitat for *Rhadine persephone* or the other sensitive karst species and destruction of habitat resulting in take of individuals of the species may or may not result when a subsurface void is encountered by machinery. Past utility construction in existing Buttercup Creek development has disclosed several theretofore unknown interstitial voids, but none have proven to be occupied or suitable for *R. persephone*, upon inspection, to date. The HCP provided herein is intended to provide continued conservation of known populations of ground beetles and other species and provide for immediate biological and geological evaluations and remedies to such encounters should they occur. LIC has requested a 10(a)(1)(B) permit to allow minimal habitat destruction during chance encounters without necessitating extended construction delays for after-the-fact permitting. Therefore, any minimal take would be mitigated by the proposed preserves on site.

As part of the proposed action, the HCP has been proposed to largely avoid to the extent practicable, or minimize and mitigate for incidental take and assure this action does not appreciably reduce likelihood of survival and recovery of TCGBs or other sensitive species in the wild, as mandated by requirements of 50 CFR Part 17.22(b)(1)(iii). Thus, no indirect impacts to known *R. persephone* sites are anticipated as a result of proposed development plans. The HCP is detailed in Section 6.0.

No take is anticipated for any other federally listed or proposed species.

5.1.1.4 Wetlands

No wetlands are present within areas proposed for development; therefore, none will be impacted by the Preferred Alternative.

5.1.1.5 Geology/Soils

The proposed development is situated over the Walnut formation. Excavation and fill for streets, utilities and grades on the buildings will occur over much of the area. Significant effects of construction to identified caves will be prevented by proposed conservation measures.

Surface soil alterations will result from proposed development, but will comply with all applicable City of Cedar Park Land Development Code and applicable EPA storm water management requirements during construction processes for erosion and sedimentation control.

5.1.1.6 Land Use

The proposed development is part of Austin's north-westward development corridor blending with the Cities of Cedar Park, Leander, and Round Rock and will convert from rural to urban. Current land use trends are generally toward residential development with supporting commercial and retail establishments.

5.1.1.7 Water Resources

Plans for streets leading to the western portion of single family residences will cross two ephemeral streams. This will result in disturbance to the riparian area and may increase runoff, but will not impede water flow.

5.1.1.8 Air Quality

The proposed development may contribute to local traffic noise and exhaust emissions by increasing numbers of gasoline-powered vehicles operating in the immediate vicinity. Initial removal of trees associated with development clearing and construction activities will slightly impact local air filtering and photosynthetic evapotranspiration rates, but may be offset by future landscaping. A temporary increase of fugitive dust emissions and noise would be expected during construction activities.

5.1.1.9 Water Quality

The proposed development site has regional wastewater service available through the City of Cedar Park. No significant impacts are expected to occur from runoff of developed areas. All applicable City of Cedar Park construction codes and development ordinances, and applicable EPA storm water management guidelines, are expected to be complied with during all aspects of development. All impervious cover runoff will be directed away from sensitive recharge areas and routed through emplaced or natural filtration and sedimentation facilities, as required by applicable City ordinances and EPA non-point source discharge requirements. This diversion may reduce moisture in some of the caves, but it is not anticipated to have a significant negative effect. Runoff from within construction zones will continue to experience natural filtration by native vegetation and will recharge cave systems as presently occurs.

5.1.1.10 Cultural Resources

No on-site impacts to cultural resources are expected to occur.

5.1.1.11 Socioeconomic Resources

The proposed development, construction, and occupation of the Buttercup Creek Section 4 and Phase V will include construction of single and multi-family residences with associated streets and utilities on the 438-acre tract. This development plan was designed in coordination with the USFWS

following review by the agency. Approximately 275 acres of the property are to be developed. The remaining 163 acres will remain undeveloped. The attendant environmental consequences of this development, as occur generally with most development, construction and occupation situations, are discussed specifically above in the sections on wetlands, geology and soils, air quality, water quality and cultural resources.

5.1.2 **Off-site Impacts**

5.1.2.1 Vegetation

No offsite impacts to vegetation are expected to occur.

5.1.2.2 Wildlife

Wildlife would largely be displaced to adjacent areas. Following construction, landscape vegetation will provide habitat for those species of wildlife suited for coexistence with urban development. Promotion of urban wildlife species and human activities associated with planned development may result in negative impacts to certain wildlife species while others may be unaffected or positively affected from this development.

5.1.2.3 Listed, Proposed and Candidate Species

The preferred action involves no construction outside its boundaries and thus will cause no direct impacts to endangered species off-site.

5.1.2.4 Wetlands

No offsite impacts to wetlands are expected to occur as a result of the Proposed Action.

5.1.2.5 Geology/Soils

No offsite impacts to geologic or soil resources are expected to occur as a result of the proposed project.

5.1.2.6 Land Use

This alternative will likely result in an increase in businesses in the surrounding area, such as gas stations, stores and restaurants, as well as, schools, offices and other services. However, the preferred alternative is fully compatible and comparable to current land use in the area.

5.1.2.7 Water Resources

Some increase in stream flow in Buttercup Creek is expected due to an increase in impervious cover.

5.1.2.8 Air Quality

The proposed development may contribute to local traffic noise and exhaust emissions by increasing numbers of gasoline-powered vehicles operating in the immediate vicinity. Initial removal of trees associated with development clearing and construction activities will slightly impact local air filtering and photosynthetic evapotranspiration rates, but may be offset by future landscaping. A temporary increase of fugitive dust emissions and noise would be expected during construction activities.

5.1.2.9 Water Quality

Although the project plans to limit impervious cover and comply with all applicable regulations, it is expected that some water quality degradation will unavoidably occur from pesticide and fertilizer use and runoff from roads.

5.1.2.10 Cultural Resources

No offsite impacts to cultural resources are expected to occur.

5.1.2.11 Socioeconomic Resources

Development of the Buttercup Tract is expected to result in an increase in the number of motorized vehicles in the area, which may result in a decrease in air quality. The development is expected to result in some impacts to local water quality and land use.

5.1.3 **Cumulative Impacts**

This section considers the past, present, and future projects, authorized or under review, that are considered to contribute to the cumulative loss of species of concern.

5.1.3.1 Vegetation

As the preferred alternative would result in disturbance of a large portion of the vegetation on-site, primarily juniper-live oak woodland, it would cumulatively contribute to loss of this vegetation type in Williamson County resulting from development, road construction, and other land use projects increasing the fragmentation of large blocks of native vegetation by urban development.

5.1.3.2 Wildlife

The preferred alternative will contribute to a cumulative reduction of habitat for some wildlife species when added to impacts resulting from other development, road construction and other land use projects in Williamson County. Wildlife species associated with urban and suburban settings would likely increase while species intolerant of development would locally decrease.

5.1.3.3 Listed, Proposed, and Candidate Species

The preferred alternative is not believed to significantly affect the likelihood of long term survival of endangered TCGBs or other species of concern or their habitat in the region when added to section 10(a)(1)(B) incidental take permits that have been or will be issued by the Service for other projects. To date one individual and one regional incidental take permit for karst invertebrates have been issued in the karst fauna regions where *Rhadine persephone* occurs. The regional permit was issued to the City of Austin and Travis County jointly. This permit included a section on known caves in Travis County, and general plans for karst species and habitat protection and preservation. There are currently 2 active incidental take permit applications for karst invertebrates being considered by the Service in the Greater Austin area. The level of impacts resulting from projects for which permits are currently being considered is dependent on the amount of take resulting from the actual number of these permits issued by the Service.

5.1.3.4 Wetlands

There are no impacts to wetlands as a result of this project. Therefore, no cumulative impacts are anticipated.

5.1.3.5 Geology/Soils

No significant cumulative impacts to geology and soils would occur as a result of the preferred alternative.

5.1.3.6 Land Use

The preferred alternative contributes to the conversion of undeveloped land to developed land in the Cedar Park area. Past, present, and future developments must comply with all development codes.

5.1.3.7 Water Resources

The preferred alternative will result in increased runoff into Buttercup Creek.

5.1.3.8 Air Quality

The preferred alternative will contribute to limited degradation of air quality in the Cedar Park area, primarily through an increase in automobile exhaust emissions. The significance of the impact will depend upon air quality requirements for construction activities and automobiles. The continued development of the area could result in a significant cumulative impact on air quality.

5.1.3.9 Water Quality

The preferred alternative, complying with local water quality codes, will cause some change in existing water quality. However, this change will not result in a significant cumulative impact from

the commercial development proposed due to the amount of undisturbed land that is to remain on-site.

5.1.3.10 Cultural Resources

This project, because of its limited scope, will not result in cumulative impacts to sites eligible for the National Register of Historic Places.

5.1.3.11 Socioeconomic Resources

The preferred alternative will contribute somewhat to degradation of air and water quality in the Cedar Park area, primarily through an increase in automotive emissions and runoff. The Service anticipates no disturbance of cultural sites over time. Because the preferred alternative will protect approximately 163 acres on-site the project is expected to add to the aesthetic and biological conditions in the area long into the future.

5.2 ALTERNATIVE 2 - ALTERNATE SITE DESIGN

5.2.1 **On-site Impacts**

5.2.1.1 Vegetation

Approximately 280 acres of land are proposed for development under this alternative. Development would primarily occur in areas that currently support open rangeland with stands of live oak and juniper species. Vegetation in development areas may be significantly disturbed as a result of grading for new roads, construction of buildings, and landscaping.

5.2.1.2 Wildlife

Impacts to wildlife would generally be similar to those described for Alternative 1.

5.2.1.3 Listed, Proposed, and Candidate Species

Impacts of this alternative to *R. persephone* would be greater than under the Preferred Alternative. No impacts to other listed, proposed, and candidate species would be expected under this alternative.

This alternative had the potential to result in the loss of some karst habitat and/or caves. The Service believed that the preserve sizes were too small to support certain necessities of karst ecosystems. For example, animal access into preserves is necessary for nutrient input, and troglobitic karst fauna require this input for survival. Some preserve buffers required greater distances than provided for additional filtration during rain events to prevent contaminants from reaching the cave entrance.

Assessment of Take

All preserves were lacking in either animal access points between adjacent preserves or insufficient upslope, undisturbed vegetative buffers.

5.2.1.4 Wetlands

Impacts to wetlands would be as described for Alternative 1.

5.2.1.5 Geology/Soils

Impacts to geology and soils would generally be as described for Alternative 1.

5.2.1.6 Land Use

Changes in land use would be the same as described for Alternative 1.

5.2.1.7 Water Resources

Impact to water resources would be as described for Alternative 1.

5.2.1.8 Air Quality

Impacts to air quality would be as described for Alternative 1.

5.2.1.9 Water Quality

Impacts to water quality would be as described for Alternative 1.

5.2.1.10 Cultural Resources

Impacts to cultural resources would be as described for Alternative 1.

5.2.1.11 Socioeconomic Resources

Impacts to the socioeconomic environment would be similar to those described for Alternative 1.

5.2.2 **Off-site Impacts**

5.2.2.1 Vegetation

Off-site impacts to vegetation would be as described for Alternative 1.

5.2.2.2 Wildlife

Off-site impacts to wildlife would be as described for Alternative 1.

5.2.2.3 Listed, Proposed and Candidate Species

Off-site impacts to listed, proposed and candidate species would be as described for Alternative 1.

5.2.2.4 Wetlands

Off-site impacts to wetlands would be as described for Alternative 1.

5.2.2.5 Geology/Soils

Off-site impacts to geology and soils would be as described for Alternative 1.

5.2.2.6 Land Use

Off-site impacts to land use would be as described for Alternative 1.

5.2.2.7 Water Resources

Off-site impacts to water resources would be as described for Alternative 1.

5.2.2.8 Air Quality

Off-site impacts to air quality would be as described for Alternative 1.

5.2.2.9 Water Quality

Off-site impacts to water quality would be as described for Alternative 1.

5.2.2.10 Cultural Resources

Off-site impacts to cultural resources would be as described for Alternative 1.

5.2.2.11 Socioeconomic Resources

Off-site impacts to the socioeconomic environment would be as described for Alternative 1.

5.2.3 Cumulative Impacts

5.2.3.1 Vegetation

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.2 Wildlife

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.3 Listed, Proposed and Candidate Species

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.4 Wetlands

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.5 Geology/Soils

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.6 Land Use

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.7 Water Resources

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.8 Air Quality

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.9 Water Quality

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.10 Cultural Resources

Cumulative impacts are expected to be the same as those for Alternative 1.

5.2.3.11 Socioeconomic Resources

Cumulative impacts are expected to be the same as those for Alternative 1.

5.3 ALTERNATIVE 3 - NO ACTION

The No Action Alternative would result in abandonment of the proposed action. The No Action Alternative was rejected, because abandonment of the proposed project would result in loss of significant monies invested in the property and in project planning and would result in severe economic hardship to the Applicant. Furthermore, the extension of Lakeline Blvd. northward to FM 1431 is a necessary component of the City of Cedar Park's transportation improvement program. More importantly, the property would have no active management for endangered species and no contribution of land would be made for the preservation of *Rhadine persephone* and the other species present, which provides the most viable strategy for preserving the aesthetic beauty of Williamson County, and recovering the TCGB.

6.0 PROPOSED HABITAT CONSERVATION PLAN

This section contains the Applicant's specific conservation plans for the proposed project. The preferred alternative consists of residential development with attendant roads and utilities on approximately 275 acres, including the extension of Lakeline Boulevard for 2,000 feet beyond the Buttercup Creek Subdivision. This HCP is provided to avoid, minimize and mitigate any potential indirect impacts on endangered karst species, while ensuring continuation and non-interruption of development processes if unforeseen subsurface voids containing listed invertebrates are encountered during excavation associated with construction. This HCP contains aspects related to preservation of identified on-site endangered species caves and other prudent development safeguards, as well as other measures that would be implemented in the eventuality that listed species in subsurface voids were documented to be impacted, whether directly or indirectly. As mandated by requirements of 50 CFR Part 17.22(b)(1)(iii), the preferred alternative is intended to ensure that the proposed development does not reduce the potential for survival and recovery of the Tooth Cave ground beetle in the wild.

The proposed preserve system and other measures proposed to avoid impacts to known population localities of the listed Tooth Cave ground beetle and other species of concern are based on an eight year monitoring program conducted within several existing cave preserves within the Buttercup Creek development (Warton 1998) and extensive geologic, biologic, and hydrogeologic studies on the proposed development area.

Preserve System

The proposed preserve system consists of twelve (12) separate cave preserve areas (130 acres) in addition to two greenbelt floodplain areas (33 acres), all totaling 163 acres of natural openspace (Figure 2). The shape and size of each preserve area was designed based on field-determined catchment areas, surface karstification, surface topography, and subsurface extent of each cave. In

all cases except for Buttercup Creek Cave, the known extent of underground passage of each cave is included within the cave preserve area. The depth of Buttercup Creek Cave where it passes under proposed development is approximately 140 feet. This significant depth is well insulated from surface activity.

The minimum dimensions for preserve design for each cave, as determined by extensive field study (Warton, 1997), are shown as dashed lines on Figure 2. These dimensions range from a 50-foot radius for relatively insignificant, non-species caves to more than 300 feet radius on the upgradient side of significant species caves. In all cases, except for Whitewater Cave and Nelson Ranch Cave, the actual proposed cave preserve area meets, and usually exceeds the recommended (Warton, 1997) minimum dimensions for each cave.

The Buttercup Creek property has two features that helped define mitigation strategies: (1) there is very little tilt in the surface topography; and, (2) the catchment basins are relatively small. These two factors taken together lessen the probability of surface contaminants entering into the subsurface system. Thus, the size of the preserves of the subject property combined with the greenbelt system were developed to be consistent with the planate character of the Buttercup Creek property.

In most cases, the cave preserve areas have been extended to create adjoining corridors between each preserve area, separated only by streets. Culverts will be placed under Lakeline Boulevard to provide travel corridors for small mammals which provide important ecosystem support in cave systems.

The dimensions and features contained in each individual cave preserve area are summarized in Table 2.

A. Cave Preserve Management and Monitoring Plan

All proposed cave preserve areas will be deeded within 90 days of recordation of the final plat to the City of Cedar Park (Conservator/Owner), which will hold the preserves in perpetuity unless otherwise approved by the USFWS for conservation management and monitoring, and who will also contract management to Texas Cave Management Association (TCMA), Texas Cave Conservancy (TCC), or another management entity approved by the Service. The following management and monitoring procedures will be followed:

1. Cave Gating

All significant cave entrances within the preserves will be gated prior to deeding of the preserves to the City of Cedar Park for the security protection of the cave's contents, and control of cave access. All cave gates will meet all requirements, standards, and guidelines for design and application or installation for endangered invertebrate species habitat caves, as approved by the U.S. Fish & Wildlife Service, and will provide adequate moisture and nutrient input.

The cave management entity/organization (Management), does not design, construct, or install such gates. However, under site management contract, Management will become responsible for their

general care and light duty maintenance. In the event such gates should become structurally damaged at any time Management will advise the City of Cedar Park and the Permittee who are responsible for the repairs or replacement. The contractor who provided the gates is to be advised accordingly by the cave management organization for their repairs.

2. Routine Inspections

All preserves are to receive regular site inspections. Such inspections will be performed on a monthly basis, and essentially at the same time each month. A site inspection form (Appendix A) will be filled out completely by the site management personnel, filed, and kept by the designated Preserve Manager. During the site inspections, one of the caves in each preserve will be measured, at the same place each time, for ambient and surface air temperature ($\pm 0.1^\circ$) and relative humidity or dew point, and the observations will be noted in the inspection sheets. Notations will also be made regarding recent weather events and the number of *Rhadine persephone* observed during those routine inspections. Copies of these inspections will be presented in an annual/yearly management report that will be presented to the Conservator/Owner of the preserves, U.S. Fish and Wildlife Service, and the Permittee. Cave management personnel are not required to wear uniforms when conducting site work. However, they must have an appropriate identification present and on vehicles used in the line of such work.

3. Access Point Maintenance

All research-only preserves will have cave gates and temporary perimeter fences installed prior to any street or home construction surrounding the preserve. All park-use preserves will have cave gates and catchment basin fences installed prior to any street or home construction surrounding the preserve. All preserves will be provided permanent perimeter fencing at the conclusion of construction surrounding the preserves. Each individual preserve will have an officially designated point of access or entry. Where entry gates are used, such gates must remain locked at all times when unattended. Each preserve's boundaries will be readily defined, generally with fencing between preserve and subdivision. Most preserves will contain "frontage" areas of various extent along subdivision streets and usually associated with the points of entry. These areas will be maintained and cared for on a regular or as needed basis to be of complimentary and matching standard with the surrounding subdivision environment. Such maintenance involves the cleaning of any trash or refuse (disposal of), grass mowings as per seasonal needs, and any form of repairs to site installations that may be easily and feasibly attended to.

4. Land Use Management

Only restricted recreational use (ie. hike or bike trails, picnic areas, etc.) would be allowed in five less sensitive preserve areas (Table 1)(Warton, 1997). An overall park use plan will be developed by the Permittee with approval from the Service. Little or no use or public access would be allowed in the seven remaining more sensitive preserves, other than authorized scientific research. Unauthorized vehicular or public access to the cave preserve areas will be excluded through bollards and/or fencing, as appropriate. Management will attend to the variable needs of each preserve area

in accordance with the design and allowable usage extent of each preserve, as may be mutually agreeable with the Conservator/Owner and Permittee in accordance with the design and allowable usage extent of each preserve, (ie., park or non park status, as indicated by Table 2, and by approval of the Service).

5. Vegetation/Habitat Management

The Permittee will maintain natural vegetation within the preserves and along the flood plain of Buttercup Creek. Management (the cave management entity) will care for and maintain the conditions of surface vegetation/habitat quality and control as may be instructed by scientific personnel with approval from the Service. Such examples are the thinnings of excessive juniper, xeriscape with native landscaping, and removals of noxious or harmful non-native plant species.

Grass will be mowed on the preserve access pathways and along street frontages, where applicable, no more than three times per growing season, and then only if needed. To help maintain the health and vigor of native vegetation and encourage seed production, mowing will not occur during primary blooming periods.

6. Fire Ant Control

Management will conduct a fire ant control and treatment program, as specified by scientific personnel, under the acknowledgment and approval of the Service. Such program may potentially include the removal of fire ants and any other non-native species that are scientifically determined to be of potential degradation to the protection and preservation of endangered invertebrate species or any other "species of concern" acknowledged and approved by the Service. On a twice per year basis, or more frequent if needed, fire ant mounds within 200 feet of caves will be treated with boiling water. No chemical treatments will occur within this zone. Beyond 200 feet, heavy infestations of fire ants will be treated carefully with bait type fire ant controls (ie., Amdro or Logic). Such baits will be placed directly on mounds in minimum quantities. No broadcasting of baits will be done. If at some point in the future, biological controls for fire ants are determined effective and biologically safe for native species, such treatments may be utilized if approved by the Service.

7. Continuing Neighborhood Education

Permittee will maintain an active role in the distribution of positive educational materials, reviewed and approved for technical accuracy by the Service, on endangered invertebrate species habitat(s), and the values of point recharge to enhance conservation of these important natural resources. Permittee is encouraged to correspond, interact, and cultivate a positive and meaningful relationship where possible with the area residents, and the subdivision's neighborhood association group(s). Permittee will maintain any educational materials or displays.

**Table 2 Characteristics of Individual Cave Preserve Areas
Buttercup Creek Subdivision**

Cave Preserve Area	Caves Included	Total Acres	Park/Research
Tree House Cave Preserve	Tree House Cave	3.3	Research
May B.A. Cave Preserve	May B.A. Cave	4.6	Park
Animal Canyon Cave Preserve	Animal Canyon Cave	8.3	Research
	Buttercup Bone Cave		
	Two Hole Cave		
Cedar Elm Cave Preserve	Cedar Elm Cave	23.1	Research
	Salamander Squeeze Cave		
	Good Friday Cave		
	Pats Pit Cave		
	Blow Hole Cave		
	Stone Well Caves Nos. 1 & 2		
TWASA Cave Preserve	TWASA Cave	8.9	Research
	Buttercup Dome Cave		
	Pig Snout Cave		
	Harvestman Cave		
Honeycomb Cave Preserve	Honeycomb Cave	10.9	Park
	Pearl Harbor Pit		
	Whitestone Pit		
	Bad Air Fissure Cave		
Whitewater Cave Preserve	Whitewater Cave	4.6	Research
Buttercup Creek Cave Preserve	Buttercreek Cave	49.6	Research
	Hide Away Cave		
	Convoluted Canyon Cave		
	Buttercup Drain Cave		
	Drainside Sink		
	Ilex Cave		
	Nelson Ranch Cave		
Godzilla Cave Preserve	Godzilla Cave	8.3	Park
	Flesh & Blood Cave		
	Links Cave		
Buttercup Wind Cave Preserve	Buttercup Wind Cave	3.6	Park
	Next Door Cave		
	Shady Shaft Cave		
	Several Additional Sinks		
Grimace Cave Preserve	Grimace Cave	4.2	Park
	Kamakazi Cave		
	Ant Riot Cave		
Boulevard Cave Preserve	Boulevard Cave	3.3	Research
	TOTAL ACREAGE	132.7	

8. Preserve Access Control

Management will correspond, consult, and coordinate with the designated site Geologist/Karst Specialist, and Regional Invertebrate Specialist (curator at the Regional Invertebrate Laboratory at the Pickle Research Center) on any actions or activities requested, and shall facilitate as needed any site accesses for scientific research and studies. The site Geologist and Invertebrate Specialist will serve Management in an advisory capacity as needed. Access into any non-park preserve or cave is restricted to Management, the Permittee, USFWS, and scientific research personnel only. The Conservator/Owner and Permittee will be allowed access to any preserve at any time and may enter with or without notification to accompany or facilitate the needs of emergency services (such as fire fighting, law enforcement, etc.). Any research projects will be submitted to the USFWS and those with the potential to harm endangered species or species of concern (this includes cave entry) must be approved in advance by the USFWS.

9. Adaptive Management

Any unforeseen circumstances or preserve conditions determined to be detrimental will trigger the need to consult with predetermined scientific personnel (such as Mike Warton, Warton and Associates; Lee Sherrod, Horizon Environmental Services; Barry Allison, Environmental and Planning Associates; USFWS; or similarly qualified individuals or environmental firms) for advice on adaptive management. Management must report immediately to USFWS, any site conditions or disturbances found for which it does not possess a way or means to readily correct. In such events, the site Geologist and Invertebrate Specialist should be contacted first. Should neither be able to respond promptly, the Conservator/Owner and the Service should then be contacted. The following measures are general procedures for dealing with foreseeable, but unpredictable circumstances that could occur. With respect to these potential uncontrollable circumstances, the Permittee and City will be required to undertake such corrective actions as may be technically justified and financially reasonable under the circumstances, in consultation with the Service.

- a. Vandalism of caves or cave preserve areas - If detected, the Service as well as local law enforcement authorities will be immediately notified. Any effects of vandalism will be documented and then corrected, as appropriate, to meet the goals of the HCP as quickly as possible;
- b. Storm damage to cave conservation areas - Damage will be assessed and documented as soon as possible. The Service will be notified and corrective measures implemented, as appropriate, to meet the goals of this HCP;
- c. Fire, wild or deliberate - Immediately notify City of Cedar Park Fire Department and the Service. Following extinguishment, assess and document any impacts and implement corrective actions, as appropriate, to meet the goals of this HCP;

- d. Spill of hazardous materials on roadways or on lawns - Immediately notify City of Cedar Park Fire Department who has spill response capability and plans. Immediately notify Service and begin assessment and documentation of any damages or impacts and implement corrective actions, as appropriate, to meet the goals of this HCP;
- e. Activities of adjacent landowners - If adjacent land owners surrounding Buttercup Creek conduct activities deemed potentially damaging to the cave preserve areas, the Service will be immediately notified and corrective measures implemented, as appropriate, to meet the goals of this HCP;
- f. Surface Land Management Adaptations - There are always possibilities for unforeseen circumstances to occur. In these cases, such circumstances will be assessed for potential impacts and corrective measures implemented, as appropriate, in consultation with the Service to meet the goals of this HCP.

10. Reporting

Management's Annual Report of all above listed activities will be submitted to: site Geologist & Invertebrate Specialist, Conservator/Owner, the Permittee and the U.S. Fish & Wildlife Service (Austin Field Office).

11. Funding

The Permittee will provide sufficient funding to establish the preserve system with requisite cave gates and fencing, as well as provide the construction safeguards. Per terms of the "Permit Implementing And Preserve Management Agreement," the City of Cedar Park will assume the financial responsibility for operation, maintenance and monitoring of the preserves upon dedication by the Permittee. Prior to this dedication, the Permittee is responsible for all funding necessary to implement the HCP.

12. Water Quality

Certain caves, agreed upon by the Service, Permittee, and Management will have two seasonal (spring and fall) water quality grab samples taken shortly following significant storm events in those seasons, which are of sufficient magnitude to allow surface water to flow directly into the cave entrance. The sampling time-line will begin immediately following permit issuance. These samples will be analyzed for parameters such as pesticides, herbicides, total petroleum hydrocarbons, total nitrates, total phosphorus, pH, dissolved oxygen, biological oxygen demand, and fecal coliforms. The results will be submitted to the USFWS in the annual report.

13. Endangered and Species of Concern Surveys

All endangered and species of concern covered by this HCP and the permit will undergo species counts conducted within a representative cave of each preserve area, where it occurs. Surveys will follow a standard method and be conducted at least one year prior to construction surrounding the preserve and once per year until construction occurring in proximity to that given preserve is completed. Following construction activity, the surveys will be conducted once a year for the first three years and then once every three years thereafter for the life of the permit. Ambient and surface air temperature ($\pm 0.1^\circ$) and relative humidity or dew point will be measured, at the same place each time, and the observations will be noted. Surveys will be conducted by a qualified expert, holding a current USFWS scientific permit. Surveys will be conducted over a one hour period during the same time of day and week as previous years. All results and observations will be submitted to the USFWS in an annual report. If negative results are documented, necessary changes, as appropriate to meet the goals of this HCP, will be implemented.

B. Construction Practices

1. Construction period erosion and siltation management (to meet at a minimum, City of Cedar Park Land Development Code requirements) and additional measures and protocols for storage, use and spill containment and countermeasures for construction-related chemical and petroleum products will be handled through a plan, produced by the Permittee and approved by the Service prior to beginning of construction, and provided to all contractors;
2. Surface water non-point source drainage flows from streets and parking areas will be diverted by permanent diversion structures to treatment systems/ponds, or will discharge down-gradient of the cave conservation areas.
3. Impervious cover will be limited to 30% or less for the gross acreage of the proposed Section 4 and Phase V area development;
4. Construction of all wastewater pipelines will be in accordance with current TNRCC aquifer protection rules, even though the site is not within the Edwards Aquifer Recharge Zone. The Applicant will restrict open trenching to approximately 500 linear feet at a time and will not pass through any preserve areas except with prior approval with USFWS.
5. The Applicant or its subcontractors will not use explosives during any part of the development activities;
6. Lakeline Boulevard extension north of Buttercup Creek will be constructed in accordance with these conservation measures.

7. Adaptive management for subsurface voids encountered during construction trenching will be implemented as follows:

- a. Team environmental consultants will be notified immediately of any subsurface void encountered and will respond immediately to assess the void geologically and biologically. Construction work in the immediate vicinity of the encountered voids will halt until project environmental consultants have completed necessary evaluations and made recommendations for treatment of the void. Project environmental consultants will initially determine if cave conditions might be favorable for the occurrence of endangered and species of concern. If potential favorable conditions are present, three biological collection surveys will be conducted over not greater than a one week period to determine the presence or absence of the listed invertebrates or other species of concern;
- b. If no listed or species of concern are determined to be present in an encountered void, environmental consultants will issue specific instructions for sealing the void along the construction zone in accordance with standard TNRCC accepted practices, as applicable for any particular void (Appendix B). Voids will be sealed so as not to allow any impacts or contamination into the karst ecosystem. The Service will be notified of methods used for sealing. Construction activity will then resume with the carrying out of those specific instructions. The Service will be notified of findings prior to resuming construction activities.
- c. If listed or species of concern are determined to be present within an encountered void, environmental consultants will immediately notify the Service. Closure and impact minimization instructions will be issued by the environmental consultants to contractor(s) with notification to the Service. Upon completion or implementation of the minimization procedures (following inspection and approval by the environmental consultants), the work will resume.

C. Operational Practices

1. The Permittee will provide additional sandy loam soil cover as needed, to provide a minimum of 3 to 4 inches suitable top soil depth in yards and landscaped areas adjacent to cave conservation zones for enhanced retention and absorption efficiencies of fertilizers, pesticides and other common constituents;
2. Applicant will continue to provide educational material (pamphlets) for homeowners in Buttercup Creek development relating to the proper storage, use and disposal of household products, waste products; and application of yard

treatments, herbicides and pesticides, and encouraging use of native-scaping by lot owners and builders (see example in Appendix C).

3. If during the tenure of this permit the project design and/or the extent of the habitat impact described in the habitat conservation plan is altered, such that there may be an increase in the impacts to the karst preserve areas, the permittee is required to contact the Service and obtain authorization and/or amendment of the permit before commencing any construction or other activities that might result in take beyond that described in the EA/HCP.

In addition the Service will include the following conditions in any issued permit:

The permit and appropriate attachments shall be recorded with the County Clerk, Williamson County, Texas prior to the beginning of development related activities on the Buttercup Creek, Section 4 and Phase V property or extension of Lakeline Boulevard. A recorded copy of this action will be returned to the Service within 30 days.

Clearing within the proposed development areas shall be consistent with the current practices recommended by the Texas Forest Service to prevent the spread of oak wilt.

Clearing for construction of buildings, streets, and other areas of impervious cover will be minimized to the greatest extent practicable. Areas outside of platted lots that are disturbed during construction, but are not occupied by impervious surfaces, will be replanted with native vegetation.

Written annual reports of the years activities including monitoring, surveys and status of clearing and construction will be submitted by October 1 of each year to the USFWS Field Office, 10711 Burnet, Suite 200, Austin, Texas 78758; and to the USFWS, P. O. Box 1306, 500 Gold Ave. SW, Albuquerque, NM 87102.

Upon locating a dead, injured or sick Tooth Cave ground beetle, or any other species of concern, Permittee is required to contact the Service's Ecological Service's Office, Austin, Texas, (512) 490-0057, for care and disposition instructions. Extreme care should be taken in handling sick or injured individuals to ensure effective and proper treatment. Care should also be taken in handling dead specimens to preserve biological materials in the best possible state for analysis of cause of death. In conjunction with the care of sick or injured endangered/threatened or species of concern, or preservation of biological materials from a dead specimen, the Permittee and its contractor/subcontractor have the responsibility to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

If during the tenure of this permit the extent or quality of the habitat described in the habitat conservation plan is altered, such that there may be an increase in the anticipated take of the Tooth Cave ground beetle, the permittee is required to contact the Service and obtain authorization and/or amendment of the permit before commencing any construction or other

activities that might result in take beyond that described in the EA/HCP. This provision does not apply to encounters with currently unknown voids, which are covered by this permit and for which prudent conservation measures have been specified.

6.1 AMENDMENT PROCEDURE

It is necessary to establish a procedure whereby the Section 10(a)(1)(B) Permit and the Implementation Agreement can be amended. However, it is extremely important that the cumulative effect of amendments will not jeopardize any endangered species or other species of concern. Amendments must be evaluated based on their effect on the habitat as a whole. The Service must be consulted on all proposed amendments. The types of proposed amendments and the applicable amendment procedures are briefly described below.

6.2 AMENDMENTS TO LOCALLY APPROVED DEVELOPMENT PLANS

It is acknowledged that upon the written request of the Applicant, the local agency having land use regulatory jurisdiction is authorized in accordance with applicable law to approve amendments to development plans for the subject development area that do not encroach on any endangered species habitat that is not presently contemplated to be taken as a consequence of the development, and which do not alter the conditions set forth in the HCP or the Implementation Agreement.

6.3 MINOR AMENDMENTS TO THE HCP

Minor amendments involve routine administrative revisions or changes to the operation and management program and which do not diminish the level or means of mitigation. Such minor amendments do not alter the terms of the Section 10(a)(1)(B) permit.

Upon the written request of the Applicant, the Service is authorized to approve minor amendments to the HCP upon information notice sent to the parties to the Implementation Agreement if the amendment does not conflict with the primary purpose of this HCP as stated in Section 2.0.

6.4 ALL OTHER AMENDMENTS

All other amendments will be considered an amendment to the Section 10(a)(1)(B) permit, subject to any other procedural requirements of federal law or regulation which may be applicable to amendment of such a permit.

6.5 DURATION

This HCP is written in anticipation of issuance of a 10(a)(1)(B) permit for a period of 30 years, during construction and operation of the Buttercup Creek subdivision Section 4 and Phase V, and extension of Lakeline Blvd (438 acres total in Williamson County, TX).

7.0 PUBLIC AND AGENCY COORDINATION

The following agencies, organizations, and people have been consulted or coordinated with during the process of addressing the proposed development of the Buttercup Creek's Section 4 and Phase V:

- U.S. Fish and Wildlife Service, Austin, TX
- City of Cedar Park, Texas
- Williamson County, Texas
- Numerous citizens, public officials, neighborhood groups of the local area
- Horizon Environmental Services, Inc., Austin, Texas
- Mike Warton & Associates, Austin, Texas
- Drenner & Stuart, L.L.P.

This document was originally prepared by Horizon Environmental Services, Inc. on behalf of the Applicant. The Service has modified portions of the document as deemed appropriate.

Publication notification of the availability of the Draft Environmental Assessment/Habitat Conservation Plan will be published in the Federal Register. All concerned agencies and entities will be provided a copy for review comment.

8.0 REFERENCES/LITERATURE

- Bailey, Gail L., Ross C. Fields, and Martha Doty Freeman. 1986. Inventory and Assessment of Cultural Resources at the Buttercup Creek's II Subdivision, Williamson County, Texas. Reports of Investigations, No. 50. Prewitt and Associates, Austin, Texas.
- Biological Advisory Team. 1990. Comprehensive Report of the Biological Advisory Team. Austin, Texas. 80 pp.
- Coffman, Robert and Elton R. Prewitt. 1985. Phase 2 Cultural Resources Investigations in Portions of the Buttercup Creek Subdivision, Williamson County, Texas. Reports of Investigations, No. 36. Prewitt and Associates, Inc. Austin, Texas.
- Elliott, W.R. 1993. Ecological studies of three caves in Williamson County, Texas: March 1993. Austin, Texas. 4 pp.
- Hauwert, Nico M. And Mike Warton. 1997. Initial Groundwater Tracing Study of the Buttercup Creek Area, Cedar Park, South Williamson County.
- Mercado-Allinger, Patricia A., Elton R. Prewitt, and Crystal Sasse Ragsdale. 1984. Inventory and Assessment of Cultural Resources in Portions of the Buttercup Creek subdivision, Williamson County, Texas. Reports of Investigations, No. 30. Prewitt and Associates, Inc. Austin, Texas.
- Mike Warton & Associates. 1998. Karst Feature Investigations (Phases 1, 2 and 3) of the Lakeline Roadway Extension Project (City of Cedar Park), Cedar Park Area, Williamson County, Texas. January and June, 1998.
- Mike Warton & Associates. 1997. A Study of Cave Habitats, Point Recharge Potential, and Associated Karst Lands of the Buttercup Creek Development Properties, including Section 4 and Phase V, Cedar Park, Williamson County, Texas.
- Natural Resources Conservation Service (NRCS), Soil Survey of Williamson County, Texas, 1983.
- Porter, S.D., A. Bhatkar, R. Mulder, S.B. Vinson, and D.J. Clair. 1991. Distribution and density of polygyne fire ants (Hymenoptera:Formicidae) in Texas. Pages 866-874 in *Journal of Economic Entomology* 84(3).
- Porter, S.D. and D.A. Savignano. 1990. Invasion of polygyne fire ants decimates native ants and disrupts arthropod community. Pages 2095-2106 in *Ecology* 71(16).

- Porter, S.D., B.V. Eimeren, and L.E. Gilbert. 1988. Invasion of red imported fire ants (Hymenoptera:Formicidae): microgeography of competitive replacement. Pages 914-918 in *Annals of the Entomological Society of America* 81(6).
- Price, Andrew. 1994. Relationships, status, and distribution of central Texas hemidactyliine plethodontid salamanders (*Eurycea* and *Typhlomoge*). Texas Natural Heritage Program, Texas Parks and Wildlife Department.
- Reddell, James. 1993. *In litt.*
- Reddell, James. 1997. Personal Communications. Texas Memorial Museum, Austin.
- Russell, W.H. 1987. Edwards stratigraphy and oil spills in the Austin, Texas area. Pages 27-31 in *The Texas Caver*. Austin, Texas.
- Russell, W.H. 1993. The Buttercup Creek Karst, Travis and Williamson Counties, Texas: Geology, Biology, and Land Development. The University Speleological Society.
- U.S. Fish and Wildlife Service. 1994. Endangered Karst Invertebrate (Travis and Williamson counties) Recovery Plan. Albuquerque, N.M. 154 pp.
- Veni & Associates. 1992. Geologic controls on cave development and the distribution of cave fauna in the Austin, Texas, region. Prepared for the U.S. Fish and Wildlife Service. Austin, Texas. V + 77 pp.

Clark, J.L., G.V. Linsley, and J.E. Gilber. 1988. Invasion of red imported fire ants
(*Solenopsis geminata*): biogeography of competitive replacement. *Annals of the Entomological Society of America* 81(6): 1015-1022.

Clark, Andrew. 1977. Relationship status and distribution of central Texas butterflies in
the Texas National Park System (Texas National Park System). Texas Parks and Wildlife Department,
Austin, Texas.

Clark, Andrew. 1982. *et al.*

Clark, Andrew. 1987. Personal Communications. Texas Memorial Museum, Austin.

Clark, W.H. 1967. Trends in butterfly and fly species in the Austin, Texas area. *Annals of the Entomological Society of America* 60(1): 1-11.

Clark, W.H. 1968. The history of the Texas National Park System. *Annals of the Entomological Society of America* 61(1): 1-11.

Clark, W.H. 1974. The history of the Texas National Park System. *Annals of the Entomological Society of America* 67(1): 1-11.

Clark, W.H. 1975. Geologic controls on cave development and the distribution of cave
fauna in the Austin, Texas region. Prepared for the Texas Parks and Wildlife Service,
Austin, Texas. V-77 (2).

