FINAL REPORT

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Endangered and Threatened Species Conservation

Project No. 3.2: Black-capped Vireo Management on Lands Of the Texas Parks and Wildlife Department

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BLACK-CAPPED VIREO MANAGEMENT ON TEXAS PARKS AND WILDLIFE DEPARTMENT PARKLANDS

I. OBJECTIVE

The objective of this document is to fulfill the requirements of USFWS Segment 6 (1 September 1993 to 31 August 1994) of Section 6 project 3.2 "Black-Capped Vireo Management on Lands of the Texas Parks and Wildlife." Segment 6 of this project directs TPWD to develop site-specific Black-capped Vireo management plans using the recovery actions discussed in the Black-capped Vireo Recovery Plan (USFWS 1991).

II. INTRODUCTION

The United States Fish and Wildlife Service (USFWS) acting under the provisions of the Endangered Species Act (1973) directs TPWD to provide Black-capped Vireo (BCVI) conservation and management on state-held lands. The general recovery goal in the recovery plan (USFWS 1991) was to improve BCVI status from endangered to threatened by the year 2020 by establishing and/or maintaining *one viable population of at least 500 to 1000 breeding pairs in six BCVI regions:* Oklahoma (1), Mexico (1), and Texas (4).

II.1 Changes in the Recovery Plan.

Revisions to the recovery plan suggested in USFWS (1996) have been approved and adopted by the USFWS (L. O'Donnell, pers. comm.) which resulted in a redefinition of recovery region boundaries and an amendment to one of the recovery goals. Instead of following physiographic regions for the six Recovery Regions in Texas the boundaries have now been drawn to the nearest county lines (Fig. 1 and 2). The resulting areas would facilitate data management, outreach and recovery strategies, and will be hereafter called Recovery Units (RU). In addition, due to low population numbers, two RU were proposed to be combined with existing RU which yields four rather than six RU. RU 1 (North-Central) was proposed to be combined with RU 2 (Lampasas Cut Plains); and, RU 6 (Trans-Pecos) was proposed to be combined with RU 5 (Stockton Plateau). RU 3 (Southeast Edwards Plateau) and RU 4 (Concho Valley) remain as discrete units (see Fig. 2).

A further change was that a viable population with at least three to five subpopulations of BCVI be maintained within each of the four new RU. This contrasts with that in the original plan (USFWS 1991) which called for at least one viable population in four of the six Texas RU.

This document will explore the six Texas regions which historically and/or currently contain BCVI and will include recovery criteria, concise available information, and management actions for public lands (excluding Wildlife Management Areas) according to designated USFWS regions. This management plan will be submitted to the USFWS for final approval

III. Recovery Criteria and Available Information

In order to achieve the USFWS goal of down-listing, the 1991 recovery plan lists critical tasks under two general headings: (1) research and information needs, and (2) existing population maintenance and improvement. The recovery criteria as outlined in the USFWS BCVI Recovery Plan (1991) are included in Appendix B of this document. Research tasks include surveys, estimating the cowbird, and other, threats, defining habitat (use, identification, management, creation, maintenance, grazer/browser control, human disturbance), examining winter range, creating population viability models, and determining the usefulness of age structure data as a population health index. Population maintenance and improvement tie dynamically into research needs; information obtained will serve, in turn, to effectively manage and maintain viable populations of BCVI. Following is a review of accomplishments from this project related to each of the recovery criteria outlined by the USFWS BCVI Recovery Plan (1991).

III.1 Surveys.

Presence/absence surveys have been conducted on parklands with unequal effort due to time and staff restrictions (Appendix C) (Connally 1993). Big Bend Ranch SNA has the potential for BCVI, but has not been thoroughly or methodically surveyed for presence/absence.

III.2 Cowbirds.

Cowbirds are listed as the top ranking threat to the population health and viability of the BCVI by USFWS (1996). The cowbird threat (primarily the Brown-headed Cowbird, *Molothrus ater*) has been addressed at a few parkland sites where BCVI have been intensively monitored. Currently, only cowbird removal has been considered as a control measure. Habitat issues have not been well understood and hence not addressed. A recent Cowbird Workshop, sponsored by The Nature Conservancy, was held in Austin, Texas, on November 4 and 5, 1993. Parasitism rates, host species, cowbird behavior and habitat, and cowbird control were issues discussed at length. A recurring theme in the conference was that cowbirds seem to target shrubland and fragmented-forest hosts; grassland and contiguous forest hosts were minimally parasitized (Cruz et al. 1993, Hahn 1993, Thompson et al. 1993). Thompson (1993) stated that cowbirds hold large but widely separated breeding, feeding, and roosting territories during the breeding season. Cowbird trapping, if highly intensive, was deemed fairly effective for controlling parasitism, but habitat issues as they relate to the host and the cowbird were recommended as the focus of sound and effective cowbird management (Hayden et al. 1993, Griffith and Griffith 1993, Laymon 1993).

Cowbird trapping was initiated on 4 departmental holdings (Kerr WMA, Lost Maples SNA, Devils River SNA, and Kickapoo SNA) and additional non-departmental lands (such as *Fort Hood MR*). Details of results from this trapping effort will be treated in the discussion of the sites later in this document. Overall, cowbird removal appears to have a positive effect on reducing the parasitism rate at the TPWD sites, and these rates are comparable to those discussed at the conference. However, removal is highly labor intensive and parasitism is not simply a cowbird density problem; habitat, livestock, and game management are also key issues on TPWD lands. Full attention should be paid to the possibility of attracting foraging cowbirds

which would put them in close proximity of BCVI (and/or Golden-cheeked Warbler, *Dendroica chrysoparia*; GCWA) populations when developing and implementing game and/or livestock management plans. Cowbird removal, however, is not a panacea. Rather, it is usually an attempt at crisis management, thus a last-ditch approach. Efforts, often less labor intensive and usually more effective, should be implemented over the long-term involving such issues as thorough habitat assessment and management of individual sites, and compatible resolution of game and livestock issues. The results from known cowbird removal areas will be discussed in the site analyses.

III.3 Other threats.

Other threats affecting the BCVI include habitat fragmentation and destruction (see below), fire ants, western scrub jays (*Aphelocoma californica*), predation, and pesticides. Some of these issues, however, are not well-documented. Fire ants are a regional affliction; some areas appear to have more of an infestation than others. However, no studies are available to determine impact on the BCVI. Western scrub jays and other nest predators have been observed taking BCVI eggs or young, but again the problem is not well-documented and lacks a geographic perspective. Pesticides have been overlooked as a research issue for Texas populations of BCVI. Human disturbance and development are also known threats to BCVI. This and other habitat-related threats will be addressed in the next section.

III.4 Habitat.

"Habitat" represents a complex set of issues including (i) identification and characterization (structure and components) in different regions, (ii) delineation and availability (by region and site), (iii) use by BCVI and cowbirds as individuals and populations, (iv) acquisition, development and maintenance, (v) cattle management, (vi) deer and exotic ungulate management, (vii) fire management, (viii) human disturbances and development, and (ix) BCVI management through private landowner cooperation.

Extensive coverage of habitat issues related to BCVI recovery can be found in Section V (Discussion) and in Appendix G (General Management Guidelines).

III.5 Other Criteria.

Three other criteria are listed in the recovery plan about which very little information is available: winter range, usefulness of age structure data as a population health index, and population viability models. Benson and Benson (1990) examine a breeding population of BCVI in Coahuila, Mexico; however, very few nonbreeding populations have been investigated. Graber (1957, 1961) and Marshall et al. (1985) are the only ones to date to have discussed in some detail the geographic limits of the wintering (nonbreeding) range. Population Viability and Habitat Assessment for the BCVI was the subject of a workshop held by the USFWS in September, 1995, in Austin, Texas (USFWS 1996). Grzybowski, in the USFWS BCVI Recovery Plan (1991), suggests that groupings of 15 or more territories contain proportionately more ASY males whereas groupings of less than 10 territories contain proportionately more SY males. This may suggest that the populations are more viable (able to reproduce) in areas which can provide habitat for greater numbers of vireos (over 15 territories). However, none of the data collected at

TPWD sites has been analyzed with sufficient statistical rigor to determine which populations at which parks are more successful, reproductively. Also, nesting attempts and successes have not been well documented at all BCVI locations. The final criterion asks for age structure data on individual populations to assess the health of a population. Age structure and sex ratio data (demographics) enables assessment of the level of dispersal and recruitment which are essential elements of gene flow. Because BCVI populations are thought to be linked by some degree of gene flow, they therefore are best described as metapopulations with all the attendant dynamical phenomena therein (see Meffe et al. 1997). No studies to date have addressed BCVI from a metapopulation perspective.

Cooperative management programs such as those initiated at the Kerr WMA for private landowners (TPWD 1992) should serve as a model for similar endeavors in the future. Livestock management is indirectly a human disturbance. More directly attributed to humans is disturbance caused by development (e.g., industrial, residential). This is well-documented in areas around Austin, Texas. It has been shown in consecutive years of monitoring by DLS Associates (1989, 1990) and other concerned individuals (Sexton et al. 1989) that the BCVI population in Travis County has severely declined with encroaching development and habitat destruction. Now, since the listing of the BCVI as endangered, the "take" of habitat by such means is subject to USFWS consultation and permits. The same procedures should be associated with development on TPWD lands. Any development of trails, picnic areas, campsites, residences, or other clearing of habitat should be approved through the proper channels at TPWD and USFWS. Appendix E lists individuals to contact to clarify any proposed development or habitat manipulation.

IV. Regional Descriptions and Site-Specific Analyses

Table 1 displays the total of the maximum count values of adult BCVI with respect to each of the new USFWS-designated BCVI Recovery Units (I - IV). The bird count values, tallied from presence/absence data, was obtained from surveys conducted in 1989 through 1996, when available (see also Appendix C for more complete data). Values reported for each site represent *maximum* values for counts of adult males, adult females, and adults of unknown sex across all years. Thus, the total for each site may include maximum values for males from one year, maximum values for females from another year, and maximum values for unknowns from yet another year. These three values are then summed to yield the total for that site across all years. This was done to approximate the maximum *potential* numbers of BCVI from available data, but these estimates should be only be considered approximations with no assignable confidence interval.

This table also includes data from public (non-TPWD) and private lands to gauge the relative importance of (1) TPWD v. non-TPWD lands, and (2) the region, in BCVI recovery efforts. Total acreage for each Recovery Unit, and acreage for each of the TPWD properties within each Recovery Unit are also provided.

Management recommendations are made on a site by site basis, but only for those properties which have documented BCVI populations. For such properties management options

will be suggested which will maintain or enhance local BCVI populations. The reader is referred to section V, entitled "General Management Guidelines" and Campbell (1995), for detailed discussion of the implementation of the management practices suggested for each property.

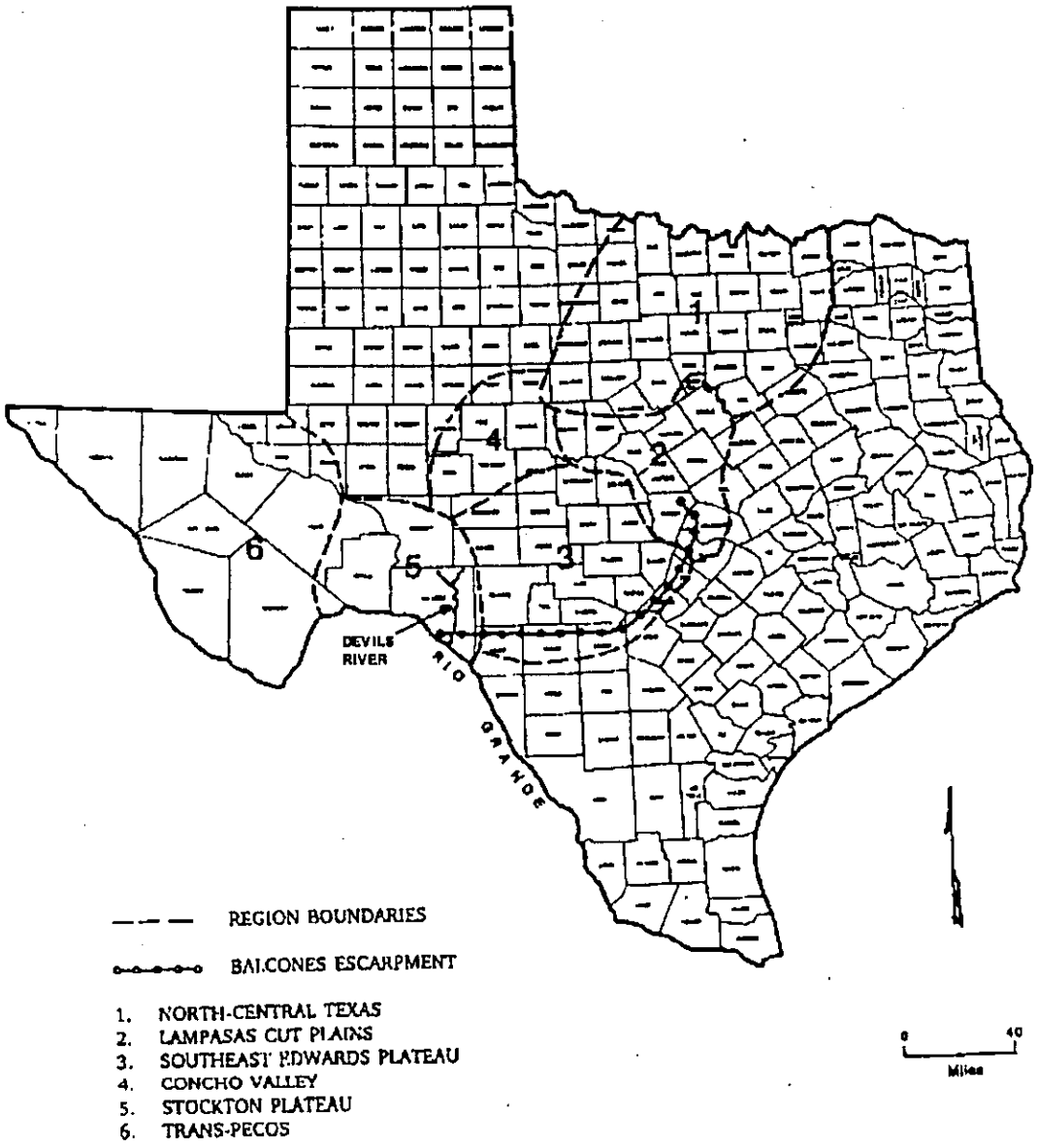

Figure 1. USFWS-designated BCVI Recovery Regions based on original BCVI Recovery Plan (USFWS 1991).

Black-capped Vireo
Recovery Units (modified)

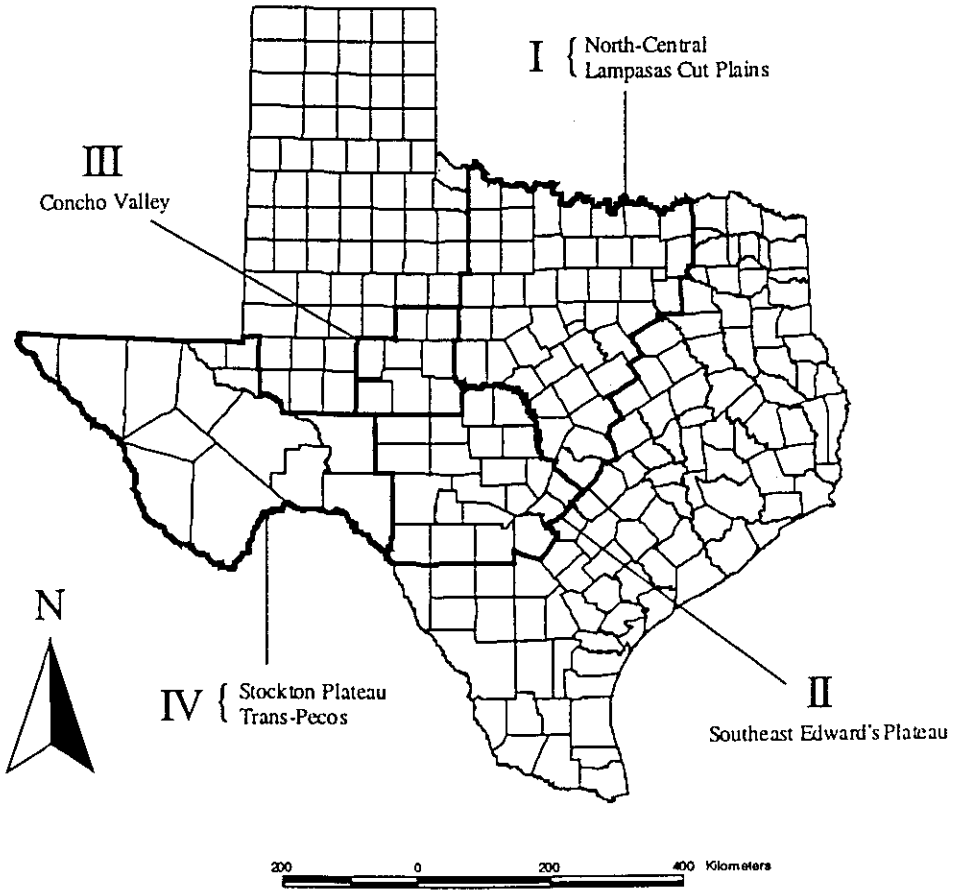

Figure 2. Modified USFWS-designated BCVI Recovery Regions, now called Recovery Units, based on recommendations in USFWS (1996).

Table 1. Compiled Totals for adult male and female BCVI in properties across the state under various ownerships (also see Appendix C).

Recovery Unit	Physiographic Region(s)	TPWD	Public	Private	Total Acreage	
					TPWD	RU
I	North-Central, Lampasas Cut Plains	18	671	10	14,250.0	25,496,165.0
II	Southeast Edwards Plateau	619	0	60	48,875.7	14,511,882.0
III	Concho Valley	0	0	1	621.4	5,328,189.0
IV	Stockton Plateau, Trans-Pecos	170	50	60	20,702.2	25,884,523.0
TOTAL		**807**	**721**	**131**	**394,730.4**	**71,220,759.0**

In the following regional descriptions, BCVI population counts are totaled for each site and organized with respect to each of the four new Recovery Units. Discussions of each Recovery Unit are organized by Physiographic Region to reflect an ecosystem approach to recovery efforts. Only TPWD parklands will be discussed in detail, whereas WMA properties will not. In each Recovery Unit section, when data exist, discussion of each site will be include historical and current information on:

- BCVI populations
- cowbird presence and effects, if any
- habitat type
- park activities near the target species
- adjacent land uses
- park use constraints, if necessary
- management and improvement recommendations, if any
- future monitoring suggestions

RECOVERY UNIT I

NORTH--CENTRAL AND LAMPASAS CUT PLAINS SITES

The physiographic regions included in this Recovery Unit, North-Central Texas and Lampasas Cut Plains, will be discussed separately.

Table 2. BCVI maximums for Recovery Unit I. Acreage represents total for each property.

Site Name	County	Count	Acreage
North-Central Sites			
Cedar Hill SP	Dallas	1	1,810.6
Cleburne SP	Johnson	1	528.8
Eagle Mountain Lake SRA *	Tarrant	0	400.7
Eisenhower SP	Grayson	2	457.3
Fort Griffin SHP	Shackelford	0	506.2
Lake Whitney SP *	Hill	0	955.0
Lake Mineral Wells	Parker	1	3,008.4
Possum Kingdom SP	Palo Pinto	2	1528.7
Subtotal		**7**	**9,195.7**
Lampasas Cut Plains Sites			
Dinosaur Valley SP	Somervell	10	1,274.1
Inks Lake SP	Burnet	0	1,201.7
Lake Brownwood SP *	Brown	0	537.5
Longhorn Caverns SP	Burnet	1	639.0
McKinney Falls SP	Travis	0	640.6
Meridian SP	Bosque	0	502.4
Mother Neff SP	Coryell	0	259.0
Subtotal		**11**	**6,583.0**
Total		**18**	**14,250.0**

* Values taken from Connally (1993), and do not appear in App. C.

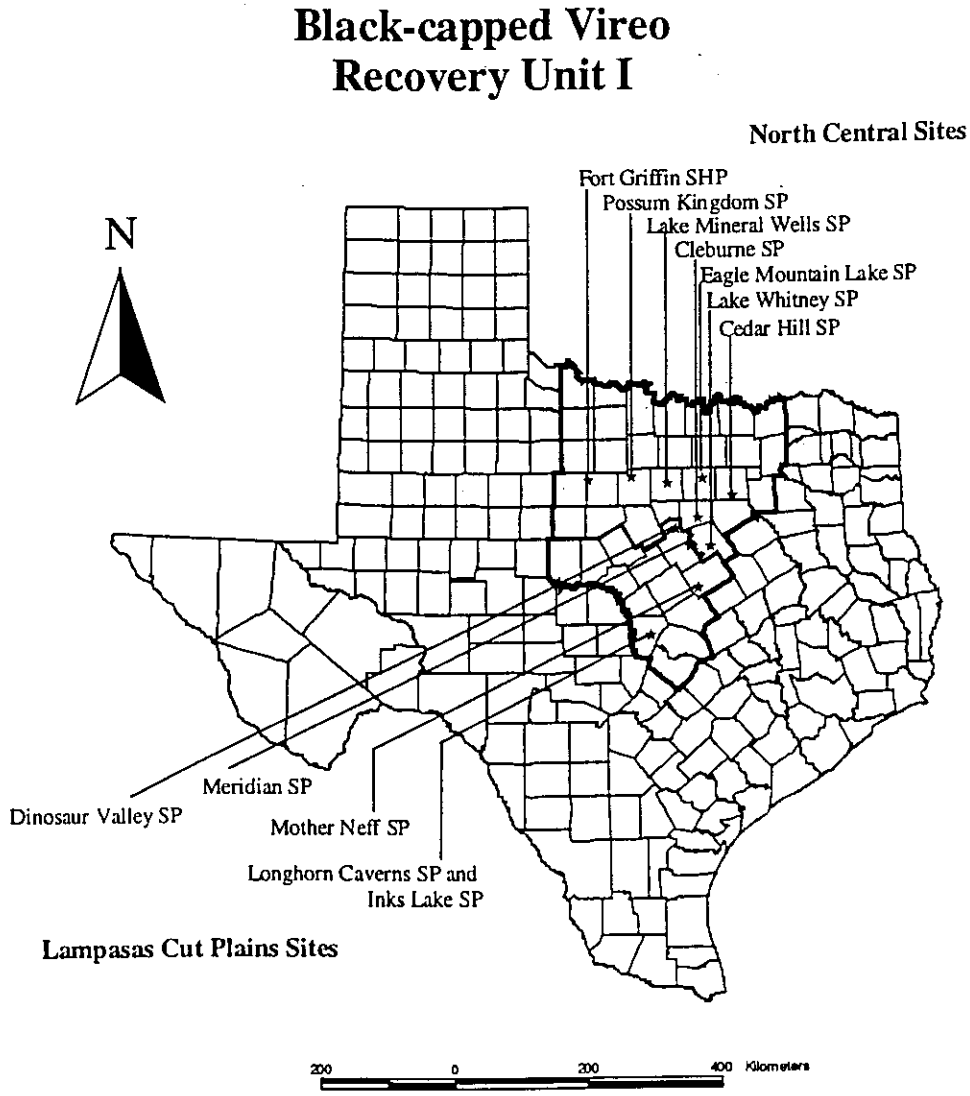

Figure 3. Recovery Unit I: North Central Texas and Lampasas Cut Plains sites

RECOVERY UNIT I

NORTH-CENTRAL TEXAS SITES

General Summary

The North-Central Texas region encompasses approximately 31counties containing 7 state parklands surveyed for BCVI (Table 2 and Figure 3). On the parklands areas, only 7 BCVI are known. The existing "populations" are small and appear isolated. Reproductive success for these individuals is not known, but during the brief 1993 survey by TPWD staff, no females were observed in the region. Historically (prior to 1985), only a few scattered BCVI records are available for the region (Oberholser 1974). The region is not a focal point in the BCVI management strategy, but should continue to be monitored in areas where habitat conditions can be improved to possibly attract BCVIs. Brown-headed Cowbirds are prominent in most of the parklands in this region. Cattle are managed on two sites (Possum Kingdom SP and Fort Griffith SHP).

RECOVERY UNIT I

NORTH-CENTRAL SITES

Specific Site Information

CEDAR HILL STATE PARK

Cedar Hill State Park (CHSP) is approximately 1810 ac. located in Dallas County, south of Dallas, in Cedar Hill, on the west shore of Lake Joe Pool (Cedar Hill, Britton, Duncanville, and Arlington quads USGS nos. 3296-322, 3297-411, 3296-323, and 3297-414; TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT) 1990 aerial photo no. 3-16-797). The elevation of the park ranges from 520 near lake level to 760 above mean sea level (amsl) along the central eastern border.

The uplands and open grasslands on the park are Ovan Clay and Heiden Clay with gently slopes of 1 to 3%. The ravine systems and slopes are Heiden Clay and Vertel Clay of 2 to 12% slopes. All of the range sites at CHSP are supposed to tend toward tall to mid-grass prairie. Only bottomlands should include any invasive hardwoods.

Three successful prairie restoration sites currently exist on the park near the lake shores. Steep slopes above the lake are heavily wooded with Ashe and Virginia junipers (*Juniperus ashei* and *J. virginiana*), hackberry (*Celtis* sp.), cedar elm (*Ulmus crassifolia*), Bigelow oak (*Quercus durandii* var. *breviloba*), and few mesquite (*Prosopis glandulosa*). Understory species include fragrant sumac (*Rhus aromatica*), coralberry (*Symphori-carpos orbiculatus*), elbowbush (*Forestiera pubescens*), small Bigelow oak, Mexican buckeye (*Ungnadia speciosa*), red buckeye (*Aesculus pavia*), littleleaf mulberry (*Morus microphylla*), rough-leaf dogwood (*Cornus drummondii*), and poison ivy (*Rhus toxicodendron*). This vegetation and structure do not appear conducive to BCVI nesting due to the density (very thick, few openings) and composition. The top of the escarpment community consists of a mosaic of grasses and mottes of mesquite, hackberry, cedar elm, Ashe and Virginia juniper, and Texas oak.

The county BCVI history is centered near the state park, most observations on the former Greenhills Environmental Center property (now, Dallas Nature Center) across FM 1382. Graber (1961), Oberholser (1974), and Marshall et al. (1984) all noted BCVI within Dallas County. Marshall (1985) noted 3 male BCVI (one of which was mated) in the vicinity of the park. Pulich (1976) suggested that the then-present population of BCVI had been dwindling since the mid-1970's. This park has been thoroughly searched by TPWD employees for the presence of BCVI in 1993 without locating any. White-eyed vireos (*Vireo griseus*) abound. According to Jeff Reid, biologist for the USFWS Arlington office, the Dallas Nature Center maintains that they have nesting BCVI on their property (number unknown). In 1993, TPWD biologist Paul Turner accompanied Reid to property across FM 1382 near the Dallas Nature Center. On that excursion, Turner reported one singing male BCVI near FM 1382 on the southwest facing slope of Cedar Bluff. The breeding population of BCVI across FM 1382 is small and there is no evidence of increase. There is probably little (if any) emigration from that population into vegetation on Cedar Hill State Park.

The vegetation communities at CHSP do not fit the structural mold of BCVI habitat in other parts of Texas. The dense thickets in the ravines and on the slopes do not have the typical open mosaic of BCVI habitat. The BCVI population in the county is not a stronghold for BCVI in Texas. The current vegetation represents very limited (if any) potential for suitable habitat. The majority of this site has more potential as prairie restoration than BCVI habitat. The range site recommendations suggest that the park is best suited for tall to mid-grass prairie, not shrubland or woodland, not BCVI habitat.

Management Recommendations for Cedar Hill SP.

Further intensive monitoring for BCVI is not recommended for Cedar Hill. However, since some of the Cedar Hill staff are capable of spotting a BCVI, they should be encouraged to note any observations made during the breeding and migration seasons. These observations should be reported to the Resource Coordinator, Natural Resource Program (Wildlife Division), and the Nongame and Rare Species specialist (Wildlife Diversity Program). If, in time, the Dallas Nature Center population expands and recruitment is noted on Cedar Hill State Park, changes will be made to accommodate possible BCVI management.

CLEBURNE STATE PARK

Cleburne State Park (CSP) is located in Johnson County and covers 528.8 ac surrounding Cedar Lake north of Waco, west-southwest of the town Cleburne (Brazos Point and Bono quads, USGS nos.: 3297-214 and 3297-241, and TXDOT 1990 aerial photo no. 4-26-1310). Elevation ranges from 710 ft to 890 ft amsl. Soils at Cleburne would tend to support tall grasses and scattered oaks for about 20% canopy cover. Woody species include Texas oak (*Quercus buckleyi*), live oak (*Q. fusiformis*), juniper (*Juniperus* sp.), and sumac (*Rhus* sp.). In poor range conditions, these soils are subject to invasion by Ashe juniper (*Juniperus ashei*) and range extension of Texas oak.

The park is a sparsely diversified woodland dominated by Ashe juniper except in the area below the spillway. Other species include redbud (*Cercis canadensis*), Texas oak, live oak, hackberry, cedar elm, and American elm (*Ulmus americana*). Few Texas persimmon (*Diospyros texana*) were found in the drier areas.

In 1984, Marshall observed BCVI near Glen Rose approximately 12 miles to the west of Cleburne SP. NO BCVI have been detected on the park. This vegetation is not conducive to BCVI in its present form or manipulated toward its natural, "undisturbed" mature community state.

The parkland is fairly isolated on all sides except the west. North and east of the park a housing development is proceeding; south and southwest, a quarry operates. To the west lay a ravine system similar to the one holding Cedar Lake. The aerial photo shows this system's community as predominantly Ashe juniper and oaks.

Management Recommendations for Cleburne SP.

Further monitoring for BCVI is not necessary at this location. Report any sightings to the Natural Resources Parks Division, Resource Coordinator, and the Nongame and Rare Species specialist (Wildlife Diversity Program).

EAGLE MOUNTAIN LAKE STATE RECREATION AREA

Eagle Mountain Lake (EMLK) is a TPWD holding, development pending. It is located in Tarrant County, northwest of Fort Worth, off of 1220 north on the east bank of Eagle Mountain Lake. Elevation on the site ranges from 650 to 750 ft amsl. The property has elements of both Grand Prairie and the Eastern Cross Timbers regions with rolling topography. The noted vegetation classification on the upland is grassland with scattered oak mottes which have not yet recovered from former grazing pressures. The slopes support woodlands of Texas Oak series and Blackjack Oak series.

The park can be categorized into three vegetational communities: bottomland which occurs on the slightly graded slopes near the lake shores, steep slopes above the bottomland, and upland. The steep slopes between approximately 690 ft and 740 ft amsl are "dry" vegetation communities: grasses mixed with scattered Mexican buckeye (*Ungnadia speciosa*), Texas persimmon (*Diospyros texana*), elbowbush (*Forestiera pubescens*), Texas ash (*Fraxinus texensis*), live oak (*Quercus virginiana*) (some 20 ft high, some shrubby approximately 4 ft high), agarita (*Berberis trifoliolata*), prickly pear (*Opuntia* sp.), two-leaf senna, and yucca. All the yucca seemed to have been severely browsed. Very few Texas oak and little fragrant sumac and poison ivy/oak are mixed in near the bottomland ecotone. This community is observed throughout the ravine systems on the lakeside of the central road. The uplands appear cleared of woody vegetation near the road, but live oak, Ashe juniper, Texas persimmon, prickly pear, tasajillo, and agarita are scattered throughout. The ecotone between the slope woodlands and the uplands appears to hold possibility for BCVI if manipulated for more shrubby vegetation. Most of the current vegetation appears too overgrown (tall) or overbrowsed (thin).

Black-capped Vireo records for Tarrant County go back as far as 1915 with breeding observations by Graham (Sexton et al. 1989), but are sparse. Pulich (1976) states only three sightings for the county. He did not locate any record of nesting activity. No BCVI were observed during the 1993 TPWD survey.

The surrounding areas are developed either commercially or residentially. Few woodland areas remain adjacent to the parksite. It is unlikely that BCVI would use the current vegetation for nesting due to structural constraints and the isolated nature of the potential habitat. However, portions of the woodlands may currently be used as part of a migration corridor for BCVI.

Management Recommendations for Eagle Mountain Lake SRA

Even though the site is isolated from other patches of habitat, the possibility exists for experimentation. Since the site is not slated for opening soon and BCVI were not noted there

recently, the uplands and/or non-steep side slopes (not bottomlands) could be burned to encourage shrubby growth, and monitored over the next 2 to 5 years. In that time, the plant community *may* attract BCVI. If so, then the park may be reconsidered for BCVI management pending other factors (i.e.,. total state BCVI population, isolation of the patch, whether BCVI are breeding on the site). The site should again be surveyed thoroughly during the peak of BCVI breeding season in the same year prior to burning. Further intensive monitoring, if habitat enhancement is not attempted, is not necessary. The Resource Coordinator should be aware of the potential for a migration record and should note the record if observed. The record should be reported to the Natural Resource Program (Wildlife Division) and the Nongame and Rare Species specialist (Wildlife Diversity Program).

EISENHOWER STATE PARK

Eisenhower State Park (ESP) is located in Grayson County north of Dallas on the southern shore of Lake Texoma near Denison (Denison Dam Quadrangle, Texas-Oklahoma, USGS no. 3396-341 and aerial photo no. 1-9-291 TXDOT). The elevation on the site ranges from 620 to 713 ft amsl. The soils are best suited to pasture and limited rangeland, with a need for brush control. A 1970 aerial photo from the resources preview (park planning) indicate some potential prairie areas. The current vegetation is dense woodland composed of the following species: walnut (*Juglans nigra*), pecan (*Carya illinoensis*), hickory (maybe?) (*Carya laciniosa*), redbud (*Cercis canadensis*), Texas oak (*Quercus buckleyi*), Durand oak (*Q. durandii*), live oak (*Q. virginiana*), white oak (*Q. alba*), post oak hybrid (*Q. stellata*), Ashe juniper (*Juniperus ashei*), another juniper (possibly *Juniperus virginiana*), cedar elm (*Ulmus crassifolia*), American elm (*Ulmus americana*), sugarberry (*Celtis laevigata*), ash (*Fraxinus americana*), Bois D'Arc (*Maclura pomifera*), rough leaf dogwood (*Cornus drummondii*), elbowbush (*Forestiera pubescens*), sumac (probably *Rhus copallina*), plus three unknown tree species. Most of the park is completely enclosed canopy.

No BCVI have been detected in Grayson County much less Eisenhower State Park since 1974 (Oberholser). Prior to that the records (Pulich 1976) indicate only one other record which is the northernmost and easternmost BCVI observation for Texas. NO BCVI were detected in the most recent (1993) survey by TPWD. Brown-headed Cowbirds (*Molothrus ater*) were evident in 1993 but not in large numbers.

Management Recommendations for Eisenhower SP.

There are no recommendations for habitat management for this area as potential for BCVI habitat does not exist. It is possible that the BCVI may use the park as part of its southern migration corridor coming out of Oklahoma, but the park does not provide the opportunity for nesting habitat. In the event that a BCVI is sighted in the park, the time of year and location should be reported to the Resource Coordinator and the Nongame and Rare Species specialist (Wildlife Diversity Program) (both TPWD).

FORT GRIFFIN STATE HISTORICAL PARK

Fort Griffin is an historical park and recreation area covering 506.2 ac. located on both sides of US Hwy 283 in Shackelford County south of the Clear Fork of the Brazos River. The soils of this park are generally classified into North Central Prairie soils which tend toward prairie in their natural states with a tendency for brush invasion where heavily grazed.

The vegetation on the park varies from riparian in a thin belt (approximately 10 m wide on either side) along the Clear Fork of the Brazos to upland and pastureland with approximately 25 % cover in general. The riparian belt is a lush canopy of tall (30+ ft high) pecan (*Carya illinoensis*), cottonwood (*Populus* sp.), and smaller hackberry (*Celtis* sp.). The understory here consists of agarita (*Berberis trifoliolata*), skunkbush sumac (*Rhus aromatica* var. *flabelliformis*), and young trees of the overstory species. The upland in general is a grassland studded by mesquite mottes and single live oak (*Quercus virginiana* maybe var. *fusiformis*) with an understory of acacia (*Acacia greggi*), catclaw mimosa (*Mimosa biuncifera*), prickly pear (*Opuntia* sp.), and tasajillo (*Opuntia leptocaulis*). Twist-leaf yucca (*Yucca rupicola*) is also present in patches. Two separate pasture areas are provided for approximately 20+ head of longhorn cattle. One of the pastures is similar to the oak- and mesquite-studded grassland and the other pasture is a dense, practically impenetrable mesquite thicket (approximately 12 ft high) with an understory of shade-tolerant grasses (where grasses were present) and prickly pear.

Shackelford County and the park are not known for any historical BCVI records. The park was surveyed in 1993 (TPWD) and neither BCVI nor its habitat was detected. BCVI are not likely to be detected there except possibly during migration. Brown-headed Cowbirds were very abundant especially in areas near the longhorns. However, since the park does not provide nesting substrate for either species, this is one instance in which the Brown-headed Cowbird poses no threat to BCVI.

Management Recommendations for Fort Griffin SP.

There are no recommendations for improving habitat, trapping cowbirds, or continuing monitoring for BCVI on the park. However, any future sighting should be reported by time of year and number of birds observed to the Resource Coordinator and the Nongame and Rare Species specialist (Wildlife Diversity Program) (both TPWD).

LAKE MINERAL WELLS STATE PARK

Lake Mineral Wells State Park is located in Parker County, west of Fort Worth on Lake Mineral Wells (Mineral Wells East and Whitt quadrangles and TXDOT 1990 aerial photo no. 2315-84). The elevation ranges from 860 to 1011 ft amsl. Most of the area is considered upland formed over sandstone with gently sloping to steep hill sides or loamy bottomlands (below the spillway and along the creekbottoms). The mature community vegetation is represented in some areas as practically undisturbed tall grass savannah with a 10 to 15 % canopy of tall trees and/or mid- to tall-grasses, few forbs, and post oak (*Quercus stellata*)/blackjack oak (*Q. marilandica*) savannah. If allowed to deteriorate to poor condition the post oak and blackjack oak will shade

out the grasses; mesquite (*Prosopis glandulosa*) and prickly pear (*Opuntia* sp.) will invade. The Redland range site of the north end of the park tends toward a savannah of tall- to mid-grasses with a diverse canopy of live oak (*Quercus fusiformis*), post oak, Bigelow oak (*Q. durandii* var. *breviloba*), Texas oak (*Q. buckleyi*), elm (*Ulmus* sp.), hackberry (*Celtis* sp.), redbud (*Cercis canadensis*), bumelia (*Bumelia* sp.), and elbowbush (*Forestiera pubescens*). It is this range site which adjoins the Sandstone Hills site and forms a steep slope ecotone with sandstone rocks and boulders near and on the surface and an open stand of post oak, blackjack oak, Texas ash (*Fraxinus texensis*), cedar elm (*Ulmus crassifolia*), skunkbush sumac (*Rhus aromatica*), elbowbush, bumelia, and greenbriar (*Smilax bona-nox*) in a 10 to 15% canopy over mid- to tall-grasses. If overgrown, the community is predominantly oak, skunkbush sumac, greenbriar, three-awn grasses, ragweed, nightshade, and mesquite.

The riparian areas were thick lush bottomlands not suitable for BCVI or GCWA. The vegetation open uplands the appear previously over-grazed and are dominated by mesquite, prickly pear, and tasajillo (*Opuntia leptocaulis*) scattered throughout large open pastures. Most of the park seemed to be recovering range sites of post oak and live oak woodland. The understory in most of the areas was thick and shrubby especially near the sandstone hills range sites. The vegetation diversifies as the relief increases along a series of ridges. These ridges are vegetated with post oak, blackjack oak, flameleaf sumac (*Rhus copallina*), fragrant sumac, agarita, Texas ash, Texas persimmon, small Ashe juniper, greenbriar, and a deeply lobed Texas oak. In this area, the vegetation structurally resembled marginal (overgrown) BCVI habitat in other parts of their range.

Historically, the county has one record for a BCVI male (Oberholser 1974, Pulich 1976, Marshall 1985, and Sexton et al. 1989). That is the last record known for the county. The vegetation is completely different: mature Ashe juniper woodland over limestone at PKSP vs. post oak woodland over sandstone at LMWSP. Brown-headed Cowbirds (*Molothrus ater*) are abundant.

Management Recommendations for Lake Mineral Wells SP.

Habitat manipulation is not recommended in this park as the mature community vegetation (post oak, blackjack oak, cedar elm) does not seem suitable for BCVI. The mature community species could only be useful to the BCVI in a shrub-like or young stage. Surrounding properties do not appear to provide adequate structure for BCVI; the possibility of the park being used by dispersing juveniles is slim.

Since BCVI have not been noted in the vicinity for 20 years and this park does not seem conducive to forming BCVI habitat, no further BCVI surveys need be conducted. However, migration records should be reported to the Resource Coordinator and the Nongame and Rare Species specialist (Wildlife Diversity Program).

Lake Whitney State Park

Lake Whitney State Park (LWSP) is approximately 955 ac in Hill County north-northwest

of Waco (Whitney quadrangle USGS no. 3197-434 and TXDOT 1991 aerial photo no. 2-17-376) The park has an airstrip and juts out on a peninsula on the eastern portion of Lake Whitney. The elevation ranges from 520 to 560 ft amsl. The area soils constitute deep sandy and loamy savannah and moderately deep loamy and clayey prairie soils which tend toward prairie vegetation.

Most of the park is disturbed open grassland with scattered single live oaks (*Quercus fusiformis*), mesquite (*Prosopis glandulosa*), hackberry (*Celtis* sp.), Ashe juniper (*Juniperus ashei*), and an understory of greenbriar (*Smilax bona-nox*). Near the lake and tributaries, small groups of pecan (*Carya illinoensis*), cottonwood (*Populus deltoides*), cedar elm (*Ulmus crassifolia*), willow (*Salix* sp.), live oak, greenbriar, post oak (*Quercus stellata*), and grape (*Vitis* sp.). Neither of these communities lends itself to BCVI nesting substrate.

Management Recommendations for Lake Whitney SP.

Based on the aerial photograph, historic records, and the 1993 survey information, there is no habitat for either BCVI at LWSP. Further monitoring for either species is not recommended as habitat does not exist for BCVI.

POSSUM KINGDOM STATE PARK

Possum Kingdom State Park (PKSP) is 1528.7 ac located in Palo Pinto County, west of Fort Worth along U.S. Hwy 180 on the east half of Possum Kingdom Lake [two topographic sheets: Cove Creek and Brad (USGS Nos. 3298-344 and 3298-341) and TXDOT aerial photo no. 2344-199 (1990)]. The site's elevation ranges from 1000 to 1245 feet above sea level. The soils and range site associated with the steep ravines and steep lakeside slopes tend toward tall- to mid-grass prairie mixed with live oak (*Quercus fusiformis*) savannah if not overgrazed or similarly manipulated. The nearly level to gently sloping soils of the pastures and uplands tend toward tall to mid-grass prairie with widely scattered live oak mottes with woody species canopy coverage somewhere around five percent. A Longhorn Cattle Management Program is in effect at this park to attempt to avoid poor range conditions and grazing abuses.

Longhorn cattle are contained in the southern-most pasture (560 ac) and corrals near the large bend in the park road. This pastureland has few scattered Ashe juniper and live oak. Most of the uplands in less than 50 % cover including oaks, mesquite (*Prosopis glandulosa*), sumac (*Rhus* sp.), Ashe juniper (*Juniperus ashei*), agarita (*Berberis trifoliolata*), prickly pear (*Opuntia* sp.), tasajillo (*Opuntia leptocaulis*), lotebush (*Condalia lycoides*), catclaw mimosa (*Mimosa buincifera*), silver-leaf nightshade (*Solanum elaeagnifolium*), and three-awn grasses. The county soil survey states these are indicators of poor range conditions due to overgrazing and similar land abuses. This area appeared impacted (TPWD 1993), possibly due to grazing and browsing pressures. Other impacts to the vegetation include several gas pipelines and drilling rigs.

Currently, most of PKSP is a large pocket of densely wooded ravines and hillsides which serves as habitat for GCWA: wooded ridges and ravines except for the central uplands which are in pasture for longhorn cattle, gas development, or visitor use areas. Vegetation in the park is

dominated by Ashe juniper with little diversification except for an occasional Texas oak (*Q. buckleyi*), live oak, and agarita. In a small area, the uplands support a patch (approximately 2 ac.) of stunted live oak approximately 2 to 3 feet high. This area is centrally located along an east-west running fenceline which leads from the longhorn pastures into a large central forked ravine. These oaks appear heavily browsed and thin. More of this type of vegetation, not so heavily browsed, also occurred along the western fenceline road. Historically, the records for BCVI in the county are sparse and no BCVI were detected between 1974 (Oberholser) and 1991. In 1991, Peter Scott located 2 BCVI along the western fenceline road. Brown-headed Cowbirds (*Molothrus ater*) appeared to be thriving in 1993 (TPWD) in all areas of the park. They were individually noted in the visitor use areas as well as in flocks near the longhorn cattle. A few individuals were noted in the southwestern portion of the park near the western fenceline road.

Management Recommendations for Possum Kingdom SP.

Only two areas of the park looked suitable for BCVI. The western fenceline road provides a good edge along thickets of oak shinnery and mixed woodland. The neighboring property to the west looks suitable from the ground (and aerial photo), mostly along the edges of clearings and road. The ecotone between the upland ridgetops and the ravine edges in the center of the park could also provide suitable BCVI habitat if the shrubs (oak, elbowbush, sumac) were allowed to flourish through reduction of browse pressure by white-tailed deer, and possibly fire enhancement. Fire could enable the oak shrubbery to flourish in 2 to 5 years in the ravine/upland edges. However, habitat improvement through fire will be negated if the browse pressure is not controlled as well.

A reduction in animal units (AU's) will not only improve the upland range conditions, but will also reduce the threat of Brown-headed Cowbirds to nesting GCWA and/or BCVI. A Brown-headed Cowbird trapping program is recommended in addition to reduction in animal units as the surrounding properties contain cattle.

Even though this park is not a *focal* BCVI area, PKSP should be monitored following any habitat enhancement. PKSP may provide better-than-marginal habitat for BCVI in three to five years following such a program. A researcher should spend time searching for evidence of nesting and possibly cowbird parasitism. Most of the surrounding area outside of the park (except to the south) appears to be either in development, cleared for cultivation/pasture, or water (lake). Areas to the south look similar to the wooded areas on the park. Any park records of BCVI or GCWA should be reported to the Resource Coordinator and the Endangered Species Branch.

RECOVERY UNIT I

LAMPASAS CUT PLAINS SITES

General Summary

This physiographic region encompasses fifteen (14) counties within which lie 6 state parks (Figure 3). TPWD Lands in the region contain approximately 11 BCVI (Table 2). Longhorn Caverns State Park (1) and Dinosaur Valley State Park (10) are the only properties which contain BCVI. The BCVI populations in these areas are much smaller than the non-parklands in the region, but the potential for population increase is good at Dinosaur Valley State Park.

Even though Meridian does not currently harbor BCVI, the park may have potential for BCVI enhancement as BCVI were known historically. This situation may be difficult since current GCWA habitat may overlay former BCVI habitat.

Two nearby non-park areas have trapped cowbirds in this region. The *Fort Hood MilitaryReservation* cowbird trapping program, initiated in 1988, was presented at the Cowbird Workshop held by Texas Nature Conservancy in Austin, Texas, in 1993. Trapping efforts began at Fort Hood with 3 to 8 traps to attempt to curb brood parasitism of BCVI. Their early efforts had little effect (Tazik et al 1993). However, as the trap effort increased to 50 traps over the next three to four years, the nest parasitism rate dropped sharply (from 60 to 90 % parasitism in 1989 to 30 to 38 % in 1992) (Tazik et al 1993). Their trap efforts were concentrated in foraging areas and thereby did not focus cowbirds into areas known to have nesting BCVI. The Balcones NWR trap efforts were concentrated near BCVI nesting areas. Cowbird trapping programs may be necessary for the survival of BCVI in this region in several of the state parklands.

RECOVERY UNIT I

LAMPASAS CUT PLAINS SITES

Site Specific Information

DINOSAUR VALLEY STATE PARK

Dinosaur Valley State Park (DVSP) is 509.64 ha (1274.1 ac) located in Somervell County southwest of Dallas and northwest of Glen Rose. The park is located on two topographic sheets: Glen Rose West and Hill City (USGS nos. 3297-224 and 3297-231) and aerial photos 2316-174 (TXDOT 1990). Elevation on the site is approximately 650 to 880 ft amsl.

Soils of DVSP are a mixture of Grand Prairie and Cross Timbers region soils. The area is complex and diverse. More detailed information on soils may be found in the TPWD 1993 BCVI Section 6 Report, or in the Somervell County soil survey. In general, the bottomlands were formed in calcareous clays and the uplands formed over limestone. The trail systems on slopes above the tributaries and the river are associated with hilly and undulating terrain. Most of the area tends toward Ashe juniper (*Juniperus ashei*) complex such as an oak/juniper woodland.

The vegetation for DVSP is divided into six communities: fields/pastures within the floodplain of the Paluxy; uplands above 750 ft amsl east of the Paluxy; uplands above 700 ft amsl west of the Paluxy; ephemeral creeks and ravines; and riparian zone including Denio Creek, Opossum Branch, and Paluxy River. A more detailed description of the park vegetation is found in the Department Lands Inventory (DLI) Summary of Representative Plant Communities (1990) or in the 1993 TPWD BCVI and GCWA report (filed at the Nongame and Rare Species (Wildlife Diversity Program), TPWD).

Open fields within the floodplains are primarily visitor use areas including campgrounds, dinosaur interpretive areas, and longhorn pastures. Approximately 10 head of cattle and one horse reside in the longhorn pasture on the east side of the Paluxy River near Opossum Branch. The pastures containing the cattle are devoid of woody plant species except near the edges close to the central park ridge (part of the river and creek trail systems).

The uplands above 750 ft amsl east of the Paluxy include most of the Denio Creek Trail, the Outer Ridge Trail, and ridges northwest of the trails area. The uplands along the trails have approximately 75% canopy cover whereas the uplands northwest of there have approximately 50 to 75% canopy cover. These areas have rocky substrate, little grass except in wide open areas, and little to no understory under the main canopy. The canopy cover in these areas is predominantly Ashe juniper approximately 15 ft high, and 1 ft diameter. Associated species include hackberry (*Celtis* sp.), cedar elm (*Ulmus crassifolia*), small live oaks (*Quercus fusiformis*), Texas ash (*Fraxinus texanus*), Bigelow oak (*Quercus durandii* var. *breviloba*), and Texas oak (*Q. buckleyi*). The uplands along the northeastern border were cleared for the fenceline, but the vegetation close to the fenceline clearing had shrubby undergrowth (Texas ash, Bigelow oak, and stunted hackberry) and larger oaks (live oak and Texas oak). In the northwestern section, there were large patches of *Baccharis* sp. and a few more open areas with

oak shinnery in thickets (0 to 4 ft high). This upland blends into the steep cliff at the bend in the Paluxy where the vegetation is slightly different: Ashe juniper/oak community with a mostly open understory of greenbriar, rough-leafed dogwood (*Cornus drummondii*), few cedar elm and hackberry. Overall, the vegetation appears to be approaching maturity according to soil survey predictions.

The uplands west of the Paluxy (above 700 ft amsl) include most of the equestrian trail west of the entrance road. This community was predominantly a grassland interspersed with oak, mesquite, and juniper mottes and individuals.

Ephemeral creeks and ravines were dominated by Ashe juniper (approximately 75% of the total composition) with greatly decreased incidence of oaks, redbud, and cedar elm . Understory was similar in species to the other areas but was not thick.

The riparian zones (Denio Creek, Opossum Branch, and Paluxy River) has more varied species composition. The vegetation community included the upland vegetation in addition to white oak (*Quercus alba*), pecan (*Carya illinoensis*), redbud (*Cercis canadensis*), greenbriar (*Smilax bona-nox*), and wild grape (*Vitus* sp.). Texas oak appeared in very small numbers and generally not as tall as in other places in the park (approximately 12 ft). Incidence of cedar elm increased near the ecotone between riparian and uplands. The northern-most section of Denio Creek near trailmarker M is thick with oak shinnery. The area is blanketed by the shinnery with large oaks and juniper scattered throughout.

DVSP has a declining history of BCVI occupation. BCVI have been reliably reported in the park since 1974 (Pulich 1976). In 1985, Marshall noted that the birds were absent from apparently potential habitat. Marshall, in a letter to David Riskind (10 February 1988), stated that he observed good habitat in the northeastern section, along Denio Creek trail, and along the northern portion of the Buckeye Loop trail. Peter Scott (TPWD 1991) noted 8 BCVI (observations only, not territories). Carl Haynie (TPWD 1991) noted three BCVI males singing along the Denio Creek Trail and Buckeye Loop. In 1993 (TPWD), three BCVI were located in an isolated patch of shinnery near the 850 ft amsl. peak in the northwestern part of the park. The BCVI population is rapidly declining due to decrease in suitable habitat and natural succession toward mature Juniper/oak woodlands (GCWA habitat). Areas offering suitable shinnery are limited (estimated less than 50 ac. total, spread throughout the park) and quickly outgrowing their usefulness. Most of the shinnery along and between the trails is under heavy canopy of Ashe juniper and the shrubs are having to grow "thinner" to reach the light. The habitat in which the 1993 BCVI were located looked good in 1994, but not excellent. The BCVI population was no longer self-sustaining with less than about 10 adults.

Management Recommendations for Dinosaur Valley SP.

The area is fortunate to have birds of special concern, but BCVI recovery in this park will be difficult because of the closely linked habitats, little BCVI acreage with which to work, and extremely low numbers of BCVI. Recruitment from surrounding areas is not very likely as most of the areas are bottomlands, flat uplands and pastures used for grazing, and juniper/oak woodlands. The park is not a stronghold for BCVI in the region (*Fort Hood MR* and Balcones

NWR have larger, healthier populations with opportunity for growth), but has far more potential for GCWA habitat enhancement. However, as long as a BCVI population remains at DVSP, TPWD must make an effort to protect and stabilize the existing population under the criteria of the recovery plan.

USFWS should be consulted prior to any habitat manipulation for either species as "recovery" for one species may involve "take" of the other. Juniper stands in which GCWA were not detected in 1993 are still considered by USFWS to be habitat if they are contiguous with currently occupied habitat. Removal of juniper in any location in this park should not occur without prior approval from the USFWS.

The uplands which contain shinnery are the best areas to concentrate habitat enhancement for BCVI (MAP II-2). Suggestions for the more accessible areas (peaks near Wildcat Hollow) include a controlled burn in the non-breeding season to enhance the existing oak shrubbery. In the event of habitat manipulation by fire, the BCVI may return in 2 to 5 years. Use caution to not invade the nearby GCWA habitat with fire. Some areas in which BCVI and GCWA habitat are closely interdigitated (north central ridges near Denio Creek) the USFWS must be consulted. TPWD recommendations in these "tight" areas include selective, mechanical juniper thinning (that which does not constitute "take" of GCWA habitat) and oak enhancement. The final goal should be to increase the shrubby habit of the oaks which currently exist without destroying suitable GCWA habitat. Trail maintenance in the park should be limited to the non-breeding season so as not to disturb either BCVI or GCWA.

Monitoring should continue at DVSP. The GCWA appear to be declining (comparing 1991 and 1993 TPWD surveys), but a more concentrated effort should be made to search for pairs and their nesting successes in the future. This park should implement its BCVI recovery measures as soon as approval is met by USFWS; the BCVI are noticeably declining and the current population is not large enough to sustain itself without further recruitment.

BHCO were prevalent in the park. Most of the BHCO observations were in the campground, other visitor use areas, and the longhorn cattle pasture. A BHCO trapping program should be instigated in the pasture areas to benefit the GCWA and possibly the BCVI if they recover to breeding status.

INKS LAKE STATE PARK

Inks Lake State Park (ILSP) is a 480.4 ha (1201 ac) property located in Burnet County west-northwest of Georgetown [Longhorn Caverns (3098-424), Kingsland (3098-423), Lake Buchanan (3098-432), and Council Creek (3098-431) quads; aerial photo no. 2-14-373, 1990 TXDOT]. The park stretches along Park Road 4 from Hwy 29 toward the Inks Dam Fish Hatchery on Inks Lake. The elevation on the site ranges from 900 to 1067 ft amsl.

Seven soil types are known from the park. Three of the soil types (Castell, Keese, and Granite Rock) are simila to the gravelly loams and rock complexes found at Enchanted Rock State Natural Area. Much of Inks Lake SP is rolling to steep granite and gneiss stones, and bedrock outcrops with little to no vegetational cover.

The narrow strip of the park from Hwy 29 to the large U-shaped curve (Devil's Waterhole) in Park Road 4 is generally an open mosaic of Ashe juniper (*Juniperus ashei*), elbowbush (*Forestiera* sp.), mesquite (*Prosopis glandulosa*), Texas persimmon (*Diospyros texana*), live oak (*Quercus fusiformis*), post oak (*Quercus stellata*), and a few hackberry (*Celtis* sp.). Canopy cover is approximately 50%. A portion of this strip is cleared for a golf course. South of the park road there is more vegetation with canopy cover nearing 70%. This changes as the slope increases on both sides of the park road near the Devil's Waterhole. The lake sides are considerably steeper near the Devil's Waterhole and the tributary that feeds it. A granitic bedrock ravine extends under the park road and beyond the eastern boundary fence. The vegetation on the east side of the road is sparse: Ashe juniper, oaks, Texas persimmon, and grasses. As the tributary slopes toward the waterhole, the juniper and oaks are more numerous as is Texas persimmon, agarita (*Berberis trifoliolata*), prickly pear (*Opuntia* sp.), whitebrush (*Aloysia gratissima*), elbowbush , and tasajillo (*Opuntia leptocaulis*). The actual lakesides near the water are nearly bare due to heavy foot traffic and visitors who do not observe signs to stay on the trails. Erosion is a serious problem here.

The central portion of the park is used for campsites and water-related activities. Most of the lakeside area is well-trafficked and only large oaks and junipers remain. Little to no understory is visible except in areas further south along the lakeshores.

The southeast section is the most vegetated and least visited area. The trails are distinct through granite boulder fields and juniper-clad ravines, but the ground does not appear overrun as in the campground areas. The vegetation is scattered in an open mosaic on the uplands containing mesquite, live oak, Texas persimmon, post oak, cedar elm (*Ulmus crassifolia*), netleaf hackberry (*Celtis reticulata*), blackjack oak (*Quercus marilandica*), white brush, Mexican buckeye (*Ugnadia speciosa*), agarita, acacia (sp. unknown), prickly pear, tasajillo, and grasses. The canopy cover varies here from approximately 35 to 60%. The cover increases toward the ravines. Ravines are predominately young to mature juniper (most less than 6 inches in diameter), but have a mixture of oaks in the bottoms with cedar elm and hackberry near the rims. Near the northeastern corner along one of the trails, pecan (*Carya illinoensis*) trees were noted (uncommon). Most of the vegetation in the bouldered areas has the species diversity evident in areas with BCVI. However, a heavy browse line was noted which prevents the establishment of proper BCVI structure (dense foliage from 0 to approximately 2 m high).

Historically, the county has BCVI observations, but the park has no records of BCVI or their habitat. Graber (1961), Oberholser (1974), Marshall (1985), and Sexton et al. (1989) have BCVI observations for the county, but not within the park. In 1991 and 1993 TPWD surveys did not located BCVI, or suitable habitat.

Management Recommendations for Inks Lake SP.

The habitat does not appear currently conducive to BCVI due to high browse lines and limited vegetation in most areas. This park has no historic records for BCVI and the surrounding areas do not seem conducive to allowing recruitment if habitat were made available. Manipulation for BCVI is not recommended. Some form of browse control is suggested for the

health of the native vegetational community.

Continued monitoring for BCVIs at Inks Lake SP is not recommended at this time. If the park personnel observe BCVI or GCWA either in breeding or migrating seasons in the area, please notify the Resource Coordinator, Natural Resource Program (Wildlife Division).

LAKE BROWNWOOD STATE PARK

Lake Brownwood State Park, occupying 537.5 ac., is located in Brown County, west of Waco and north of Brownwood, on the northwestern shore of Lake Brownwood (Lake Brownwood quadrangle USGS No. 3199-441 and TXDOT 1990 aerial photo no. 2364-54). The elevation on the site ranges from 1420 to 1520 ft amsl. Most of the park according to the county soil survey grows toward short to tall grasses, forbs, and live oak under ideal range conditions. One range site, Rocky Hills, seems to encourage mid-to short grasses, forbs, and shrubs which structurally represent BCVI habitat.

Currently, about half of the park is predominantly open grasslands sparsely punctuated with mottes of mesquite (*Prosopis glandulosa*), cedar elm (*Ulmus crassifolia*), live oak (*Quercus fusiformis*), and Texas oak (*Q. buckleyi*) with an understory of tasajillo (*Opuntia leptocaulis*), prickly pear (*Opuntia* sp.), fragrant sumac (*Rhus aromatica*), poison ivy (*Toxicodendron radicans*), and elbowbush thickets (*Forestiera pubescens*).

The Rocky Hills range site is expressed as bluffs, which parallel the lake shore, and an elevated site south of the park road. The vegetation is dense and diverse here: walnut (*Juglans* sp.), cedar elm, post oak (*Quercus stellata*), live oak, few Texas oak, fragrant sumac, greenbriar (*Smilax bona-nox*), cat claw acacia or cat-claw mimosa (*Acacia greggi* or *Mimosa biuncifera*), Mexican buckeye (*Ungnadia speciosa*), some variety of hawthorn (*Cratageus* sp.), and thickets of poison ivy. The understory is thicker here and along the edges between the grassland and this range site, the oaks are shrubby and thick. This would indicate a possibility for BCVI habitat. The aerial photograph depicts much of the same open grassland with few mottes and mixed woodlands for most of the area surrounding the park. Many of the adjacent properties are cultivated or cleared for pasture.

Historically, the county and the park do not have any records for BCVI during the nesting season. Most of the park is not suitable for BCVI as the potential habitat covers less than 5 ac. Habitat for GCWA is not present. Brown County sits among several counties which are known to harbor BCVI (i.e.,. Coke, Erath, Mills, San Saba; see USFWS 1996). In 1993, the park superintendent (Robert Ellis) reported that birders witnessed six (6) BCVI in October (pers. comm.). This seems late for migration, but 1993 was balmy. It is not known how long the BCVI stayed, but this would indicate that Lake Brownwood State Park may be important as part of a migration corridor. The park may also provide foraging habitat for dispersing pre-migration juveniles from surrounding populations.

Management Recommendations for Lake Brownwood SP.

Continued intensive monitoring of the state park is not recommended because the possibility for BCVI colonizing the area is remote. However, the park personnel should be aware that the ridge site and the lake bluffs could harbor possible dispersing juveniles or a "stray" second-year (SY) male BCVI. Brown-headed Cowbirds (*Molothrus ater*) were abundant on the park and surrounding pastures. No cowbird trapping is recommended at this time since BCVI have not been reported during the breeding season at LBSP. This area could be censused every other year. Park personnel should report any sightings to the Resource Coordinator, Natural Resource Program (Wildlife Division), and the Nongame and Rare Species specialist (Wildlife Diversity Program).

LONGHORN CAVERNS STATE PARK

Longhorn Caverns State Park is a concession-operated holding in Burnet County, approximately 1.5 miles south of Inks Lake State Park along Park Road 4. The park is located on two topographic sheets [Longhorn Caverns and Kingsland (USGS nos. 3098-424 and 3098-423)] and one aerial photo from TXDOT (1991), number 2-14-375. The elevation on the site ranges from 960 to 1380 ft amsl.

This park is divided into three general soil sites. They include stony loams and clays, steep rocky and Redland range sites. The natural mature community vegetation for most of the park tends toward an open oak woodland. Undisturbed, this open mosaic would support such woody plants as shin oak, kidneywood, deciduous yaupon, and blackhaw. Grasses such as big bluestem, indiangrass, and little bluestem and forbs such as Englemann daisy, bush sunflower, orange zexmenia, bundleflower, and sensitive briar would fill the open spaces in such a mosaic. It should be noted that prior to TPWD purchase, this area had a long history of heavy grazing.

The plant communities from the intersection of FM 2342 and Park Road 4 to the small ravine system just west of the concession is generally an oak/juniper woodland with approximately 60% canopy cover. The dominant species here are live oak and small (approximately 15 ft high) Ashe juniper, cedar elm (*Ulmus crassifolia*), and mesquite (*Prosopis glandulosa*). The understory consists of scattered smaller versions of the dominant species and Texas persimmon (*Diospyros texana*), whitebrush (*Aloysia gratissima*), and elbowbush (*Forestiera* sp.). The roadsides are grassy, without trees in general, and provide an edge to the woodland.

The small ravine system at the edge of the above-mentioned community is a steep, rocky juniper "brake" with a few live oak, Texas persimmon, cedar elm, and Texas oak (*Quercus buckleyi*) near the bottom, across the fence. The juniper seemed to be approximately 4 inches in diameter in the thicker areas.

The central part of the park contains the visitor center, picnic grounds, and nature trails. Apart from the nature trails, the vegetation appears trimmed and trampled, with solitary live oaks standing over sparse shrubs [mostly persimmon and agarita (*Berberis trifoliolata*)] and grasses.

The nature trails, which do not appear to be heavily used, wind through a thick juniper/oak woodland. Most Ashe juniper in this part of the park seem to be approximately 4 inches in diameter, some 6 inches. Live oak, Bigelow oak, and juniper form the upper canopy (closure approaching 80%); Texas redbud (*Cercis canadensis*), elbowbush, Texas persimmon, Mexican buckeye (*Ugnadia speciosa*), lantana (*Lantana horrida* probably), catclaw (*Mimosa biuncifera*), tasajillo (*Opuntia leptocaulis*), and prickly pear (*Opuntia* sp.) form the understory and trail edges. The remainder of the park (a small portion across Park Road 4 and the half east of the cavern entrance) is essentially similar to the nature trail area. The cover in the remainder of the park approaches 95% except in the "water" areas. Juniper and oak dominate the eastern half of the park with little additional shrubbery except near the fencelines, roads, waterhole, or other edges (hog trails). Hogs and wallows are noticeable in this part of the park.

Historical records for BCVI in Burnet County and near the park are spotty. Both Graber (1961) and Oberholser (1974) note BCVI in the county. Marshall et al. (1987) states one record near Marble Falls. There are no BCVI records for the park. In 1993 (TPWD), one ASY BCVI was located in the oak shinnery along Park Road 4 on the non-park side of the fence.

In 1993, no BHCO were detected on the property. It would not appear that BHCO currently threaten the continued existence of GCWA or BCVI.

Management Recommendations for Longhorn Caverns SP.

Longhorn Caverns is not a stronghold for BCVI in the region; the habitat appears to be non-existent to marginal. Habitat improvement for BCVI is not recommended unless additional acreage across fences near Park Road 4 are purchased and monitored for BCVI. Further monitoring on a yearly basis probably is not necessary. The park should be surveyed for presence/absence, increase/decrease every 2 to 3 years.

McKinney Falls State Park

McKinney Falls State Park (MKSP) (approximately 641 ac) is located in Travis County in Austin east of IH 35 near the TPWD headquarters complex. The park is on the Montopolis topographic sheet (USGS no. 3097-213). The aerial photo was not ordered. Elevation in this park ranges from 480 to 700+ ft amsl. The eastern portion of Travis County (containing the park) is east of the Balcones Escarpment and lies at the edge of the Edwards Plateau/Blackland Prairie Ecoregions. Onion Creek and Williamson Creek form a confluence within the park.

The vegetation at MKSP seems characteristic of eastern Texas more so than the adjacent Hill Country/Edwards Plateau region just west of the park. Two creeks flow through the majority of the park. The creek beds and surrounding slopes harbor bald cypress (*Taxodia distichum*), cedar elm (*Ulmus crassifolia*), netleaf hackberry (*Celtis reticulata*), rough-leafed dogwood (*Cornus drummondii*), and a few small ferns in wet rocky spots. Ashe juniper (*Juniperus ashei*) and Texas persimmon (*Diospyros texana*) were more common on the uplands as well as a few mesquite (*Prosopis glandulosa*), wafer ash (*Ptelea trifoliata*) and hackberry (*Celtis laevigata* probably). The uplands supported a mosaic habit interwoven with hike and

bike trails, visitor facilities, and campsites. This park has a high degree of visitor use.

Historically, the western portion of Travis County has supported BCVI, but currently the remaining small populations are in severe decline. The eastern part of the county has had documented presence of BCVI. Marshall et al. (1987) stated that "Greg Lasley has banded out there (the park) for years and has not observed any BCVI" and emphasizes that the park has been visited by other researchers without observing BCVI or GCWA. Peter Scott did not cover this park in his 1991 census of TPWD public lands. This year's survey did not locate either target species, but did observe sixteen additional bird species: McKinney Falls State Park does not have the habitat structure or species composition necessary for either BCVI or GCWA. It is not likely to have such in the future.

Management Recommendations for McKinney Falls SP.

No further monitoring for either BCVI is recommended.

MERIDIAN STATE PARK

Meridian State Park, at 502.4 ac., is located in Bosque County northwest of Waco and south of Meridian (Meridian topographic sheet, USGS No. 3197-343 and 1990 TXDOT aerial photo no. 2317-45). The park completely surrounds Lake Meridian. Elevation on the site ranges from 960 to 1060 ft amsl.

The Bosque County soil survey states that the majority of the park should grow toward open tall- and mid-grass prairies with live oak (*Quercus fusiformis*) scattered throughout. Portions of the park include more savannah with 10 to 15% canopy of tall trees. Soils along the creeks have flooding potential. Further information is available in the 1993 TPWD park survey for BCVI and GCWA (Connally 1993).

In 1993, the majority of the park was an Ashe juniper (*Juniperus ashei*)/oak (*Quercus* sp.) woodland. The southern half of the park is dominantly Ashe juniper whereas the northern half is more diverse. The northeastern arm of the park is largely undeveloped, 90% Ashe juniper (approximately 15 ft high), 10% small live oaks (10 ft high). The diversity increases from the northeast corner toward the road and the small finger ravines which extend from the lake. Toward the road, more oak shinnery (presumably *Quercus durandii* var. *breviloba*) is visible along with large Durand oaks (*Quercus durandii*), clumps of fragrant sumac (*Rhus aromatica*), flameleaf sumac (*R. copallina*), and redbud (*Cercis canadensis*). Along the Shinnery Ridge Trail the dominant vegetation is a nearly even mixture of Ashe juniper and tall, thin oak shinnery; the shinnery is prominent along the trail edges. Numerous trails have been made by visitors "off the beaten path." Additional understory species include coralberry (*Symphoricarpos orbiculatus*), greenbriar (*Smilax bona-nox*), and a few redbud. A thick Ashe juniper ravine runs between the Shinnery Ridge Trail and the northern-most arm of Lake Meridian. More information on the vegetation communities of the park is available through the DLI conducted in 1989. An oak die-off is occurring at the park destroying the Texas oak as a result of the "oak wilt" virus (D. Riskind, pers. comm.).

Meridian State Park has historical BCVI observations from 1970 to 1988 (Appendix C). In 1989, Marshall and Sexton mention that prime habitat still exists and the lack of birds is puzzling. In the 1991 and 1993 TPWD surveys, no BCVI were located. Habitat for the BCVI was not available due to the invasion of Ashe juniper throughout most of the shinnery areas (Shinnery Ridge and cliffs near the lake). The shinnery in these areas is heavily shaded by juniper and therefore grows thin and tall instead of shrub-like. Also, openings were not present as are characteristic in most BCVI-occupied areas. Openings may become more prevalent in the future if the "oak wilt" continues to kill trees and create open canopy. These possible openings may allow the oak shinnery under the canopy to form a more shrub-like habit. BHCO did not appear abundant in 1993.

This potential vegetation of the area is mid-grass prairie community according to the Bosque County soil survey. The survey also mentions brush control to maintain the prairie. Apparently, the prairie disappeared in favor of shrubs and larger invasive trees (Ashe juniper and live oak). It is not advisable to attempt a prairie restoration project over endangered bird habitat restoration in this park. The area possibly could be improved for BCVI.

Management Recommendations for Meridian SP.

BCVI have not been noted in the park for at least 5 years. This is not a significant amount of time to declare the park unoccupiable. Habitat can be improved for the BCVI through selective small (approximately 6 inches diameter) juniper thinning and shinnery trimming to provide openings and thicker shinnery undergrowth along the Shinnery Ridge Trail. No clearing should be implemented without consent of USFWS to avoid "take" of GCWA habitat. BCVI habitat improvement is not recommended in other areas of the park as it would disturb suitable GCWA habitat. Following any habitat manipulation for the BCVI, monitoring should continue every other year.

The park should monitor the progression of the oak wilt virus to assess whether the dying oaks will open more of the canopy, thereby allowing more shrubby growth (more BCVI habitat). GCWA habitat may decline as the oak wilt spreads. This park should be monitored for both BCVI and GCWA as the disease progresses.

MOTHER NEFF STATE PARK

Mother Neff State Park (MNSP) is a 259 ac. property located in Coryell County, west-southwest from Waco shown on the Eagle Springs topographic sheet (USGS no. 3197-132). Site elevation ranges from 600 to approximately 790 ft amsl.

The park has five range sites based on six soil types. The range sites extend from the Bottomlands near the Leon River (Lake Belton), through Clay Loam, Low Stony Hills, and Steep Rocky range sites in the center of the park, and to the Clay Loams and Shallow Clays of the prairie pastures in the northern end of the park.

The vegetation community of the park varies greatly from the floodplain of the Leon

River/Lake Belton to the uplands and prairie pastures in the north end of the park. Most of the southern half of the park is heavily used by visitors and soils are compacted. Compaction and lack of understory vegetation in the use areas is due to extensive flooding which affected much of the park to the 630 ft amsl line. The overstory community includes pecan (approximately 35 ft high), cedar elm, Texas ash, catalpa, White oak, and hackberry.

The center of the park is a woodland through which runs a small ravine. The ravine carries water from a spring fed pool (called the Wash Pond), past an historic cave, to the floodplain. This ravine contains pecan, hackberry, Ashe juniper, Bigelow oak, Texas oak, Texas ash, fragrant sumac, catalpa, Texas redbud, elm (probably cedar elm), white oak, coralberry, plum, and greenbriar. The understory is thick, but gradually thins toward the uplands near the observation tower. The tower is surrounded by Ashe juniper and live oak. The uplands begin at approximately the 710 ft amsl contour line. A line of woodland forms the ecotone between the ravine system and the prairie uplands. This woodland is mostly Ashe juniper, hackberry, live oak, and few Texas oak with an understory of coralberry and greenbriar. Beyond this woodland is the prairie restoration project in the northern most fields of the park. Mottes of Ashe juniper and live oak are scattered throughout the grasslands.

Oberholser (1974) reported one BCVI record from Coryell County, but the locality is unknown. Marshall et al.(1985) searched the park and did not find BCVI. In the Draft Distribution and Status of BCVI (Sexton et al. 1989), there are numerous BCVI observations recorded for the county. These are located at *Fort Hood MR* approximately 15 miles to the west and southwest of the park. BCVI, and BCVI habitat, were not observed during the 1993 survey of the park. It is possible that the park could be used during the migration period given the proximity to *Fort Hood MR*; however, it is unlikely that the BCVI would use the park in the breeding season.

Management Recommendations for Mother Neff SP.

The park seems best suited toward bottomlands and prairie restoration. BCVI are not common in the types of vegetation available at Mother Neff. Fort Hood provides more suitable habitat for BCVI. There are no recommendations to continue monitoring Mother Neff for nesting BCVI. Efforts in the area should be concentrated toward prairie restoration and flood damage repair. Migrating or dispersing/foraging juvenile BCVI may be observed in the park since *Fort Hood MR* is in close proximity. Any observations should be reported to Resource Coordinator, Parks Division, and the Nongame and Rare Species specialist (Wildlife Diversity Program). If banded birds are identified *Fort Hood MR* and TPWD would be interested in the information.

RECOVERY UNIT II

SOUTHEAST EDWARDS PLATEAU SITES

General Summary

Recovery Unit II includes 21 counties containing 10 state park, 3 SNAs, 1 SHP, 1 SRA, and 2 WMAs (Figure 4). The Southeast Edwards Plateau inscribes some of the state's most viable BCVI populations. This region is by far the most BCVI populated among the four USFWS Recovery Units with an estimated 619 adult BCVI (Table 3). Four parklands have well-studied significant breeding BCVI populations: Kickapoo SNA, Lost Maples SNA, Hill Country SNA. A small (probably non-breeding) population exists at Garner SP. Kerr WMA has one of the best-studied viable populations. Walter Buck WMA is also well-documented, but is a small population closely associated with the South Llano State Park property. Surveys on the WMA properties and South Llano SP were handled by the Wildlife Division and recovery on those areas will be addressed by that division. The Southeast Edwards Plateau is the closest to meeting the USFWS recovery goals, is the best-studied, appears to be the easiest to enhance (habitat), and could possibly be managed to overcome inadequacies in population, habitat, and viability in other regions.

Kerr WMA has conducted successful and fairly efficient cowbird trapping which at a glance appears to have favorably affected BCVI production. That site will be addressed in the WMA's separate BCVI management plans. The Lost Maples SNA and Devils River SNA trapping projects were discontinued after one to two years due to predation, maintenance, and staffing problems. The effect of trapping at Lost Maples could not be determined due to lack of monitoring BCVI and GCWA reproductive successes during trapping and subsequent years. Devils River SNA cowbird trapping was discontinued as a "control" site for comparison to Kickapoo Cavern SNA. BCVI monitoring at Devils River was conducted only two years during the 5 year Kickapoo study, so information is limited.

Kickapoo Cavern appears to have the best data available for parklands: 5 years of BCVI monitoring and cowbird trapping. This study showed a decrease in the brood parasitism rate from 37 % in 1989 (Bryan and Stuart 1990) to 7 % in 1990 (Bryan and Stuart 1990). Brood parasitism was at 6.6 % for 1993 (Lockwood and Stuart 1993). This number has not dropped much apparently due to the release of some cowbirds as part of a banding project to attempt to determine the home range of a cowbird. This banding project was not as successful as hoped; bands were too difficult to read in the field (Stuart and Lockwood 1993). Fort Hood Military Reservation has also conducted cowbird removal and has seen a considerable reduction of brood parasitism over the last 7 years. In 1987, when their project began, brood parasitism was 90.8 % (Tazik et al. 1990).

Table 3. BCVI maximums for Recovery Unit II. Acreage represents total for each property..

Site Name	County	Count	Acreage
Southeast Edwards Plateau sites			
Blanco SRA	Blanco	0	104.6
Colorado Bend SP	San Saba	46	5,328.3
Devils Sinkhole SNA *	Edwards	0	1,801.7
Enchanted Rock SP	Gillespie	0	1,643.5
Garner SP	Uvalde	3	1,419.8
Government Canyon SP *	Bexar	0	4,717.3
Guadalupe River SP *	Comal	2	1,938.3
Hill Country SNA	Bandera	68	5,369.8
Honey Creek SNA	Comal	0	2,293.6
Kerr WMA	Kerr	178	6,493.0
Kerrville SRA *	Kerr	0	517.2
Kickapoo Cavern SP	Kinney/ Edwards	260	6368.4
LBJ Historic Park *	Gillespie	0	732.7
Lost Maples SP	Bandera	39	2,208.0
Pedernales Falls SP	Blanco	1	5,211.7
Walter Buck WMA/ S. Llano River SP	Kimble	22	2640.0
Total		**619**	**48,875.7**

* Values taken from Connally (1993), and do not appear in App. C.

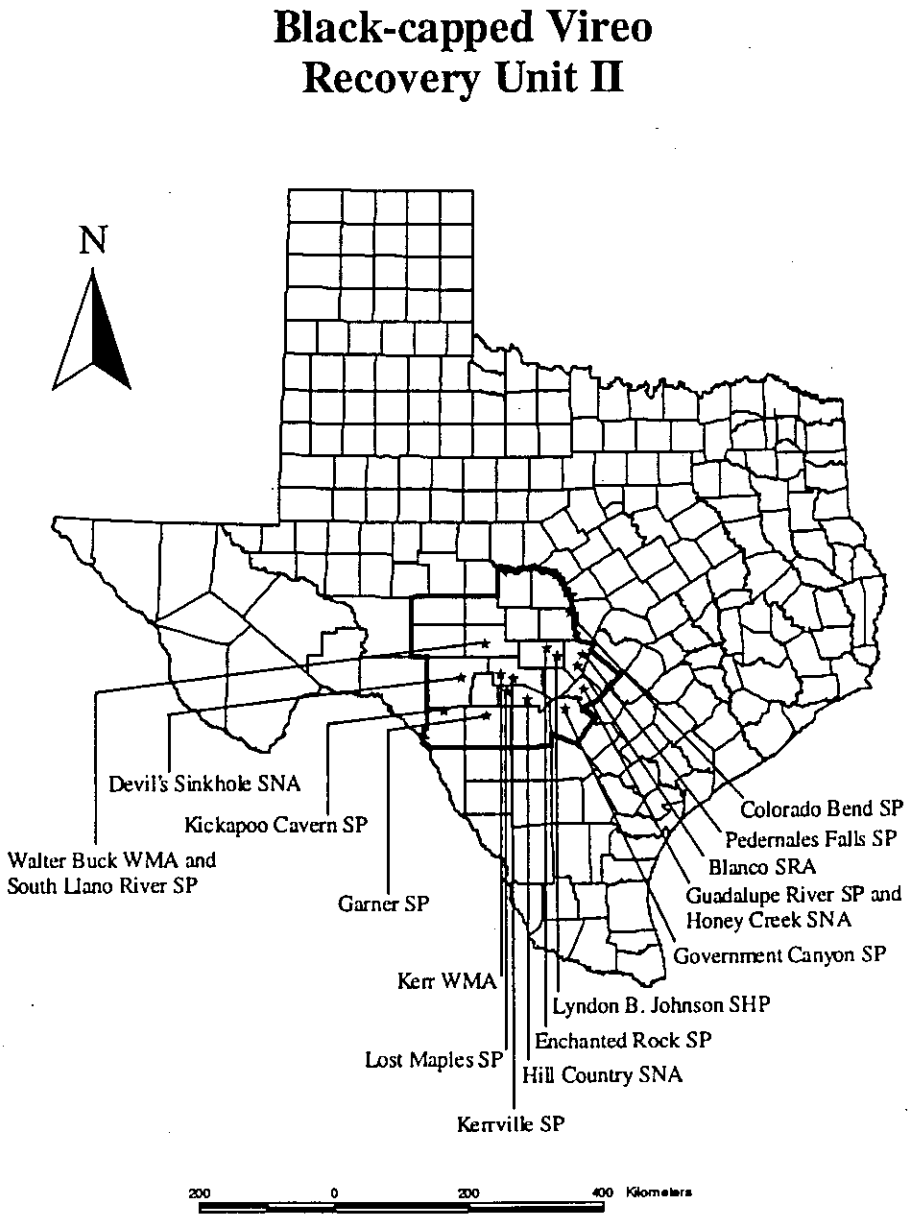

Figure 4. Recovery Unit II: Southeast Edwards Plateau

RECOVERY UNIT II

SOUTHEAST EDWARDS PLATEAU SITES

Site Specific Information

BLANCO STATE RECREATION AREA

Blanco State Recreation Area is a small park (104.6 ac) located in Blanco County south of the Blanco River within the town of Blanco. The park is located on the Blanco quad sheet (USGS no. 3098-122) and aerial photo number 2434-102 (TXDOT 1990). The elevation of the park ranges from 1300 to 1360 ft amsl from the river bank upslope.

The park is used intensively for recreation. A small vegetated area exists on the northwest side of the river. Here lies a strip of hackberry (*Celtis* sp.), mesquite (*Prosopis glandulosa*), live oak (*Quercus virginiana*), cottonwood (*Populus deltoides*), willow (*Salix* sp.), Texas persimmon (*Diospyros texana*), a few non-native ornamentals, lantana (*Lantana horrida* probably) and pecan (*Carya illinoensis*). The southeast bank of the river is also wooded, but to a much greater (and more natural) extent. This area has an overgrown footpath which does not extend the length of the property. Beyond the footpath, the park extends to just beyond the FM 1623 crossing. The vegetation along the footpath and the extension is pecan, live oak (some 30 ft high), few Texas persimmon, mulberry, and hackberry. A more complete vegetation survey was conducted in 1991 as part of the DLI.

There are records for historical sightings of BCVI near the park. Peter Scott did not cover this park in his 1991 census of TPWD public lands. In 1984, Marshall visited the park and surveyed along the river and found no suitable habitat for the BCVI (Marshall et al. 1985). Later, two singing males were observed by B. Meriweather east of Blanco on RR 2325 east of the junction with RR 165. Sexton (unpubl. data) visited the same site in 1988 and did not relocate BCVI. He suggests the habitat had been disturbed.

During the 1993 survey, BCVI nor their habitats were detected in the park. The vegetation appears to be either overgrown, isolated, or not of the proper species composition. BHCO were not noted during the survey. This park does not have enough habitat for BCVI. Not much could be done to remedy that due to the fact that so much of the tiny park is in recreational use areas.

Management Recommendations for Blanco SRA.

Further monitoring of Blanco State Park is not recommended unless a significant amount of habitat and acreage are added to the park property.

COLORADO BEND STATE PARK

Colorado Bend State Park encompasses 5263.6 ac, and is located partly in southeastern San Saba County on the east of the Colorado River, and Lampasas County on the west side of the

Colorado River. Therefore, it straddles two Recovery Units: I (Lampasas Co.) and II (San Saba Co.). Two physiographic regions, Lampasas Cut Plains and Edwards Plateau, intersect on this property. Elevation ranges from 1000 to approximately 1446 ft amsl.

The property was purchased by TPWD in two units: the Gorman Falls area in 1984, and the Lemon Fish Camp in 1987 (see Appendix F for summary of land use history). In the 1940's the area was heavily covered in mature Ashe juniper. The juniper was cut and slash-burned over the years creating a mosaic of old- and second-growth, the latter being invaded by root-sprouting species such as shin oak (*Q. sinuata* var. *breviloba*). The area was also heavily grazed prior to purchase by TPWD. Excessive numbers of deer also populate the area, which result in low availability of root-sprouting vegeation.

The area is dominated by limestone-derived soils of the Honeycutt, Gorman, and Tanyard Formations of the Ellenburger Group. These formations are associated with the Llano Uplift. Karst features are common in this area. Any habitat restoration for either species will require the approval of USFWS. Gorman Creek Canyon, side canyons, and the cliffs from Gorman Falls north to the park boundary provide habitat for BCVI and GCWA. The BCVI and GCWA habitats are close together and in some areas actually overlap. Four major edaphic habitats occur on the property, including uplands, dry canyons, mesic slopes, and river terraces. The mesic and riparian areas support an interesting diversity of woody and herbaceous plants but this area represents only a small fraction of the property. The vast majority of the park is identified as rolling uplands with shallow clay soils that once supported tall to midgrasses dominated by little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), tall dropseed (*Sporobolus asper*), and sideoats grama (*Bouteloua curtipendula*). Scattered throughout this area are plateau live oak (*Quercus fusiformis*) mottes. Soil erosion is prevalent due to cattle grazing and brush control practices. Shorter, less palatable herbacious species are now common on the uplands. Woody species of brush have invaded, including Ashe juniper and Texas Persimmon.

On the San Saba County portion of the park, BCVI have been observed singing in the upper reaches of the Gorman Creek drainage the uplands above Gorman Falls. On the Lampasas side of the park, there have been numerous recent sightings (as of 1996) of BCVI in second growth juniper/oak mottes (M. Lockwood, pers. comm.).

Management Recommendations for Colorado Bend SP.

BCVIs are restricted to areas which have previously been posted and which are now growing back in second growth vegetation. Thus, there is the potential for this habitat type to grow back to a closed canopy situation resulting in a decrease in BCVI nesting. Controlled burning, or selective brush management, would be appropriate in these areas in order to maintain and/or enhance the BCVI populations. Efforts should be made to determine whether the BCVI are replacing themselves, and to what extent cowbird parasitism may be impacting them.

DEVILS SINKHOLE STATE NATURAL AREA

Devil's Sinkhole SNA encompasses 1807.1 ac. in Edwards County east of Rocksprings, and falls within the Live Oak-Mesquite Savannah subregion of the Edwards Plateau Ecoregion.

The topographic sheet for the area is Devil's Sinkhole (USGS No. 3000-111). The majority of the topography is uplands in the northern portion whose slopes drain into the South Llano river watershed, whereas to the south there are deeply dissected slopes draining into tributaries of Hackberry Creek. Elevations range from 2321 ft. to 2060 ft amsl. The most significant geological feature is the 351 foot deep sinkhole discovered in 1867 which harbors bats, including Mexican free-tailed bats (*Tadarida brasiliensis mexicana*) and the rare ghost-faced bat (*Mormoops megalophylla*).

The Cretaceous Limestone derived soils currently support an array of disturbance-derived vegetational communities. Historical management practices including overgrazing, fire suppression and selective juniper clearing have probably been most responsible for the present vegetational representation. The uplands perhaps once supported a midgrass community consisting of Curlymesquite-Sideoats Grama associations, but now is largely taken over by weedy increasers and shrubby woody species. Some shrubbery preferred by BCVIs is available, including Texas persimmon, shin oak, and Texas mountain laurel. Evidence of extensive juniper clearing is widespread. The mesic drainages probably once supported Pinyon Pine-Oak series vegetation, but the Pinyons currently appear senescent with little evidence of reproduction.

Vegetation on the slopes is mostly deciduous/evergreen woodland or shrubland. Oaks such as Lacey oak, plateau live oak and shin oak are common. Second growth juniper is abundant. Remains (large stumps) of old juniper also are frequent in the area. Shrubs include agarito, Texas persimmon, Texas mountain laurel, brush myrtlecroton, and netleaf elbowbush.

Management Recommendations for Devil's Sinkhole SNA.

Several surveys of the avifauna at Devil's Sinkhole have not revealed the presence of BCVI. There is scant habitat available for BCVIs on the area but they may someday occur on the site as there are well-occupied sites nearby (e.g., Kickapoo Cavern State Park). No management is recommended for the natural area at this time. Report any sightings to the Natural Resources Parks Division, Resource Coordinator, and the Nongame and Rare Species specialist (Wildlife Diversity Program).

ENCHANTED ROCK STATE NATURAL AREA

Enchanted Rock State Natural Area is located in Gillespie County west of Austin and north of Fredricksburg. The park is found on two topographic sheets: Enchanted Rock and Crabapple (USGS nos. 3098-321 and 3098-234). One aerial photo covers the park (no. 2425-142, TXDOT 1990). Elevation ranges from 1340 to 1825 ft amsl.

This park contains six soil types and the granite outcrops. The granite outcrop areas include the minor peaks and the named peaks: Enchanted Rock, Little Rock, Turkey Peak, Freshman Mountain, Flag Pole, and Buzzard's Roost. Three soil types occur north and northwest of the named peaks. These include Click gravelly sandy loam (1 to 8% slopes), Keese-Rock outcrop complex (8 to 20% slopes), and a granite gravel type in the northwest corner (slope not available). The southern third of the park and the far southeast corner are also Keese-Rock outcrop complex (8 to 20% slopes). In the southwest portion surrounding Sandy Creek, the soil

is Keese-Rock outcrop complex (1 to 8% slopes). Along Sandy Creek south of the mounds and along the southwest-northwest running border (Ranch Road 965) the soil is Castell gravelly sandy loam (1 to 5% slopes). Near the entrance the soil is Ligon (undulating).

These six soil types and the outcrops are grouped into five (5) range sites. These range sites include Sandy Loam (Castell gravely sandy loam), Granite Gravel (northwest corner), Shallow Gneiss (Keese-Rock outcrop complexes), Schist (Ligon), and the Granite Outcrop (peaks). The Sandy Loam site is suited to open pastures or brushland with a mature community of grasses, scattered individual oaks, and forbs. The Granite Gravel site is also suited to open grasslands or brushland but grows to open savannah with mottes of post oak (*Quercus stellata*), live oak (*Q. fusiformis*), and blackjack oak (*Q. marilandica*). This site is susceptible to invaders like mesquite (*Prosopis glandulosa*) and juniper (*Ashe juniper*) under poor range conditions. The Shallow Gneiss areas are poorly suited for open grassland, and are best suited for brush growth. The mature community in these areas is scrub oak with few (if any?) grasses and forbs. The Schist range site is also suited for brushland with more grass than the Shallow Gneiss site. Shist range site grows toward a grassland with low shrubs and forbs. The Granite Outcrop is not suited for any range condition.

The granite outcrops, despite their negative range site rating, are sparsely vegetated. Vernal pools on the tops of the peaks, which form as the rocks weather, harbor a variety of seral stages as the pools change seasonally and over the years. Primary succession is evident in these small, fascinating ecosystems. "New" pools seem to have more water and less vegetation: few grasses, sedges around the edges, and a carpet-type moss growing along the rock/water interface. As the pools mature, dry, and become more eutrophic the moss grows thicker, grasses invade further into the pool, more soil is available, and a few cacti begin to appear. The more advanced pools are no longer pools, but merely depressions holding soil and catching seeds. These depressions contain grasses, more cacti [claret cup (*Echinocereus triglochidatus*), tasajillo (*Opuntia leptocaulis*), and prickly pear (*Opuntia* sp.)], agarita (*Berberis trifoliolata*), and shrubby live oak. The most advanced depressions have more mature shrubs and live oak trees in addition to grasses.

Near the bases of the major peaks (named peaks), the woody plants seem to grow in a band approximately between the 1500 and 1600 ft amsl contours. This community has live oak, few post oak, agarita, mesquite, cedar elm (*Ulmus crassifolia*), and cacti growing among the cracks in large boulders sloughed from the peaks. Grasses are present near the base of the vegetation band. Canopy cover varies from 70 to 50%. The least amount of canopy is found along the outlying peaks; the most cover along Echo Canyon. The community turns to savannah with scattered oak mottes and single mesquite trees in the contours below approximately 1500 ft amsl.

In the northwest quarter of the park and along the north fenceline, the vegetation resembles savannah with scattered large mottes of live oak, post oak, blackjack oak, and grasses. Mesquite and agarita seems to grow well in the mottes and the open areas. Also scattered in the open areas are prickly pear and tasajillo. Claret cup cacti seem to stick to the crevices in surrounding rocks. Closer to the north and west fencelines, more juniper is evident. Not much shrubby oak is apparent.

Along Sandy Creek, the vegetation is in recovery. When TPWD bought the property, the east side of the creek had been horse pasture. The soils (what was left of them) were severely compacted and void of vegetation. Currently, the old house (near the former horse pasture) and surrounding area has been replanted with elms in an attempt to restore the native riparian vegetation. Few grasses have been able to take root, but improvement is visible. The Loop Trail to Buzzard's Roost runs along the west side of the creek. This trail is flanked by grasses, agarita, mesquite, few oaks, tasajillo and prickly pear. The area is shaded (approximately 40 to 50% canopy cover) and is dominated by invaders.

Throughout most of the park, the vegetation is heavily modified by visitor impact. The trails appear severely compacted. The bases of the climbing areas are devoid of vegetation (i.e.,. "Cracks" area) and erosion is a serious problem. Attempts are in progress to restore the vegetation in areas where the problems are most severe. In remote parts of the park, the browse line is evident to approximately 4 ft off the ground.

There are two observations for BCVI within Gillespie County: Graber (1961) and Oberholser (1974). There is only one record for a BCVI in ERSNA. The observation was by R. A. Rowlett in 1963 and cited by Marshall and Clapp (1985). This record is not duplicated in any other literature. In 1987, Marshall et al. observed a patch of habitat west of Harper (approximately 25 miles to the southwest of the park) but did not census the habitat. Sexton et al. (1989), in his Draft BCVI Status and Distribution, noted the presence of BCVI habitat in the western portion of the county, but no record of BCVI for the park. Peter Scott covered ERSNA in his 1991 census of TPWD public lands. He did not observe any BCVI in his one day search. He observed a heavy browse line of approximately 6 ft. and stated that this contributes heavily to the lack of BCVI. In his 1988, W. Pulich, Sr. (pers. comm.), documented neither GCWA or BCVI for the area.

Management Recommendations for Enchanted Rock SP.

The lack of habitat at Enchanted Rock State Natural Area precludes BCVI. The high browse line in areas of marginally suitable vegetation for BCVI habitat excludes the possibility for BCVI in the area. The area does not appear suitable to modify for BCVI. The historical records do not indicate much BCVI affinity for the area. Any habitat management effort would probably not produce a colony. The restoration efforts should be concentrated in areas of native vegetation replanting, erosion control, and trail repair.

GARNER STATE PARK

Garner State Park (GSP) is located in Uvalde County west of San Antonio and north of Uvalde and Concan. The park is covered on two topographic sheets (Magers Crossing and Reagan Wells, USGS nos. 2999-312 and 2999-321). One aerial photograph depicts the park well: no. 2466-25 (TXDOT 1990). The elevation at the park ranges from 1390 to 1867 ft amsl.

Ten soil types are noted for GSP on a wide range of inclines ranging from floodplain to 45% slopes. Along the Frio River, three soils occur: Frio silty clay loam (frequently flooded),

Orif soils, and Bosque loam (coarse variant). The latter two types are best suited to loamy bottomland within the floodplain of the Frio River. The Orif soils have also formerly been mined for gravel in some places. On the east side of the river, the soils are also considered bottomland soils (loamy and clay) with slight slope (0 to 3%). Also across the river is a small portion of Olmos soils (undulating) which form a shallow ridge near the eastern border of the park. Most of the "flats" on both sides of the river are considered Atco loam with less than 1% slope. This area is a high lime range site generally used for rangeland. The steep hills at GSP are Rockland-Real association and Real-Eckrant soils which range from undulating to steep (up to 45% slopes). These soils are limestone derivatives. The Rockland-Real association occurs on upper slopes and the narrow caps of rock (limestone) whereas the Real-Eckrant soils form the lower slopes and valleys. Two soil types were mentioned as unsuitable for brushland wildlife: Rockland-Real (upper slopes) and Uvalde silty clay loam (east side of the river). The soil survey did not discuss potential mature community vegetation for these soil types, however a woody plants list was given in the Department Land Inventory (1989) for Garner.

The park north of the late arrival/overflow parking areas (map page 75) includes the Persimmon Hill, Live Oak, and Rio Frio campgrounds. These areas are predominantly floodplain with approximately 3% slope. The vegetation near the Persimmon Hill campground is plateau live oak (*Quercus fusiformis*)/Ashe juniper (*Juniperus ashei*) woodland with approximately 50% canopy closure. This woodland blends into fields of grasses and wildflowers occurring near the roads and Live Oak campground (the campground has a few scattered live oaks). The understory of the woodland is thin: mesquite (*Prosopis glandulosa*), persimmon (*Diospyros texana*), agarita (*Berberis trifoliolata*), tasajillo (*Opuntia leptocaulis*), and prickly pear (*Opuntia* sp.). A browse line is evident on the larger trees and shrubs to approximately 3 feet off the ground. The Rio Frio area has a mixture of grassland; oak, mesquite, and juniper; and riparian vegetation.

Most of the central portion of the park surrounding the headquarters and the overflow camping areas is open fields of grasses with few trees. The Shady Meadows campground is an open pecan (*Carya illinoensis*) grove near the base of the large hills on the property. Understory here is practically non-existent as the ground is heavily traveled by visitors. The other visitor use areas such as the Oakmont and Pecan Grove campgrounds, Dance Hall, and concessions areas are generally open (no understory) oak/juniper stands. This park is heavily used.

The remainder of the park, the southwestern quarter, is in tall steep limestone hills characteristic of the hill country. A trail runs along the old entrance road to the park. Along this trail the vegetation is predominantly Ashe juniper and live oak with a few Texas Oak. The canopy is thick here (probably 70% coverage). Agarita and a few hoptrees (*Ptelea trifoliata*) grow beneath the junipers. Another trail system (not on the park trail maps) is located between 1500 and 1600 ft amsl contours in the two canyons adjacent to the main park road. One of the trails covers the canyon between the old road trail and the second ridge south of that trail ("A" on map). This canyon is a live oak/juniper woodland with an understory of agarita, Texas mountain laurel (*Sophora secundiflora*), guajillo (*Acacia berlandieri*) , evergreen sumac (*Rhus sempervirens*), Texas persimmon, sotol (*Dasylirion texanum*), and blue salvia (*Salvia ballotaefora*). The canyon bottom had a few Texas oak (*Quercus buckleyi*). Canyon "A" also has an open cave which has been vandalized. The second canyon south ("B" on map) had

similar vegetation with fewer Texas oak on the bottom and a band of oak shinnery on the east-northeast facing, south side (noted on map as "OAK", outlined). The cliffs beyond this canyon along the Frio River are heavily trafficked and the white exposed limestone is visible from a great distance away. Very little vegetation grows here except in bands where the people cannot walk. Erosion is a problem.

The tops of the ridges in the southwestern quarter are also juniper-oak communities with less canopy closure than the thick inner canyons to the east. The southern most ridge has considerably more juniper, tighter canopy closure, and less understory than the other ridges. Most of the ridges have agarita, prickly pear, tasajillo, and oaks (which appear thinner than oaks in the canyons). These plants occur on the ridgetops then thin to Ashe juniper, grasses, sotol, and other cacti in a steep horizontal band below the top of the ridge. This band then lessens in slope(slightly) as it enters the wooded corner canyon ("C" on the map).

The southwestern corner canyon is densely wooded with Ashe juniper, few Texas and live oaks, Texas persimmon, and agarita until nearing the bottom. The canyon then thins to few Ashe juniper and oaks with little else. A dump and remains of an old home are situated near the mouth of the canyon.

The historical occurrence of BCVI at GSP is erratic. Researchers of the past have intermittently considered Garner to contain, alternately, unsuitable and suitable habitat. BCVI have been observed in the county by Graber (1961) and Rowlett (pers. comm.). Marshall et al. (1987) does not state a BCVI record for the park, but Greg Lasley has records (1985) from Neal's Lodge near Concan. Also in the Marshall report, G. Lasley and C. Sexton are mentioned to have mapped 9 territories in this location. The Draft Distribution and Status of BCVI (Sexton et al. 1989) suggested that the species sometimes occurs within the park according to a 1971 source. Upon visiting the park circa 1985, Marshall et al. found the vegetation too tall and dense for BCVI. The park is not described as habitat or an area of presence in the BCVI Recovery Plan (USFWS 1991).

The 1993 survey (Connally 1993) produced some interesting results; three BCVI were located in the steep section of the park. The BCVI were found two canyons apart on different vegetational communities. B_1 was singing quietly near the old road trail where it intersects the main park road. B_1 appeared to be an SY male. The bird did not sing much and flew to the east side of the main park road. Visual contact was lost following this move. The bird appeared to fly over the cliff area near the "scenic overlook" and into a thicket of evergreen sumac. No vocalizations were heard. After 30 minutes, the bird still had not resurfaced. No additional contact (visual or auditory) was made. The second BCVI was located in the heart of the canyon "A." This male also was not very vocal. B_2 sang one phrase and shradded once in 25 minutes. A second shrad which may or may not have been a separate bird (female, B_2, or additional BCVI male) was heard in some sumac shrubbery east of the initial contact. Visual contact was not made to accurately determine the age of the B_2. The third BCVI was detected from a distance. From the north slope of canyon "B", B_3 was heard vocalizing from the opposite slope. The slope on the south side, which faces east-northeast, has a band of oak shinnery from which this bird appeared to be vocalizing. Closer inspection revealed the bird was using the shinnery and juniper woodlands upslope of the oak. B_3 was heard fairly consistently for more than 20

minutes, but the bird was very mobile and visual contact was not made. It did not appear by behavior that any of the three BCVI located were nesting. The possibility exists that the second BCVI was mated.

BHCO were common in the fields in the northern portion of the park. Vegetational diversity in the park seems to have decreased since the time of the DLI list, even to the untrained botanist.

Management Recommendations for Garner SP.

The area as a whole is not very suitable for BCVI but there are two pockets of currently acceptable habitat on the park: the scenic overlook brush and the band of shinnery on the southern cliff areas. The scenic overlook probably maintains itself with the incline too steep to allow trees to hold. This area naturally encourages shrubby thickets with an open understory. However, the shinnery along the south cliffs is not on such a steep incline and is threatened by encroaching juniper. Also, the Persimmon Hill campground area is not currently suitable for BCVI but seems to have species and structure similar to habitat on Kickapoo Cavern State Natural Area.

Habitat improvement for the BCVI should be implemented based on the possibility of increasing the population in this park. For example, browsing should be significantly reduced in the Persimmon Hill area, and the over-encroachment of juniper should be controlled. Perhaps visitors could be limited in areas near the southern cliffs and the Persimmon Hill campground during the BCVI nesting season.

GOVERNMENT CANYON STATE PARK

Government Canyon SP (4,717.3 ac.) is a newly acquired tract of land in Bexar County just northwest of San Antonio and west of Helotes. A cursory glance was taken of the park one day to examine the *possibility* of BCVI or GCWA on this piece of property.

This property (map page 112) is cut approximately east-southeast to west-northwest by the Balcones Fault (Tracor 1972). The two-thirds of the property north of the fault is the "canyonland." Government Canyon, Wildcat Canyon, and the associated tributary canyons comprise a canyon system with exposed limestone steep rocky cliffs, moist overhang/shelter caves, and at least one known spring. One historic building in fair repair remains up Government Canyon.

South of the fault, the ground is level to gently rolling, sloping southward. These "flatlands" were used for grazing while the land was in private holding and a portion of these lands are still used for that purpose until a caretaker is hired by TPWD. None of the vegetation on the park seems to be in naturally mature communities except maybe that of the steepest slopes, cliffs, and overhangs.

The plant communities of this tract are representative of the Edwards Plateau and

Blackland Prairies. The Edwards Plateau influence seems to diminish south of the fault line. South of the fault line the community is highly disturbed. These "flats" were used for grazing and all of the "native" vegetation seems to have been eliminated (possibly cleared). This area should represent a true prairie, but instead has been invaded by thickets of whitebrush (*Aloysia gratissima*), mesquite (*Prosopis glandulosa*), condalia (*Condalia spathulata*), agarita (*Berberis trifoliolata*), horehound (*Marribium vulgare*), nightshade (*Solanum eleagnifolia*), prickly pear (*Opuntia* sp.), tasajillo (*Opuntia leptocaulis*), and thistles (*Circium texana*). A few small juniper (*Juniperus ashei*) and live oaks (*Quercus virginiana*) are present in the thickets near the edge of the canyonlands and along the roads.

Of the canyons, only Government Canyon was surveyed during this visit. Wildcat Canyon and accessory canyons were seen only from a distance. These areas seem to conform more to the "Hill Country" vegetation. The ridge tops appear to be dominated by Ashe juniper and oaks, while the botttoms of the canyons and slopes appear more diverse. Government Canyon (near the dry creek bed and slopes) included such species as hackberry (*Celtis* sp.), live oak (*Quercus fusiformis*), cedar elm (*Ulmus crassifolia*), little walnut (*Juglans microcarpa*), Texas persimmon (*Diospyros texana*), Ashe juniper, agarita, Texas mountain laurel (*Sophora secundiflora*), flameleaf sumac (*Rhus lanceolata*), and Texas oak (*Quercus buckleyi*). Bill Carr and John Williams pointed out boneset (*Eupatorium havanense*) and beargrass (*Nolina texana*). Bill Carr, TPWD Botanist, has compiled an extensive list of plants for Government Canyon (DLI for 1993). David Riskind (Tracor, 1972) collaborated on a report including vegetation community observations prior to the departmental purchase.

Bexar County is known to have BCVI in a few locations (i.e.,. Friedrich Park off of IH-10 and Camp Bullis off of Blanco Road). These locations are approximately 10 to 15 miles from Government Canyon and could possibly feed the area with dispersing juveniles or young adults. The property is not known to have BCVI. This year's survey was too brief to determine with high confidence whether or not the target birds exist on the park. The flats appeared to have potential for shrubby BCVI-type habitat whereas the juniper clad, diverse ravines looked like suitable habitat for GCWA.

Management Recommendations for Government Canyon SP.

This park should be more thoroughly surveyed for BCVI. Future park staff should be made aware of the potential presence of endangered birds on the property and should report all sightings the Nongame and Rare Species specialist (Wildlife Diversity Program), the Regional Resource Specialist and the Natural Resource Program..

GUADALUPE RIVER STATE PARK AND HONEY CREEK STATE NATURAL AREA

Guadalupe River State Park

Guadalupe River State Park (GRSP), comprising 1938.3 ac., is located in Comal County off of Hwy 46 northwest of San Antonio, and lies directly adjacent to Honey Creek State Natural Area. The park is located on three topographic sheets: Anhalt, Bergheim, and Spring Branch

(USGS nos. 2998-432, 2998-341, 2998-433). One aerial photograph from TXDOT (1990), no. 2434-95, depicts the park and a portion of the Honey Creek SNA. Elevation on the site ranges from 1020 to 1300 ft amsl.

Seven range sites are found at GRSP. Loamy Bottomlands are located near the river in the riparian zone. These soils generally tend toward savannah comprised mostly of oaks, pecan (*Carya illinoensis*), hackberry (*Celtis* sp.), elm (*Ulmus* sp.), cottonwood (*Populus* sp.), and sycamore (*Platanus occidentalis*). Portions of the lands upslope from the riparian zone are also considered Loamy Bottomland and Adobe range sites. The Adobe generally forms dense thickets of juniper or "brakes" if not controlled. Uplands on the park fall within two range sites on fairly level to rolling land: Gravelly Redland and Shallow. The Gravelly Redland tends toward open savannah of 90% grasses and 5% woody species predominately post oak (*Quercus stellata*)/blackjack oak (*Quercus marilandica*) in mottes. The Shallow site is similar but tends to a more even distribution of grasses and woody species. The two final range sites occur on steep uplands called Low Stony Hills and Steep Rocky range. The "peaks" at 1200 ft amsl, and at 1300 ft amsl conform to these range types. They tend toward live oak (*Quercus fusiformis*) savannah or live oak/Texas oak (*Quercus buckleyi*) savannah under optimal, natural conditions. A complete vegetation survey was conducted in 1989 and is listed in the DLI.

The plant communities of the park seem to be recovering from disturbance in some areas and tending toward natural mature community in others. The portion of the park north of the river is an Ashe juniper/oak woodland with edges and understory of Texas persimmon (*Diospyros texana*), agarita (*Berberis trifoliolata*), and prickly pear (*Opuntia* sp.). Two clearings exist on that side of the river: one near the northeastern edge and another near the cliffs on the river. Goats were located on this part of the park, presumably escaped from a neighboring ranch (it is not known if these are "permanent" residents or were soon returned to their owner). This area seemed to be dominated by disturbance vegetation.

Moving south of the river and into visitor use areas, the vegetation seems to be predominately Ashe juniper and oaks, with some riparian vegetation remaining where not trampled. Bald cypress (*Taxodia distichum*), cedar elm (*Ulmus crassifolia*), and sycamore are present in some areas along the river. Upland from the riparian and into less used areas of the park, the vegetation tends toward live oak, cedar elm, and Ashe juniper spread about in mottes and as individuals. An occasional agarita, Texas persimmon, or flameleaf sumac (*Rhus lanceolata*) is present in the mottes. The canopy cover is approximately 70%.

The area northwest of the headquarters, on the 1300 ft peak, and the 1200 ft peak nearer the river appear thicker in Ashe juniper than the rest of the park. Not much understory is present in the thick of the canopy (cover approximately 90%). East and southeast of the headquarters, the park personnel have cleared much of the oak and juniper to make a more open mosaic with 50% canopy cover.

The large ravine system which is located in the center of the park and feeds Honey Creek above Beek Springs is the most diverse portion of GRSP. This ravine is steep and rocky with large drop-offs formed by porous limestone boulders. Maidenhair and other fern varieties, *Salvia roemeriana*, and many varieties of mosses and fungi grow from the moist crevices in the rocks. Woody species in the ravine include cedar elm, hackberry, few Texas persimmon, Texas oak,

Durand oak (*Quercus durandii*), yaupon (*Ilex vomitoria*), rough-leafed dogwood (*Cornus drummondii*), agarita, and live oak. The vegetation becomes more lush as it descends toward Honey Creek.

Historically, records for BCVI in the county have been numerous, but there are few for the park. The Draft Distribution and Status of the BCVI (Sexton et al. 1989) states that the first BCVI nest and eggs known to science were collected on the Guadalupe River 23 mi. NW of New Braunfels in 1878! This report also states that extensive historic records for the county exist prior to the inception of the park, but there are no records on the park land. Both Graber (1961) and Oberholser (1974) have record of BCVI in the county. Recent documentation shows a significant decline in the county population overall. Sexton says the last known record is for one singing male between TX 32 and Canyon Lake in 1981 by B. O'Connor (unpubl. data). Marshall (1985) omitted GRSP from his search efforts because the park appeared to be surrounded by open farm land. An editorial comment (author unk.) in the margin of that report states the possibility for BCVI habitat in the northern portion of the park (across the river?). Peter Scott did not cover this park in his 1991 census of TPWD public lands.

The south side of the river seems to have outgrown its usefulness to BCVI as most of the "shrubs" do not provide sufficient foliage between 0 and 3 meters. It has been more than 12 years since the last BCVI was sighted at GRSP. BHCO were prevalent in most of the upland areas.

Management Recommendations for Guadalupe River SP.

This park probably has little to no potential for BCVI habitat improvement. However, the areas which were recently cleared east and southeast of the headquarters should be watched as the shrubbery regrowth begins. If the structure and species composition are similar to other known BCVI-inhabited areas, the potential exists for BCVI to move into the park area again.

Honey Creek State Natural Area

Honey Creek State Natural Area (HCrSNA) comprises 2293.7 ac., and is located in Comal County adjacent to and south of Guadalupe River State Park. Access to the property is only through GRSP or by gate off of Spring Branch Road (near Hwy 46). One topographic sheet covers the area: Anhalt (USGS no. 2998-432). The aerial photo no. 2434-93 from TXDOT (1990) depicts HCrSNA. The elevation here is 1020 to 1320 ft amsl.

Honey Creek SNA is variable in terrain from gently sloping uplands to steep ravines and holds 8 range sites. The creek (Honey Creek and its tributary ravines) and the riparian zone of the Guadalupe River are in Eckrant soils which occur as part of the Steep Rocky range site. This site in combination with a riparian environment, in an undisturbed natural setting, would grow toward riparian vegetation such as bald cypress (*Taxodia distichum*), cedar elm (*Ulmus crassifolia*), and pecan (*Carya illinoensis*). Without the riparian component (i.e.,. the ravines drier than the mainstream of the creek and river) this site produces a Texas oak (*Quercus buckleyi*) and live oak (*Q. fusiformis*) savannah. The uplands of HCrSNA would produce open

savannahs of post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), and live oak interspersed with tall grasses and true prairies on Steep Adobe, Shallow Range, Low Stony Hills, Gravely Redland, and Clay Loam range sites. These range sites are well-scattered throughout the gently sloping uplands of the natural area.

The vegetation communities can be described as associated with the uplands or the ravine systems in the park. The uplands from Spring Branch Road, including the old house and surrounding fields, and northeast from the house toward the 1203 ft amsl "peak" are oak/juniper savannah. The area is recovering from grazing pressures and shows evidence of invasive vegetation such as Ashe juniper (*Juniperus ashei*), Texas persimmon (*Diospyros texana*), agarita (*Berberis trifoliolata*), prickly pear (*Opuntia* sp.), and tasajillo (*Opuntia leptocaulis*) under and in addition to a live oak/Durand oak canopy. Cover on the uplands does not generally exceed 80% and in some places is less than 30% (cleared fields).

The ravine systems can be divided into those which have ephemeral or permanent water. The ephemeral ravines such as the large ravine system in the south end of the park and the moderate ravine system west of peak 1203 have water which collects in pools, but do not seem to have any "internal" source. These ravines are diverse by comparison to the uplands and are steep from head to mouth. They generally descend toward Honey Creek through a maze of large porous limestone boulders and steep soil banks. The rock crevices near pools harbor a variety of tiny ferns and mosses, a few noticeable fungi, and some relatively larger flowering plants like *Salvia roemeriana*. Surrounding and within the ravines, the canopy provides a cool shade with plenty of walking space beneath. The canopy species include cedar elm, live oak, Ashe juniper, post oak, few blackjack oak, Durand oak, Texas persimmon (taller and thinner than on the uplands), a few agarita bushes, and rough-leafed dogwood (*Cornus drummondii*). As the ephemeral ravines reach the permanent water ravine (Honey Creek Canyon), the diversity increases to include huge bald cypress (some 5 ft in diameter), sycamore (*Platanus occidentalis*), walnut (*Juglans* sp.), soapberry (*Sapindus drummondii*), pecan, and hackberry (*Celtis laevigata* and *C. reticulata*). The ground vegetation is more lush and includes palmettos (*Sabal* sp.), more moss varieties, and water plants such as hyacinth and lilies (water's edge and in the water). Springs line the waterway and gush clear water into the creek. Unfortunately, this ecosystem is in extreme jeopardy due to the extensive hog damage: rooting and digging has destroyed many palmettos and other sensitive vegetation and lowers the water quality in numerous creekside springs. The Honey Creek ravine runs to the Guadalupe River where the diversity decreases along the edges of the mouth: no palmettos, fewer mosses and small plants, more large trees and ferns.

Records for BCVI in the county have been numerous, but little is known about the actual area where Honey Creek SNA actually sits. The Draft Distribution and Status of the BCVI (Sexton et al. 1989) states that the first BCVI nest and eggs known to science were collected on the Guadalupe River 23 mi. NW of New Braunfels in 1878! This report also states that extensive historic records for the county exist prior to the inception of the park, but there are no records on the park land. Both Graber (1961) and Oberholser (1974) have record of BCVI in the county. Recent documentation shows a significant decline in the county population overall. Sexton says the last known county BCVI record is for one singing male between TX 32 and Canyon Lake in 1981 by B. O'Connor (unpubl. data).

This park does not have a history for BCVI as the area was acquired for "public use" only within the last 13 years. Not much could be located about observations of either species on the property prior to TPWD acquisition.

Few BHCO were noted on this survey and only on the uplands. Not much notice was made on additional bird species as the vegetation and intensity of search for BCVI precluded "birding."

Management Recommendations for Honey Creek SP.

This area, while unique and extremely lush for the central Texas "Hill Country", does not seem to harbor a population of BCVI. BCVI nesting substrate of acceptable structure and composition is not available here. Most of the vegetation is overgrown for BCVI.

Some manipulation of the uplands to increase shrubby clumps of vegetation could increase habitat for BCVI; however, this may not be wise since BCVI have not been known in the area for a number of years. Honey Creek should continue to be monitored for BCVI.

HILL COUNTRY STATE NATURAL AREA

Hill Country State Natural Area (HCSNA) is a large tract (5369 ac.) of land situated in Bandera and Medina counties on the Edwards Plateau. Two topographical sheets, Twin Hollow (USGS no.2999-412) and Tarpley Pass (USGS no.2999-413) cover the area. An aerial photo was not obtained for this area. The elevation ranges from approximately 1380 along Bandera creek in the south portion of the park to 2000 ft amsl near the northwestern corner.

Soil information was obtained from a Departmental Plant Survey (DLI, August 1990 update to an October 1989 report). The park is practically bisected by an east-west fault with uplift occurring north of that "line." The soils of the uplands (north of the fault) are shallow to very shallow, generally calcareous, and well-drained. They overlay Cretaceous limestones, dolomites, and marls. On top or near the top of most of the steep slopes and hills of the uplift area, Edwards Limestone is exposed. South of the fault, the soils of the bottomlands, along terraces, and near the foothills are deep to moderately deep, calcareous, and well-drained.

The park is generally divided into four historic mature community communities: uplands and ridges, wide deep valleys, floodplains associated with West Verde Creek, and slopes. The ridges, uplands, and deep valleys actually have similar mature community species compositions included in a Plateau Live Oak/Midgrass Series. The difference between the two communities is generally that the ridges and uplands have a less open expression of the woody plant/grass mixture. The deep valleys also would have a greater percentage of tall grasses in well-watered open areas. The floodplains of the creek usually would be expected to grow toward a Sugarberry-Elm Series, a deciduous forest community with a diverse understory of smaller trees, shrubs, and forbs. The final community, the slopes, are of two varieties: drier southern slopes and more moist areas of the north slopes and deep steep ravines. The southern slopes tend toward an Ashe juniper/Oak Series woodland while the northern slopes and ravines grow toward

a Texas Oak deciduous woodland. The degree of moisture is subjective as the slopes are generally rockier and drier than the other main communities mentioned.

Prior land use has played a major role in affecting how the plant communities have actually grown. Sparkman (1996) details the land use history of HCSNA and describes extensive use of clearing and heavy grazing. The ridges and broad deep valleys were affected mostly in a reduction of tall grasses, a change in species composition of midgrasses, and an increase in woody species (such as juniper). The rich floodplain community is deeply affected by heavy clearing which wiped out nearly all of the forest zones. Now, a few tall trees remain among pastures and fields which have been invaded heavily by woody plants and "weeds." The slopes were least damaged by any manipulation for ranching purposes. However, they did not remain completely untouched. These areas by their nature (slope) are less accessible to cattle grazing and clearing practices. Currently, the vegetation is dominated by disturbance-type communities. All of the park was affected, some parts to a lesser degree, by the land use practices while the land was ranched.

Most of the upper steep slopes and ridges are now in a plateau live oak/Ashe juniper community, displayed as a semi-open mosaic of mottes interspersed with small patches of grasses (predominately invader grasses and King Ranch bluestem seeded while the ranch was in operation). The understory and shrubs found in open spaces in this community are Texas persimmon (*Diospyros texana*), agarita (*Berberis trifoliolata*), shin oak (*Quercus sinuata* var. *breviloba*), and Texas mountain laurel (*Sophora secundiflora*). Moving downslope into the mesic ravines, additional species were observed: Texas oak (*Quercus buckleyi*), Escarpment black cherry (*Prunus serotina*), Texas redbud (*Cercis canadensis*), little walnut (*Juglans microcarpa*), evergreen sumac (*Rhus virens*), buckeye (*Aesculus pavia* var. *flavescens*), and poison ivy (*Rhus toxicodendron*). The drier slopes and ravines were dominated by juniper in contiguous cover with little if any ground cover (mostly exposed limestone fragment slopes). Occasionally on the drier slopes leading into southerly draining ravines also contained flameleaf sumac (*Rhus lanceolata*), catclaw mimosa (*Mimosa biuncifera*), Texas madrone (*Arbutus xalapensis*), lacey oak (*Quercus glaucoides*), bluesage (*Salvia ballotaeflora*), and elbowbush (*Forestiera pubescens*).

The lowlands associated with West Verde Creek are mostly open fields with intermittent live oak-dominated mottes. Small pecan (*Carya illinoensis*), cedar elm (*Ulmus crassifolia*), agarita, American beautyberry (*Callicarpa americana*), evergreen sumac, fragrant sumac (*Rhus aromatica*), and elbowbush were also present within the mottes generally below oak canopy.

Nine additional areas were described by Sparkman out of the general vegetation descriptions as being potentially suitable, but unoccupied, BCVI habitat. The map on page 80 delineates the specific "search areas" and identifies the potential habitat areas. Search area 2 contains potential BCVI habitat in a belt of shrubbery approximately 20 to 40 m wide on the upper slopes of canyon headers. Search area 4 contained a structurally similar patch of habitat: a band of shrubs 10 to 20 m wide which encircled the canyon on the upper slopes. Potential habitat located in search area 6 was described as a woodland covered hilltop including lower wooded slopes with openings in the canopy created by larger fallen trees. Search area 8 contains potential habitat along the south-facing slope with shrub height of 4 to 8 ft with 10 to 15 ft between clumps of shrubbery. Potential habitat for search areas 9 and 10 (grouped) is described

to be more gently rolling hills with large clumps beneath oak mottes spaced approximately 10 to 15 ft apart. Search area 12 contained similar potential habitat as described for the previous region. The final patches of potential habitat occur in search areas 13, 15, and 16. These areas contains shrubbery beneath individual oaks and oak mottes, with developing shrubby growth in the open spaces between mottes.

Historically, BCVI have been noted in the county. Both Graber (1961) and Oberholser (1974) record observations of BCVI in the county. Marshall et al. (1987) states records of BCVI in Lost Maples SNA. On an interesting note, that same report states that the surveyors did not find evidence of a single BCVI at HCSNA. The Draft Distribution and Status of BCVI (Sexton et al. 1989) noted one or a few vireos in the park as per the Nongame and Rare Species (Wildlife Diversity Program) records. In 1991, a mere two years later, Peter Scott partially covered this park in his census of TPWD public lands. He located 16 BCVI territories.

In 1992, Lori Sparkman located 28 BCVI territories. Out of the 28 males located, 13 were confirmed mated. One nest was located for one territory. Five BCVI fledglings were located for four territories. One BHCO fledgling was located for an additional territory. At least 5 territories were nesting and producing young.

A 1993 survey located 43 males, of which 36 held identifiable territories. Twenty-one territories were in nearly the same locations as 1992 territories; 6 territories (nos. 4, 8, 9, 11, 12, and 13) from 1992 remained unoccupied. Fifteen new territories were placed on the map. Four individuals (nos. 25, 33, 37, 38) were not observed more than once and were not included in the final territory count. Boundaries for three males (41, 42, 43) were not observed and therefore not included in the territory record. Twenty-six of the 43 males were mated. Fourteen were known to produce young (19 BCVI and 2 BHCO). Four nests were located. The map on page 80 details the territories located, males without delineated territories, locations of females, and approximate boundaries of search areas.

Management Recommendations for Hill Country SNA.

This park has an established and probably growing population of BCVI. The vegetation, as it recovers from the clearing and grazing pressures of the past, has grown into ideal BCVI habitat (shrubby in habit, 0 to 4 m height coverage, mottes with open spaces). The slopes and drier ravines seem suited to BCVI potential habitat as they grow toward (but before they reach) a vegetationally mature community. The oak/juniper-clad ravines do not seem to allow much capability for BCVI; as the ground recovers, the potential exists for an expanding GCWA population. This park should remain a place of protection for BCVI and GCWA as it is a large tract of suitable habitat for both species with great potential to remain so.

Habitat improvement for BCVI could involve selective thinning of the larger canopy cover (but not total removal) on densely wooded ridges and south slopes to allow for increased shrubby growth.

The currently shrubby growth should be monitored for signs of outgrowing its usefulness for BCVI. Action should be taken to delay the shrubbery in its current seral stage on a rotating basis so that not all habitat is "under construction" at the same time.

In areas where GCWA are known, no juniper clearing should occur. Any exception to that may include trail maintenance and juniper removal of trees approximately 6 inches in diameter. Juniper could be thinned in thick contiguous areas to allow for oaks and other large canopy species which are associated with prime GCWA habitat.

KERRVILLE-SCHREINER STATE PARK

Kerrville-Schreiner State Park occupies 517.2 ac. in southeastern Kerr County in the Edwards Plateau Ecoregion. It is mapped on three topographic sheets: Kerrville (USGS No. 3099-112), Fall Creek (USGS No. 2999-443), and Legion (USGS No. 3099-111). Much of the property lies along the southwest bank of the Guadalupe River. Elevation ranges from 1580 ft. to 1840 ft amsl.. Cretaceous limestone-derived soils are found on the slopes and uplands, whereas Quaternary age deposits are found along the river terraces.

The area has a long history of intensive livestock grazing and recreational use, intense drought cycles, and severe outbreaks of Live Oak wilt. As a result vegetational communities depart from the "expected" by a notable margin. For example, the uplands are now thoroughly covered in Ashe juniper-Oak series woodland community.

The gentler lower slopes once supported a plateau live oak-midgrass series woodland but now tend more toward an Ashe-juniper-plateau live oak community, probably as a result of overgrazing and drought. In many areas woody understory is sparse (below 50%) with juniper saplings, some yucca (*Yucca rupicola*) and prickly pear (*Opuntia lindheimeri*) dominating. As such this habitat is not suitable to BCVI.

Management Recommendations for Kerrville-Schreiner SP.

BCVI are recorded as rare breeders on the state park checklist of birds. However, no records exist in the Texas Biological Conservation Datasystem (Nongame and Rare Species (Wildlife Diversity Program), TPWD) and several surveys over the years have not revealed the presence of BCVI on the property. The slope habitat, if properly restored to the historical plateau live oak-midgrass series woodland, may eventually attract BCVIs since there are documented records for this species within 2 miles of the park. Report any sightings to the Natural Resources Parks Division, Resource Coordinator, and the Nongame and Rare Species specialist (Wildlife Diversity Program).

KICKAPOO CAVERN STATE PARK

Kickapoo Cavern SP encompasses 6368 ac. of land purchased in 1986 from the Seargeant family who had the property since 1870 (see Appendix F for summary of land use history). Topographic sheets for the area include Kickapoo Cavern (USGS No. 2900-422), and Wiley Waterhole (USGS No. 2900-423). The property has a long history of sheep and goat grazing. Deer hunting also supplemented the landowner's income. At the time of purchase by TPWD there were approximately 2,000 head of sheep and goats grazing the site. Large parts of the property had reportedly been cabled, chained, and later hydro-axed. Extensive (98% of cedar

posts in 1941) cedar-chopping was also carried out on the property, but the owner states that cedar-choppers did not clear the native pinyon pine (*Pinus cembroides*). Efforts were made to spare live oak mottes from cutting over the years. Few if any natural fires were known for the property, and no controlled burning was attempted.

Vegetation cover types, by association, are as follows (Lockwood and Riskind, unpubl. data): (1) pinyon pine - plateau live oak (*Q. fusiformis*) woodland, 230 ac.; (2) guajillo (*Acacia berlandieri*) shrubland, 380 ac.; (3) plateau live oak - midgrass, 375 ac. woodland; (4) cenizo (*Leucophylum fructescens*) shrubland, 12 ac.; (4) Ashe juniper - plateau live oak woodland, 450 ac.; (5) Curley mesquite (*Hilaria belangeri*) - side oats grama (*Bouteloua curtipendula*) mid-grassland, 280 ac.; (6) netleaf hackberry (*Celtis reticulata*) - little walnut (*Juglans microcarpa*) deciduous woodland, 20 ac.; (7) herbaceous - native/non-native old field, 80 ac.; (8) woody herbaceous - native/non-native deciduous shrubland, 4516 ac.; (9) developed areas, 25 ac.

In 1990, 1991, 1992, and 1993 an effort was made to characterize the nest site habitat for BCVI. The preferred shrub species used as nest substrate was Texas persimmon, plant canopy above the nest was predominately the same species, but also some plateau live oak. Nest height averaged 0.94 m, and canopy height averaged 3.76 m above the nest.

Kickapoo Cavern SP contains one of the largest populations of BCVI among all properties owned by TPWD. Therefore, this is a significant site for recovery efforts. Five continuous years of data were collected regarding population numbers, productivity, and brood parastism rates. No other TPWD property has received this much attention for BCVI research. Following is a table summarizing the five years worth of productivity data.

Table 4. Productivity data for BCVI at Kickapoo Cavern SP: 1989-1993.

Activity	1989	1990	1991	1992	1993
1. Estimated number of pair	90	--	--	--	--
2. Territories mapped	58	80	89	118	138
3. Nest attempts monitored	37	89	94	135	158
4. Nests found	31	71	73	81	122
5. Nests fledging at least 1 BCVI	14	47	68	90	67
6. Nests fledging at least 1 BHCO	3	0	0	2	1
7. Nests lost to predation	14	16	13	29	72
8. Nests abandoned	6	3	10	11	16
9. Nests destroyed					
by hail	1	--	--	--	--
unknown	2	8	2	3	2
10. Number fledgling BCVI	32	157	217	311	229
11. Nest success (%); line 5 divided by line 3	0.38	0.53	0.72	0.67	0.42
12. Fecundity (ave. fledglings per nest); line 10 divided by line 3	0.86	1.76	2.31	2.28	1.45

Both measures of productivity, nest success and fecundity increased dramatically from 1989 to 1990 and remained higher throughout the study. This increase may have been due in part to concerted efforts to trap Brown-headed Cowbirds at the park. Brown-headed Cowbirds were trapped in 1990, 1991 and 1993. In 1993, USFWS aluminum leg bands and color bands were applied to approximately half the captured cowbirds in an attempt to monitor movement. This proved rather unsuccessful as observations of marked birds in the field were few and the birds that were sighted were found less than a mile from the capture site. Observation of the banded birds was seriously limited by the ability to actually see the bands and read the combinations in the field. Several other means of marking the birds were attempted without success. Table 5 displays the results of the cowbird trapping efforts.

Table 5. Brown-headed Cowbird trapping efforts at Kickapoo Cavern SP: 1990, 1991, 1993.

Activity	1990	1991	1993
BHCO males trapped	137	169	56
BHCO females trapped	88	90	57
BHCO immatures trapped	20	20	0
Total trapped	245	279	208
Number removed	236	269	approx. 100
Number escaped	9	10	approx. 100 banded and released
Number eliminated prior to trapping	37	0	101(lost to predators; six were banded)
Total eliminated	273	269	ca. 201

Management Recommendations for Kickapoo Cavern SP.

The question whether active or passive management is necessary as Kickapoo Cavern SP remains open. Clearly, the habitat, in its present state, supports a large population of BCVI. Of the vegetation associations which naturally occur on the area, two stand out as prime BCVI habitat: plateau live oak - midgrass, and guajillo. These areas have experienced some regrowth since the property was purchased and contain a broad assortment of woody shrubs (e.g., Texas persimmon) which are favored by nesting BCVI. In areas which might lose some understory, or gain more Ashe junipers, as a natural part of succession, controlled burning might prove beneficial. Selective brush management might also assist in managing this habitat. BCVI populations should continue to be monitored yearly to determine the extent of space use, productivity and parasitism rates. Since cowbird trapping has ceased on the area it would be interesting to note whether BCVI productivity has dropped below 1990 levels.

Lyndon Baines Johnson State Historical Park

Lyndon B. Johnson SHP covers 732.7 ac. in Gillespie County between Hye and Stonewall with US Hwy 290 bordering the property to the south and the Pedernales on the north. Topographic sheets for the are include Hye (USGS No. 3098-214), and Stonewall (USGS No. 3098-213). The landscape is predominately river bottom with a few gentle slopes along the margins of the property. Characteristic woody vegetation of the river terrace community includes Ashe juniper, cedar elm, honey mesquite, pecan, hackberry (Celtis sp.), and sycamore. Slopes harbor several woody species including honey mesquite, Ashe juniper, catclaw mimosa, black walnut (Juglans nigra), and willow (Salix sp.).

The property is largely developed and vegetational communities are somewhat disturbed. However, no BCVI have been recorded for the park and none are likely to be.

Management Recommendations for LBJ SHP.

No recommendations are suggested here due to the small size of the property and lack of suitable habitat. Report any sightings to the Natural Resources Parks Division, Resource Coordinator, and the Nongame and Rare Species specialist (Wildlife Diversity Program).

LOST MAPLES STATE PARK

Lost Maples State Park comprises 2,208 ac. of land along the Sabinal River and its watershed in the northwest corner of Bandera County. The topographic sheet for the area is Sabinal Canyon (USGS No. 2999-341). The property features a combination of rugged limestone canyons and steep slopes with scattered drainages and seeps. The park was purchased as two units (see Appendix F for further land use history information). The back portion was an exotic game ranch purchased in 1973, whereas the front portion operated as a goat ranch and was purchased in 1974. The range conditions show strong evidence of overgrazing.

The native flora is diverse and interesting. Generally, upland plateaus are grasslands dominated by Texas wintergrass (*Stipa leucotricha*), tall dropseed (*Sporobolus asper* var. *asper*), purple threeawn (*Aristida purpurea*), and Texas grama (*Bouteloua rigidiseta*). Scattered shrubs such as mountain laurel (*Sophora secundiflora*), shin oak (Q. sinuata var. breviloba) and Texas persimmon (*Diospyros texana*) are scattered throughout. Trees in the uplands and on upper slopes include Ashe juniper, Lacey oak (*Q. glaucoides*), Texas madrone (*Arbutus xalapensis*), and plateau live oak.

The slopes harbor forested areas with Lacey oak, plateau live oak, Texas red oak (*Q. texana*), and Arizona walnut (*J. macrocarpa*). The understory on the slopes is characterized by several shrub species, including Texas persimmon, mountain laurel, Mexican buckeye (*Ugnadia speciosa*), Texas redbud (*Cercis canadensis* var. *texensis*), elbowbush (*Forestiera pubescens*), southern blackhaw (*Viburnum rufidulum*) and red buckeye (*Aesculus pavia* var. *flavescens*). Browsing pressure and human disturbance create erosion problems on these slopes which result in low herbaceous cover in several places.

Bottomlands and stream terraces contain the greatest plant diversity with hardwoods such as Chinquapin oak (*Q. muehlenbergii*), Shumard oak (*Q. shumardii*),Texas ash (*Fraxinus texensis*), Florida basswood (*Tilia floridana*), and little walnut (*Juglans microcarpa*). The main attraction to the park is its spectacular disjunct stand of bigtooth maples (*Acer grandidentatum*) which grow mainly in the drainages of the Sabinal River and Can Creek. Other endemic, rare, threatened and/or endangered biota find refuge within the park boundaries.

Both the upland plateaus and bottomlands have, at some point in the past, undergone clearing for livestock and/or exotic game browsing and grazing. As many as 23 BCVI territories have been recorded mainly on the south-facing slopes which are dominated by more xeric flora than the north-facing slopes. In 1990 a study was undertaken to parallel similar studies at Kickapoo Cavern SP and Devils River SNA in which (1) preferred nesting habitat was

qualitatively characterized, and (2) productivity was assessed (Table 6). However, this study lasted only one year at this park. Results from the habitat study showed that the preferred nesting shrub was Texas mountain laurel and that Ashe juniper was the most common woody species in the canopy above the nest. Nest height averaged 1.11 m, and average canopy height measured 4.93 m.

Table 6. Productivity data for BCVI at Lost Maples SP: 1990.

Activity	**1990**
1. Estimated number of pair	--
2. Territories mapped	18
3. Nest attempts monitored	17
4. Nests found	8
5. Nests fledging ≥ 1 BCVI	14
6. Nests fledging greater than 1 BHCO	0
7. Nests lost to predation	2
8. Nests abandoned	0
9. Nests destroyed	
by hail	
unknown	1
10. Number fledgling BCVI	30
11. Nest success (%); line 5 divided by line 3	0.82
12. Fecundity (ave. fledglings per nest); line 10 divided by line 3	1.76

Management Recommendations for Lost Maples SP.

The vegetational structure in a few areas on the south-facing slopes lends itself well to being occupied by BCVI. In these areas edaphic (e.g., shallow, limestone-derived soils) and climatic characteristics may possibly preclude colonization by taller canopy species such as Texas oak. Thus, minimal active management would be required. However, active management would be required to limit or prohibit browsing of shrub species by exotic and/or native ungulates in many of the sites currently utilized by BCVI. A small (< 40 individuals), relatively stable population appears to be maintained on these south-facing slopes. If controlling animal

densities is not an option then erecting exclosures around known nest areas might be warranted.

Controlled burning or selective brush management might be advised if juniper invades these areas. Areas currently occupied by BCVI should be monitored yearly for invasion by juniper and other canopy forming woody species. Juniper should be kept below 10% overstory cover. Care should be exercised, however, so as to not disturb adjacent GCWA nesting areas.

PEDERNALES FALLS STATE PARK

Pedernales Falls State Park lies directly west of Austin approximately 50 miles within Blanco County and covers 4860 ac.. Two topographic sheets, Pedernales Falls and Hammet's Crossing (USGS nos. 3098-131 and 3098-142) and two aerial photos (nos. 2434-23 and 2434-22, TXDOT 1990) cover the park. Site elevation ranges from 760 ft. amsl near the Pedernales River to 1229 ft. amsl on the far south end of the park near the county road.

The Blanco County soil survey emphasizes 13 soil types classified in 9 range sites: Deep Upland, Tight Sandy Loam, Redland, Steep Rocky, Adobe, Steep Adobe, Shallow, Very Shallow, and Rocky Upland. These nine sites range from the river terraces to the "cedar brake" type of rocky, steep hill country. The river terraces consist of approximately one-third of the park area, while the hill country portion comprises the remaining two-thirds south of the Pedernales River toward county road 2766. Plant information on mature vegetational communities was scarce in the literature, but a detailed account can be located in the DLI (1989).

Deep Uplands are most evident in the portion of the park located across the Pedernales River in a well-pronounced bend in the river. Another small pocket of the Deep Upland lies near Duck Lake. Originally, this site was a mature prairie community.

Tight Sandy Loams are scattered in pockets along the west side of the river uplands. This area was considered prime for native grassland with few mottes of trees and woody plants.

Redland sites occur on uplands along the Pedernales River and in a tiny portion of the area south of county road 2766. These sites have very productive soils generally along the river terraces. The mature community vegetation supported by the site would originally have been an open mosaic of prairie and oak/elm/shrub savannah. In association with the Redland sites are Steep Rocky sites along the high river banks. This range site grows similarly to the Redland sites, but is stratified vertically instead of horizontally and with the "open" portion of the mosaic provided by large and small boulders.

Adobe and Steep Adobe are present along the county road 2766, surrounding Wolf Mountain and the series of hiking trails in the southern half of the park, and in a very small portion of the river bend on the north side of the Pedernales River. These sites comprise almost half of the state park. These sites are considered the "hill country" area of the park. The Shallow and Very Shallow sites are found alongside the Adobe and Steep Adobe "hill country" as small flat plateaus, benches on the hillsides, or as a transition zone between the hill country and river terraces. All four range sites historically did not support a wide variety of plant life.

The final range site, Rocky Uplands, is found as the tops of major "peaks" on the park such as Wolf Mountain. This site is also relatively unproductive like the Adobe and Shallow range sites.

Vegetation diversity seems to decrease from the river to the south portion of the park and from the ravines to the steep rocky uplands. Therefore, the ravines nearest the river are the most diverse and the uplands farthest from the river the least. The river banks (excluding the scoured rockbeds) of the northwestern part of the park held a diverse community of cedar elm (*Ulmus crassifolia*), post oak (*Quercus stellata*), live oak (*Quercus fusiformis*), Ashe juniper (*Juniperus ashei*), small bald cypress (*Taxodia distichum*), Texas persimmon (*Diospyros texana*), and very few small scattered mesquite (*Prosopis glandulosa*). The banks near the falls were less lush than those further south. Further south, the vegetation resembled the northern banks and included hackberry (*Celtis* sp.), rough-leafed dogwood (*Cornus drummondii*), pecan (*Carya illinoensis*), walnut (*Juglans microcarpa*), flameleaf sumac (*Rhus lanceolata*), wild grape (*Vitis* sp.), and sycamore (*Platanus americana*). There are more steep tributaries to the river south from the falls. These ravines held similar community as the river banks, but excluded cypress and added Texas oak (*Quercus buckleyi*), more rough-leafed dogwood, and some Escarpment cherry (*Prunus serotina*). These ravines were also thicker in more mature juniper and oaks than the river banks.

Progressing upland from the river and its ravines, in the northern third and the section of the park across the river, the vegetation is drier. The canopy closure decreases from the river (approximately 75%) to the uplands (near the Duck Pond, approximately 50%). Ashe juniper and live oak are the dominant canopy members. Cedar elm and mesquite are also present in the taller canopy, but in fewer numbers. Post oak seems to fade upslope from the northern river banks. Texas persimmon, agarita (*Berberis trifoliolata*), and small (approximately 6 ft high) mesquite make up the understory near the corral and small clearings. Dirt roads and clearings are reproduced on the site map. Extensive juniper clearing has occurred along these roads, making the roads wider than 8 ft across in some places. Some juniper which have been cut appear to be in excess of 8 inches in diameter. Selective juniper (approximately 6 inches in diameter) thinning is evident along the dirt roads east of the main park road.

The middle third of the park on the west side of the river encompasses ravine systems (discussed above) to steep rocky hills surrounding the ravines. A trail system winds throughout this part of the park. Along this trail also, extensive juniper clearing has occurred. Bee Creek and Mescal Creek were running at the time of the survey and vegetation in these ravines was similar to the southern ravines described above. The ecotone between ravines and uplands is less diverse and composed differently than the inner ravine. Plants here include bear grass, twistleaf yucca (*Yucca rupicola*), few Texas persimmon, live oak, and Ashe juniper. The uplands however appeared barren except for Ashe juniper and very few scattered live oaks (dense "cedar brake"). The ground was grassless in most places and the small amount of soil contained fragmented exposed limestone. Canopy cover in the uplands was approximately 70%.

The southern portion of the park resembled the uplands of the middle third, but with less slope and more oaks. The south fenceline vegetation also had an understory of Texas persimmon and agarita.

According to Marshall et al. (1985), the park was assumed to have good BCVI habitat in the far reaches of the park. He and his group incompletely surveyed the park and did not find BCVI or GCWA. In 1987, Marshall revisited the park and found it "overgrown with junipers approaching a continuous canopy." He notes that the park bird list includes one BCVI observation "7 miles up the primitive trail by an observer now deceased." Unfortunately, the primitive trail is not even 7 miles long. The Draft Distribution and Status of BCVI (Sexton et al. 1989) reiterates the same historical notations and briefly discusses more recent notations from elsewhere in the county. Peter Scott partially covered this park in his 1991 census of TPWD public lands. His survey resulted in zero BCVI. This year's (1993) survey did not yield any BCVI records.

Brown-headed Cowbirds were prominent in all areas of the park, particularly surrounding the park roads and campground areas. Fewer were seen in the Wolf Mountain area, but were still heard here.

Management Recommendations for Pedernales Falls SP.

This park seems to be a well-established nesting ground for GCWA and every effort should be made to continue the species survival here. The vegetation seems well-suited to GCWA habitat. However, habitat does not appear to exist for BCVI in the park. All of the potentially shrubby vegetation is too overgrown. Most of the park appears to be in an advanced seral stage. The omnipresent BHCO may play a part in the limited numbers of GCWA as well as the lack of BCVI.

Further juniper clearing in the north and mid-sections of the park, if necessary, should eliminate only those trees which are less than six inches in diameter. The GCWA should be monitored more closely for reproductive habits and successes than was attempted in the short two-day survey conducted this year. The park east of the river should be more thoroughly surveyed. Attempts should be made to improve deciduous shrub and tree diversity on the uplands surrounding Wolf Mountain Trail where the brakes are intensely monotypic. Soil erosion should also be curtailed.

RECOVERY UNIT III

CONCHO VALLES SITES

General Summary

Recovery Unit III contains two occupied counties out of eleven partial counties (Figure 5). Coke County was investigated for BCVI along Seminole Pipeline properties and the surrounding areas (DLS Associates 1992). Approximately 20 to 25 BCVI were located within Coke County. Most of the birds were on private property and could not be intensively monitored for mated or nesting status. The surrounding counties were also superficially investigated close to Coke County borders. One record (a single singing male) was made in Sterling County. The bird could not be relocated a second time. The majority of Region Four lies very close to the northwestern edge of the known BCVI range. Most of the region is not suitable BCVI habitat, but pockets of small populations (approximately 15 birds) exist (most in Coke County, but perhaps elsewhere). Since TPWD does not have any holdings with potential habitat for BCVI in this region and most of the region is privately owned, the area has not been well-searched for more "pockets" of BCVI. Management of this region is left to USFWS.

Table 7. Recovery Unit III -- Concho Valley compiled BCVI totals.

Site Name	County	Count	Acreage
Concho Valley Sites			
Abilene SP	Taylor	0	621.4
Total		**0**	**621.4**

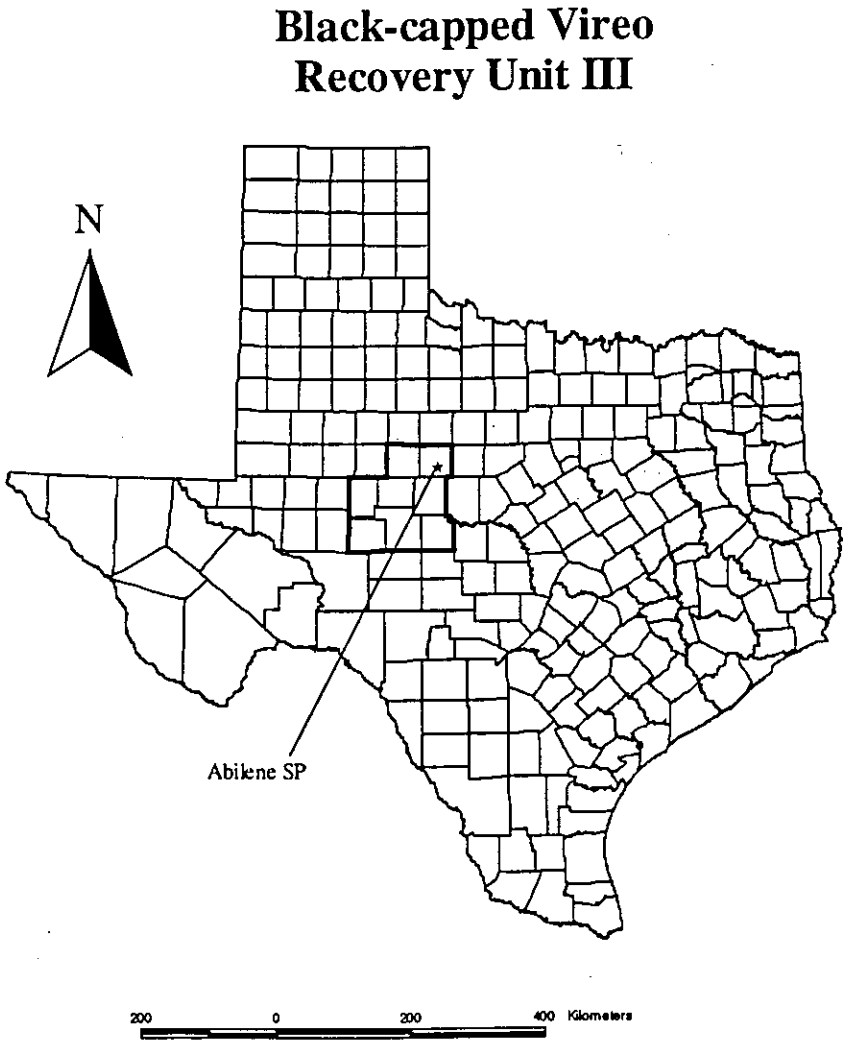

Figure 5. Recovery Unit III: Concho Valley sites

RECOVERY UNIT III

CONCHO VALLEY SITES

Site Specific Information

ABILENE STATE PARK

Abilene State Park is 621.4 ac located in Taylor County, west-northwest of Waco, south of Abilene, near Lake Abilene (Lake Abilene and Tuscola quadrangles USGS Nos. 3299-223 and 3299-224 and TXDOT 1990 aerial photo no. 2365-159). The elevation on the site ranges from 1960 to 2140 ft amsl. The Taylor County soil survey indicates the park proper is best suited for loamy bottomland supporting a riparian community. Across FM 89 near the dam, the soil types make a shallow clay and deep hardland range site with severe limitations to brush, shrubs, and upland range plants.

Uplands of the park proper consist of Ashe juniper (*Juniperus ashei*) and live oak (*Quercus fusiformis*) woodland (20+ ft high). Some areas have little to no understory due to human impact. Other areas have small Ashe juniper, small hackberry (*Celtis* sp.) (approximately 10 ft high), elbowbush thickets (*Forestiera pubescens*), prickly pear (*Opuntia lindheimeri*), tasajillo (*Opuntia leptocaulis*), agave (*Agave lechuguilla*), and twist leaf yucca (*Yucca rupicola*) for understory. An 80 ac pasture across the county road south of the park proper is similar to the park proper uplands and contains two longhorn cattle and one bison. Ashe juniper (approximately 8 ft high) is more prominent here. The mid-pasture area is an open mosaic of juniper and mesquite with few live oaks, hackberry, and Mohr's oak (*Quercus mohriana*) mixed closer to the road.

Nearing the riparian bottomlands grows Texas oak (*Quercus buckleyi*) (20+ ft high), tall hackberry (20 ft high), live oak and large pecan (*Carya illinoensis*), with sparse understory of (*Smilax bona-nox*). The portion of the park west-northwest of FM 89 is red sand hills, mostly barren, with few mesquite (*Prosopis glandulosa*), Ashe juniper, and prickly pear. The area backs into the earthen dam which contains Lake Abilene.

In 1993 (TPWD), BCVI were not located on the tract. Pulich (1976) did not mention this county as part of the range for either BCVI. Marshall et al. (1985 and 1987) located potential BCVI shinnery habitat along Hwy 277 west of the access road to the park which still sparsely exists as of 1993 (TPWD). However, no BCVI were observed in that area. Brown-headed Cowbirds (*Molothrus ater*) were not noted in abundance (no large flocks), but were present (groups of 2 to 5 individuals foraging) throughout the park.

Management Recommendations for Abilene SP.

The only park areas with potential for *marginal* BCVI habitat (brushy, 0-1.5 m from the ground, interspersed with open spaces) include the county road sides and possibly the areas along the fence in the eastern portion of the park. Elbowbush and Mohr's oak seem to be the dominant shrubs with growth characteristics which resemble shrub characteristics in known BCVI-occupied areas. However, since the area is not historically or currently significant, it is unlikely that BCVI would return as a viable population here even with improvement of the marginal habitat. Most of the surrounding areas near the park (according to the aerial photo)

appear to be densely covered in juniper or a sparse shrubland mosaic. It seems that suitable BCVI habitat is not present in the surrounding properties.

Further BCVI investigations of Abilene State Park on a yearly basis are not necessary. Park personnel should be aware of the possibility of a migration record and report any incidental sightings to the Resource Coordinator and the Nongame and Rare Species specialist (Wildlife Diversity Program).

RECOVERY UNIT IV

TRANS-PECOS AND STOCKTON PLATEAU SITES

General Summary

The Trans-Pecos, covering an area of approximately 20.5 million ac. in extreme western Texas, represents twelve percent of the land area of Texas and is roughly the size of the state of Maine (Schmidly 1977). An extensive mountain and basin physiography, typical of the southwestern United States, and which reaches its easternmost U. S. extent in Texas, has a pronounced positive effect on the region's biodiversity (Schmidly 1977, LBJ School of Public Affairs 1978, Stiling 1992). Thus, of the eleven ecological regions in Texas, the Trans-Pecos contains not only the greatest topographic relief but the greatest number of plant communities.

Receiving less than 12 inches of average annual precipitation the Trans-Pecos has a pronounced scarcity of water, and is the most variable and limiting factor affecting both plant and animal life in the Trans-Pecos (Schmidly 1977). Predictably, aquatic systems attract the greatest level of biodiversity in this ecoregion. The Trans-Pecos being is represented by five of the eleven primary aquatic habitat types in Texas, outlined by Edwards et al. (1989), including ephemeral, intermittent and permanent creeks, springs, perennial streams and rivers (in addition to others less well known such as seeps, hot springs, draws). Unfortunately there are many threats to the aquatic resources in this region, and declining quality of habitat associated with aquatic ecosystems in the Trans-Pecos is recognized as the highest priority for attention in the conservation action plan for that region (Linam et al., 1995). Indeed, the Trans-Pecos has the iniquitous distinction of containing more federally listed, proposed listed and category 1 taxa than any other of Texas' ecoregions (Texas Biological and Conservation Data System, 1996).

The following data summaries will be divided into Trans-Pecos and Stockton Plateau sites to follow the order established in the BCVI Recovery Plan (USFWS 1991). Table 8 displays BCVI count data from visited parks and associated acreages for the properties.

Table 8. Recovery Unit IV -- Stockton Plateau and Trans-Pecos compiled BCVI totals.

Site Name	County	Count	Acreage
Stockton Plateau Sites			
Devils River SNA	Val Verde	158	19,988.6
Fort Lancaster SHP	Crockett	3	81.6
Subtotal		**162**	**20,070.2**
Trans-Pecos Sites			
Big Bend Ranch SP	Brewster	0	269,713.9
Black Gap WMA	Brewster	7	102,068.4
Davis Mountains SNA	Jeff Davis	0	2,677.9
Elephant Mountain WMA	Brewster	1	200.0
Subtotal			**374,660.2**
Total		**170**	**394,730.4**

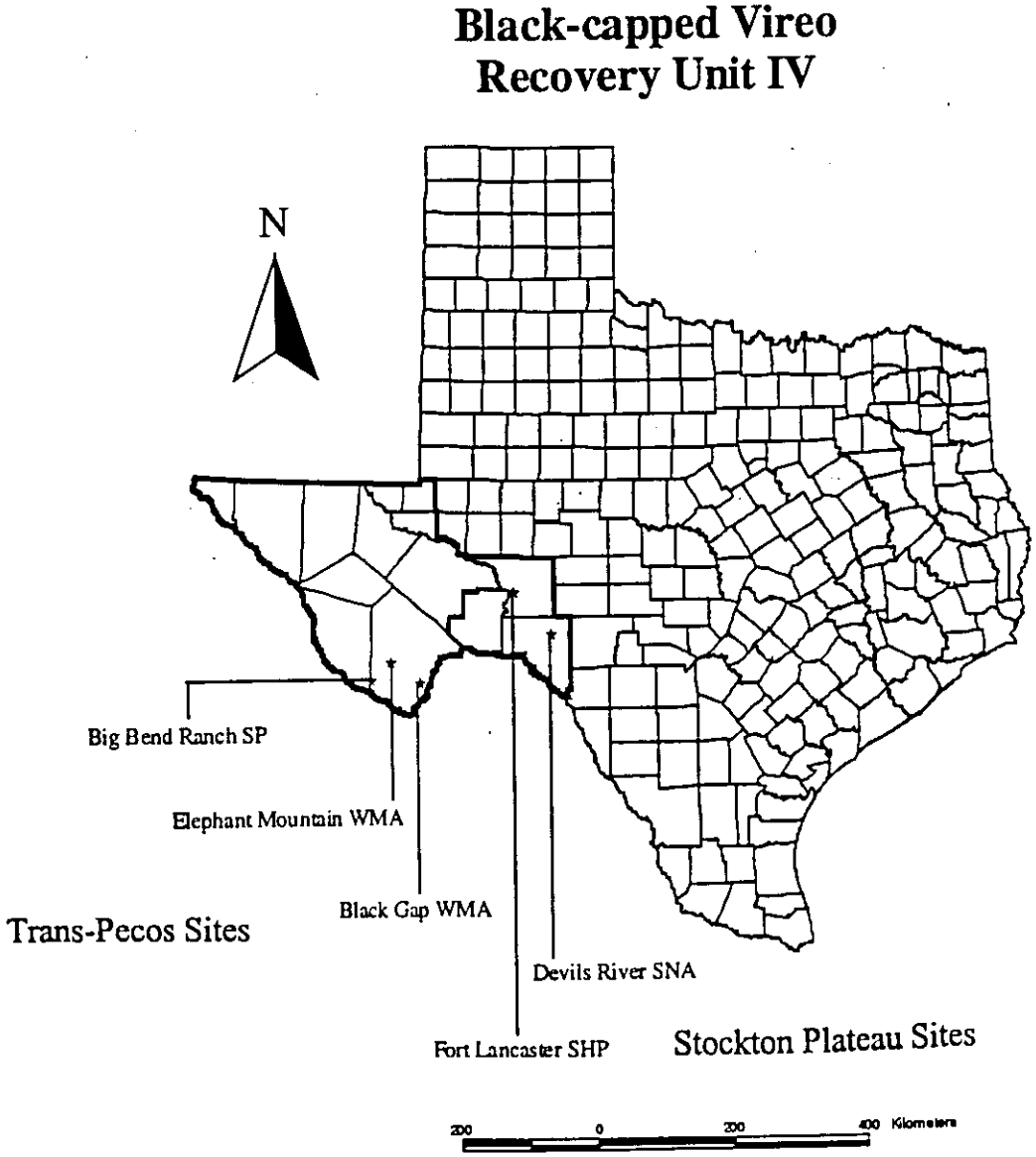

Figure 6. Recovery Unit IV: Stockton Plateau and Trans-Pecos Sites

RECOVERY UNIT IV

STOCKTON PLATEAU SITES

Site Specific Information

DEVILS RIVER STATE NATURAL AREA

Occupying approximately 21,000 ac. in Val Verde County, the Devils River SNA encompasses edges of three major ecological regions: western Edwards Plateau, western South Texas Plains, and eastern Trans-Pecos. Topographic sheets for the area include Dolan Springs (USGS No. 2900-333), and Telephone Canyon (USGS No. 2901-444). The area contains plentiful upland plateaus, numerous steep canyons, and several drainages, most notably that of Dolan Creek. The property was purchased in 1988 by TPWD from the Finnegan family, who had owned it since 1883 (see Appendix F for more information on land use history of this area).

The property had mainly been used as a sheep and goat ranch, with a stocking rate of approximately 1 AU per 15 ac. All livestock were removed between 1987 and 1988. Exotic game (aoudad sheep, axis deer, sika deer, barbado sheep, fallow deer, and red deer were stocked on the area for commercial hunting. Several exotics, most notably aoudad sheep, still are abundant. Root-plowing occurred in a few of the bottomland sites, giving rise to mesquite and persimmon thickets which now dominate the area.

Cretaceous limestone and dolomites form the majority of the geological strata in the area. Pleistocene fluviatile and Recent alluvium deposits are found on the broad stream terraces. Soils range from shallow, well-drained, moderately alkaline stony loams on the uplands to more gravelly loam on the slopes to deep, well-drained, moderately alkaline gravelly clay loam soils on the gently sloping terraces and bottomlands.

Because the natural area is situated on three ecological regions the plant communities are quite diverse. Plateau upland communities consist of short to midgrasses of the Curly mesquite-sideoats grama series. Woody plants cover only about 10 percent of the uplands, and these typically consist of Texas persimmon, Texas mountain laurel, brasil (*Condalia hookeri*), and plateau live oak. These shrubs generally form mottes with smaller shrubs, such as agarito (*Berberis trifoliata*) and fragrant mimosa (Mimosa borealis), occupying the understory. Overgrazing and root-plowing over the years have allowed numerous pricklypear (*Opuntia sp.*), brasil, and honey mesquite to take over. Other upland sites contain Ashe juniper - oak series vegetation, with scattered redberry juniper (*J. pinchotti*), vasey oak (*Q. pungens* var. *vaseyana*), and Texas mountain laurel.

Slope communities vary depending upon exposure. In areas not directly exposed to the sun for large portions of the day, vegetation of the Ashe juniper - oak series is typical, although Ashe juniper itself is not very common. Vasey oak is the most abundant tree, but shrubs such as netleaf hackberry, Mexican buckeye, guajillo, netleaf elbowbush (*Forestiera reticulata*), wafer ash (*Ptelea trifoliata*), Texas persimmon, agarito and evergreen sumac (*Rhus virens*) are common. In some parts, these plants form dense, practically impenetrable thickets. Areas containing well-developed stands of brush myrtlecroton (*Bernardia myricaefolia*) would suggest

that goat browsing has been eliminated for substantial periods.

More xeric slopes are dominated by succulent vegetation, such as sotol (*Dasylirion texanum*), lechuguilla (*Agave lechuguilla*), yucca (*Yucca torreyi*, and other sp.), red falseyucca (*Hesperaloe parviflora*), sacahuista (*Nolina texana*), tasajillo (*Opuntia leptocaulis*), prickly pear (*O. lindheimeri*) and ocotillo (*Fouquieria splendens*).

On the gently sloping to level stream terraces, evidence of brush control is common. The most common shrubs in these regions are guajillo, cenizo, honey mesquite, whitebrush (*Aloysia gratissima*), netleaf hackberry, Texas persimmon, Texas mountain laurel, lotebush (*Ziziphus obtusifolia*), coyotillo (*Karwinskia humboldtiana*), granjeno (*Celtis pallida*), agarito, and several acacias. Honey mesquite is restricted to areas with deeper soils.

BCVI could potentially be found in the shrublands associated with drainage systems throughout the area. Large portions of the area have not been surveyed for BCVI due to the remoteness and ruggedness of the terrain. In 1989, a study of BCVI productivity was initiated on the area. This study, designed to parallel efforts at Kickapoo Cavern and Lost Maples SP, was conducted yearly through 1991 (Table 9).

Table 9. BCVI productivity estimates for Devils River SNA: 1989-1991.

Activity	1989	1990	1991
1. Estimated number of pair	70-80	--	--
2. Territories mapped	9	93	77
3. Nest attempts monitored	--	84	82
4. Nests found	2	61	53
5. Nests fledging ≥ 1 BCVI	--	42	41
6. Nests fledging ≥ 1 BHCO	--	5	7
7. Nests lost to predation	--	6	9
8. Nests abandoned	--	12	15
9. Nests destroyed			
by hail	--	--	--
unknown	--	3	3
10. Number fledgling BCVI	4-5	101	114
11. Nest success (%); line 5 divided by line 3	--	0.50	0.50
12. Fecundity (ave. fledglings per nest); line 10 divided by line 3	--	1.20	1.39

Brown-headed Cowbirds were not trapped on the area during this time as it was set aside as a control to monitor the effects of cowbird removal at Kickapoo Cavern SP. BCVI productivity was moderately good at the area despite no cowbird control. No BHCO census or survey work has been conducted there.

In 1990, a qualitative assessment of preferred nesting substrate was initiated to parallel that of Kickapoo Cavern SP and Lost Maples SP. In this area, Texas mountain laurel was the preferred nest substrate, and the most abundant woody species above the nest was also Texas mountain laurel. Nest heights averaged 1.12 m and canopy height averaged 4.17 m. The study was not continued after 1990.

Management recommendations for Devils River SNA.

BCVIs prefer the shrubland dominated slopes and stream terraces associated with most drainage systems at Devils River SNA. In these areas edaphic, hydrological, and climatic pressures result in limiting canopy forming trees from successfully colonizing. Therefore, there

is a pronounced lack of the "temporal window of opportunity" which characterizes habitat to the east (e.g., wetter climates). Instead a vast mosaic of shrub-thickets whose foliage form the requisite "apron" to ground level, is found here. As long as browsing is kept to a minimum by ungulates, most notably aoudad sheep, then there should be little to affect the quality of habitat currently available. Occasional severe flooding along drainages might alter vegetational structure and species composition in such a way as to make the area less desirable to BCVIs. Wildfires are not common in the area, and none are known for this property. Such a disturbance might eliminate large portions of available habitat, but would be revegetated rather quickly by desirable species.

FORT LANCASTER STATE HISTORICAL PARK

This 81.6 acre property, located in Crockett County, borders the Stockton Plateau and the western edge of the Edwards Plateau on the east bank of Live Oak Creek, which is a tributary of the Pecos River. The topographic sheet for the area is Fort Lancaster (USGS No. 3001-313). Elevations range from 2040 ft. to 2681 ft amsl.. Approximately 50% of the park is developed. The area has numerous slopes rising up from the stream terrace. There is no botanical survey for this park but the area probably exhibits vegetation typical of the western Edwards Plateau. The slopes and uplands are Cretaceous limestone-derived soils, whereas the stream terraces are largely formed from alluvial and colluvial deposits, and some Trinity sands.

Management Recommendations for Fort Lancaster SHP.

There exists one Element Occurrence Record (EO Code: ABPBWO1120.009) for the park from 1984 for three singing male BCVIs, and from May 1985 for singing males (number unreported). No nest was discovered and this species has not since been seen on the area. This region of Texas typically has appropriate habitat for BCVI and it would be conceivable that BCVI might utilize some of the area on the property in the future, but due to its small size and limited botanical knowledge of the area there are no management recommendations to be made at this time. Report any sightings to the Natural Resources Parks Division, Resource Coordinator, and the Nongame and Rare Species specialist (Wildlife Diversity Program).

RECOVERY UNIT IV

TRANS-PECOS SITES

Site Specific Information

BIG BEND RANCH STATE NATURAL AREA

This property, at 269,713.9 ac., is the single largest holding among TPWD properties. Straddling both Presidio and Brewster Counties, it contains some of the most diverse landscapes in the Trans-Pecos Ecoregion. Nineteen toposheets represent this very large property:

Quad name	USGS No.
Sauceda Ranch	2903-233
Lajitas	2903-231
Santana Mesa	2903-232
Redford SE	2904-141
Bander Mesa South	2903-321
La Mota Mountain	2903-322
Manzanillo Canyon	2904-411
Cerro Redondo	2904-412
Casa Piedra	2094-414
Alamo Spring	2904-413
La Boquilla	2904-441
Plata	2904-424
Cienega Mountains	2904-442
Shafter	2904-442
Presidio East	2904-421
Redford	2904-421
Agua Adentro Mountain	2904-144
Yellow Hill	2903-243
The Solitario	2903-234

Sauceda Ranch property lies within the Chihuahuan Desert region and features a rich and rugged terrain which can be subdivided into five distinct natural regions: (1) the Rio Grande and its tributaries, (2) the Bofecillos Volcanic platform, (3) the Solitario, (4) the Fresno and Contrabando Lowlands, and (5) the Cienega Mountain and associated watershed (Cienega and Alamito Creeks). Botanical surveys exist (LBJ School for Public Affairs) for the Bofecillos Mountains, the Solitario, Fresno Canyon, and Colorado Canyon.

Numerous water resources are located within the park boundaries, including seeps, cienegas and streams and associated mesic vegetation. Approximately 400 bird species have been recorded for the area. However, this list does not include BCVIs.

Management Recommendations for Big Bend Ranch SNA.

No management is recommended at this time due to insufficient data on BCVI distribution on the property. Although no BCVIs have been recorded, more systematic surveys are needed to confirm that they do not occur on the area. This property has had no systematic survey of potential habitat for BCVIs.

DAVIS MOUNTAINS STATE NATURAL AREA

Located in Jeff Davis County, in the Trans-Pecos Ecoregion, and occupying 2,677.9 ac., the Davis Mountains State Park consists of a mixture of foothill slopes and canyons along Keesey and Limpia Creeks. Topographic sheets for the area include Fort Davis (USGS No. 3003-322), and Casket Mountain (USGS No. 3003-323). Elevations range from 4900 to 5680 ft amsl. Underlying geological strata are from the Miocene and are largely volcanic in origin.

Two general habitat types occur within the park boundaries: (1) rocky igneous slopes support a midgrass grassland of the New Mexico Little Bluestem-Wolftail Series, and (2) evergreen oak woodland of the Emory Oak Series are found along the rocky alluvial soils of stream terraces.

Management Recommendations for Davis Mountains SNA.

There are no records of BCVI on the property, or even for the county. The combination of unsuitable habitat, geology (BCVI are more often associated with limestone-derived soils) and high elevation make this are largely unattractive to BCVIs. Therefore, no management recommendations are suggested for the property. Report any sightings to the Natural Resources Parks Division, Resource Coordinator, and the Nongame and Rare Species specialist (Wildlife Diversity Program).

V. DISCUSSION.

Survey results for BCVI from this study suggest that properties owned by TPWD contain insufficient numbers of BCVIs to meet the recovery criterion of 500 to 1,000 pairs in each of four Recovery Units (USFWS 1991). There is insufficient information to determine whether TPWD properties can meet the amended criterion (USFWS 1996) of maintaining three to five subpopulations within each Recovery Unit. The total estimated population size for BCVIs on all TPWD properties from all Recovery Units (incl. WMAs) is 807. Of the four designated RU, only RU II, the Southeastern Edwards Plateau sites, harbors a significant number of BCVIs on TPWD properties. Although relatively high (619 adults), this value represents roughly one-half that required to meet the recovery goal for that Recovery Unit. Second in rank is RU IV, the combined Stockton Plateau and Trans-Pecos sites, which have 170 adults documented on TPWD properties. RU I, the combined North Central Texas and Lampasas Cut Plains sites, has 18 adults, whereas RU III, the Concho Valley sites, has no documented BCVIs on TPWD properties.

No accurate or precise census of BCVI in Texas has been performed to date. What data exist are results of inconsistent and sporadic efforts over approximately that last twenty years. The vast majority of suitable habitat in Texas most likely occurs on private land which has not been adequately surveyed. Thus, the total population size for BCVI in Texas can only be roughly approximated. This report summarizes efforts toward ascertaining population counts from TPWD, public and a small number of private properties, revealing a total of 1,659 individual BCVI (of both sexes). The only other reliable data on rangewide (Texas) population numbers comes from USFWS (1996) who reported 1,636 *male* vireos tabulated from counts from all counties of known occurrence. If we accept this latter figure as the uppermost documented record of population size, and, if a 1:1 sex ratio can be assumed for BCVIs in Texas, then the total population size *may be* as high as 3,272 individuals as of 1995. The discrepancy between the results for this report and that of USFWS (1996) may be due largely to two effects: (1) Differences in survey methodology. For example, for this study only verified sightings of male and female BCVI were recorded, whereas in other studies the number of males is often multiplied by two to give the total number of BCVI in an area. This would make our estimates more conservative. Additionally, survey efforts were not systematic such that properties, and habitats within properties, received unequal time for surveying, and different observers were used throughout. (2) USFWS (1996) utilized a larger sample of survey data taken from private and state-owned lands (e.g., TxDOT) which do not appear in the figures for this report.

Given these discrepancies, and using USFWS (1996) as the current estimate for BCVI population size in Texas, TPWD properties would thus contain approximately one-quarter of the known number of individual adult BCVIs in the state. The total acreage of property owned by TPWD (394,730 ac.) accounts for approximately 0.65% of that within the Recovery Units (71,220,759 ac.)(see Table 1). Therefore, it is not likely that current TPWD properties would be able to support the numbers of BCVIs recommended by the Recovery Plan (USFWS 1991, USFWS 1996). However, it must be pointed out that with the exception of survey data from the Kerr WMA, Kickapoo Cavern SP, Hill Country SNA, and Walter Buck WMA, surveys were not conducted on a systematic (all available habitat), consistent (year-year) basis due largely to staff and time limitations. Thus, at some sites (particularly, Devils River SNA) there is the potential to locate many more BCVIs.

Given the space limitations of producing large viable populations of BCVI on Texas state

parklands the primary focus should be on maintain or improving existing populations such that greater productivity might be achieved. Therefore, an emphasis on producing "source" populations should be an imperative long-term goal.

Alternative Management Strategies.

Ecosystem, rather than species-specific, management is the approach endorsed at this level. However, managing ecosystems is a complex effort, to say the least. Being dynamic and disturbance-driven on many different spatial and temporal scales ecosystems must be managed with the thought in mind that it is a continual, learning experience. Meffe et al. (1997) suggest that sound conservation management of ecosystems should, at minimum, include attention to: (1) maintenance of essential ecological processes and biodiversity, (2) minimizing external threats and maximizing external benefits, (3) conservation of evolutionary processes, and (4) minimally intrusive management. Thus, management should be responsive, adaptive and predictive.

The decision regarding whether, or to what extent, management should be implemented for Black-capped Vireos depends upon at least the following: (1) the degree of threat to the local BCVI population, in terms of abundance and productivity, (2) the proximity to other populations in the area, (3) the extent of available or potential habitat; and, from a practical point of view, (4) available funding, time, and staff resources. Achieving recovery goals should be the principle motivation for management. However, because management at any level in a natural ecosystem can be considered a form of disturbance, it should only be undertaken with great care and forethought. Understanding the nature of stability (i.e., resistance and resilience) of a particular habitat or ecosystem is perhaps the single most important aid in successful management.

Two alternative approaches, which are not mutually exclusive but actually represent two extremes of a continuum, will be discussed below. The reader is not asked to choose among these strategies, but rather to incorporate those aspects of each which best suits his/her individual needs. In either approach it is assumed the manager has a working knowledge of the biology and ecology of the local BCVI populations and their habitat. Campbell (1995) and USFWS (1996) outline general management strategies for BCVIs, which should be consulted along with those in Appendix G.

One particular management practice, which is hereby recommended for all TPWD properties harboring breeding BCVIs, is that of controlling brood parasites (especially, Brown-headed Cowbirds). Generally, parasitized BCVI nests do not fledge BCVIs (Pease and Grzybowski 1995). Thus, cowbirds, as brood parasites, represent the number one (proximate) threat to recovery of the BCVI (USFWS 1991, USFWS 1996, Grzybowski 1995). Population and habitat viability assessment models (PHVA) have been generated (see below) which strongly suggest that the risk of extinction is greater than allowable for recovery when cowbirds are not controlled. Therefore, it is imperative that this issue be addressed as a fundamental management practice on all sites containing BCVIs. Details for controlling cowbirds are outlined in Appendix G, "General Management Guidelines."

A. Biological Approach

Information about the biology and ecology of local BCVI population(s) is required for this approach. Ideally, such information should include habitat characterization, presence/absence data, age structure, productivity, mortality (e.g., predation, parasitism), and dispersal. Given this information a distinction can then be made between source and sink populations (Pulliam 1988, Meffe et al. 1997). Sources and sinks are tied to habitat quality with the understanding that in "good" quality habitats populations will survive and reproduce more successfully than in "poor" habitats. Thus, populations in good habitats (sources) tend to produce an excess of individuals who might disperse to outlying areas. In poor habitats (sinks), mortality and/or emigration outpaces reproduction, and without immigration from outside sources, the local population can go extinct. In many cases, especially with endangered species, habitat is fragmented and gene flow is exchanged poorly among subpopulations. If such subpopulations are sinks then viability of the entire group of subpopulations (metapopulation) is in danger of extinction. Without proper investigation (for example, relying solely upon presence/absence data without considering productivity; Martin 1992, Robinson 1992), sinks can be mistakenly confused with source populations, or vice versa, and conservation of the metapopulation (or species) may be threatened. In addition, valuable time, funds and energy might be misapplied.

As sources are more important in terms of productivity they should receive higher priority when considering alternative management practices. Sink populations, those in which breeding is absent, rare or significantly below levels specified in USFWS (1996) and Pease and Grzybowski (1995), should not be ignored, however, but should be investigated for ways in which breeding may be enhanced (e.g., habitat manipulation). Sink populations serve as important sources of replacement of members of source populations which die off or disperse. Thus, disperal corridors between adjacent subpopulations might also be an appropriate avenue for management.

Since maintenance of critical ecological processes is vital to sound ecosystem management, it is important to have guidelines to follow in the near term. Such guidelines are often unknown, but simulation of natural events using available data are a good start. Models have their limitations, but the values supplied by USFWS (1996) and Pease and Grzybowski (1995) should serve as at least a rough indicator for when management might be appropriate. In their work, USFWS (1996) estimated that in order to have a low probability of extinction (< 5% over 100 years as agreed upon by participants of the BCVI PHVA workshop held in Austin, 1995) in BCVIs, mean fecundity (assuming a 1:1 sex ratio, and various levels of predation and parasitism) should be 1.25 female offspring per female, which implies 2.5 offspring of either sex per female. In a separate model, Pease and Grzybowski (1995) calculated that in order to achieve long-term viability the highest levels of seasonal fecundity, without parasitism or predation, would need to be in the range of 2.7 - 3.1 female offspring per adult female. Actual fecundities range between 1.0 - 1.4 (Grzybowski 1995), without cowbird removal. Thus, it can be logically deduced that cowbird removal is essential to long-term viability of BCVI populations.

For this study, BCVI productivity was monitored on three properties, Lost Maples SP, Devils River SNA, and Kickapoo Cavern SP. Only in the latter was there sufficient data to make any statements about productivity. At Kickapoo Cavern, five continuous years of monitoring, from 1989 through 1993, yielded the following figures for fecundity (ave. fledglings per nest): 0.86, 1.76, 2.31, 2.28, and 1.45. The mean for these five years of data then is 1.73 (s.d. = 0.61). Cowbirds were trapped on this property in 1990, 1991, and 1993, and may have positively

influenced productivity since only 1 nest was documented as having fledged a cowbird during that time. In the two years that cowbirds were not trapped, however, an average of 2.5 cowbirds (n = 5) per parasitized BCVI nest were fledged.

Following the guidelines suggested by USFWS (1996) and Pease and Grzybowski (1995) productivity at Kickapoo Cavern SP, without parasitism being controlled (mean 1.57, s.d. = 1.00 fledglings per nest), was numerically but not statistically significantly ($p<0.05$) higher than Grzybowski's (1995) range of actual fecundity values (1.0 - 1.4) without cowbird control. Variability in these values may be accounted for by such effects as intermittent cowbird trapping, climatic conditions, or resource availability factors influencing Brown-headed Cowbird productivity.

For the years, 1990, 1991, and 1993, in which cowbird trapping was implemented at Kickapoo Cavern SP, BCVI productivity was higher (mean = 1.84, s.d. = 0.43). The above models suggest that, on average, 2.5 offspring of either sex should be produced per adult female when parasitism and predation pressure is factored in. Thus, BCVIs at Kickapoo Cavern are not replacing themselves at a rate which would keep the chances of extinction below 5% over 100 years.

Models inherently have several limitations. Largely, departures between observed and expected results can be anticipated when they cannot be strictly tailored to the life history traits of the target species. For example, (1) models may include uncontrolled demographic stochasticity parameters which may adversely affect population size, (2) fecundity and survival rates may or may not be correctly assumed to vary independently, (3) sources of mortality and morbidity are usually difficult to assess accurately, (4) dispersal offsite after initial nesting attempts may bias fecundity estimates, (5) incomplete knowledge about mating systems (e.g., extra-pair copulations and mixed paternity) may adversely affect reproductive success, and (6) carrying capacity is typically unknown. These problems are due to insufficient data; however, the close match between predicted and empirically gathered data on fecundity in the Pease and Grzybowski (1995) model suggests that such biases may be of relatively minor importance. Limitations notwithstanding, the values for fecundity used here are the only ones we have and should at least serve as a point of departure.

Another approach to deciding when to implement management strategies is to monitor population size (i.e., abundance). Although mere abundance data can be misleading (see above), sometimes this is all the information a manager has, or can expeditiously acquire. Thus, when numbers fall below a certain level, then management could be initiated toward the goal of recovering the population to some predetermined level. W. E. Armstrong (Kerr WMA biologist, pers. comm.) suggests setting a threshold for implementing management at 50% of current levels. In the case of the Kerr WMA this would correspond to levels below those of the 1990 survey. Reduction of a population by 50% may be unreasonable for certain populations, especially smaller ones in which such levels may preclude successful breeding (e.g., colony sizes below 3 - 5 mated pairs). At present there is no standard threshold below which management should begin except that outlined in the BCVI Recovery Plan (USFWS 1991) which states that all populations should be "maintained and enhanced." One possible suggestion is use the average of all years of BCVI population size data currently available for each site, and refer to that number as the "normal" population size for that area. A 95% confidence interval (Snedecor and Cochran 1980:56) could be constructed about that mean and population numbers which fall below the lower limit of the confidence interval would suggest management is in order.

In summary, by having a sound understanding of the distinction between source and sink populations, based upon knowledge of reproductive success and habitat characteristics, a manager can more efficiently direct his/her attention to appropriate and successful management strategies. This is especially important in view of the limited funds and staffing which abound in conservation. The main limitations to this approach are: (1) acquisition of a good data set from which to operate, and (2) reliability of predictions about fecundity and extinction rates from mathematical models. Given that these limitations are tolerable, the biological approach should ensure long-term viability and, hopefully, recovery of the population(s).

B. Habitat Approach

This approach relies solely on the notion that in good quality habitat the target population(s) will take care of itself. Thus, depending upon habitat quality, little, if any, intervention may be necessary. In its purest form, this approach differs from the preceding one in that: (1) there are no *a priori* assumptions made about the dynamics of the target population(s) in a given habitat, other than to assume that "poor" habitat will not support the population as well as will "good" quality habitat, (2) effort directed at monitoring the target population will be reduced since habitat is the main determinant of population health and viability, and (3) decisions to manage or not to manage are based solely on the condition of the habitat.

Paramount for successful implementation of this approach is a solid understanding of the nature of "quality" BCVI habitat and how to identify it (see discussion on habitat in Appendix G). Previously, BCVI breeding habitat characterization has been carried out using general observations reported by Graber (1961), Grzybowski (numerous, for Oklahoma and Texas), Sexton et al. (unpublished MS 1989), *Fort Hood MR* personnel (Tazik et al. 1990), and TPWD personnel (departmental reports 1985 through the present). In most regions, the structural characteristics of breeding habitat include restriction to open shrublands (cover between 35 and 55 %) with a high density of deciduous vegetation from 0 to 3 m (Grzybowski et al. 1994). Estimates of juniper cover in central, eastern and northern portions of the range tolerated by BCVIs has been suggested to be below 10 % (USFWS 1991, Grzybowski et al. 1994). The floristic components vary widely with no single species dominating in all regions. Western portions of the range are drier, exhibit lower growth forms and are probably mostly under the influence of edaphic and climatic factors rather than the disturbance factors which predominate elsewhere (see "Habitat" under Management Guidelines).

Currently, the USFWS is recommending standardized habitat characterization protocol for use on all lands (Appendix D). This will be useful in standardizing measurements for comparison of habitats across the regions and identifying habitat for possible future acquisition.

Although there are data to suggest that floristic components of BCVI habitat are not as important as physiognomic components (Grzybowski et al. 1994) more work could be done in this area. For example, what is the relationship between plant species composition and prey abundance and availability? Virtually no published information exists to answer this question and answers may be very important to management of the habitat. With regard to habitat physiognomy (structure and dynamics) there are no universal rules, although Grzybowski et al. (1994) adequately described the structure preferred by BCVIs in the central and northern extent of their range. From what is known thusfar, BCVIs prefer dense, low-growing vegetation with

foliage extending to the ground interspersed among open spaces and with a minimal amount of juniper. This habitat type is found in early and mid-succession in the central and northern portions of the range, whereas as it is a more or less permanent feature of habitats in the west (e.g., RU IV). Thus, knowledge of the landscape is crucial to an understanding of the extent to which BCVI habitat should occupy an area.

When taking the habitat approach one need be primarily interested in providing an adequate amount habitat for successful BCVI reproduction. Adequate amount of BCVI habitat is contingent upon the types of floristic and structural components BCVIs prefer in a given area. If this habitat type is absent or if available habitat is unsuitable then restoration practices (outlined in Appendix G) should be considered. The extent of coverage BCVI habitat should occupy in a given area is a decision that should be made by analyzing the landscape. In most cases this will be facilitated by knowledge of the potential vegetation cover types obtained from thorough botanical surveys, historical and current remote sensing analyses, previous published investigations, and discussions with previous landowners. With an idea in mind of how much of an area was historically in BCVI habitat then the manager could use that figure as a goal to reach, and implement management practices accordingly.

One important caveat to allowing the landscape to dictate habitat availability, however, is that the extent to which habitat occurred historically may have little bearing on the extent to which BCVI habitat should occur currently. This is true because in an ecosystem approach to management we no longer view ecosystems as static, climax-oriented entities, but rather as shifting-mosaics which change dynamically over spatial and temporal scales. Maturity of a habitat is now best measured by energetic relationships (e.g., ratio of gross production and community respiration approximately equal to one, etc. Odum 1969) rather than by species composition. Moreover, across temporal scales, change occurs in disturbance regimes, climate, and species richness and abundance. Therefore, the likelihood is low that natural forces shaping ecosystems in the past are still functioning today.

Delineation of habitat in parklands is typically subjective, but based in part on county soil surveys and botanical surveys. Figures vary within a region since standard characterization methods were not used in early assessments (i.e.,. before 1993). It seems that delineation can only be based on observations of current populations of BCVI (habitat is where the bird occurs). Many of the parkland sites appear to have decreasing populations of BCVI but reliability of these estimates is dependent upon consistent effort over time which was often not possible. Some of the areas in some parklands, which has outgrown the BCVI, has become GCWA habitat. Waiting from one year to the next to delineate, set aside, and manage a patch of habitat could prove fatal for BCVI habitat. Estimates of existing and occupied habitat (areas with known BCVI as of 1994) is delineated on individual park maps in Appendix A.

Research has been conducted by J. Grzybowski, employees of TPWD, and personnel at *Fort Hood MR* on BCVI habitat use. Territory size and other pre-dispersal breeding season issues have been fairly well studied (Grzybowski 1995; references therein). The average territory size for an adult male (ASY) ranges from 1 to 10 ac. with most falling within 3 ac. (Tazik and Cornelius 1989). The males hold territories from late March through mid- to late August. Information is lacking, however, as to how other sex/age groups use available habitat. For instance, it would be useful to know the range of females and juveniles (post-dispersal and pre-migration), and SY males (which move within a breeding season) in order to assess

necessary patch sizes for viable populations. Juveniles move fairly freely after fledging and females occasionally follow. These movements may be associated with foraging and strengthening the juveniles for the migration. It would be useful to know more about this habitat in an attempt to increase juvenile viability and probability of return to the area (i.e., recruitment). Also, the role habitat plays in the reproductive potential of SY males is of interest. For example, the distance from outlying habitat to the main colony may be of importance to SY males to the extent that they can be involved in testing their territory acquisition and mate attraction skills. Future habitat research should focus on these issues.

Little information is available for recommending patch size for the BCVI with the exception of Pease and Gingerich (1989). Their viability estimates for BCVI population size is the goal set by the 1991 USFWS recovery plan: 500 to 1,000 pairs per region. Their work focused on patch size, relation to other patches, and minimum viable populations of BCVI (and GCWA) near Austin, Texas. Some inferences drawn from this work can be made useful on TPWD parklands. For example, they suggest that for populations to be considered distinct (non-interacting, non-competing), the separating distance between/among populations must be 5 to 10 km. For each metapopulation (see Pulliam 1988, Primack 1993:253, Meffe et al. 1997) of BCVI, they recommend 50,000 ha to 350,000 ha to allow for recruitment. For preserves of 50,000 ha, all area within the preserve should be protected to prevent fragmentation. Within each preserve, less than 5% of the area of the preserve should be within 100 m of the preserve boundary or any road or internal human disturbance to minimize predation and parasitism. These preserve area estimates are not practical for current TPWD management considering the amount of land available. Building relationships with adjacent private landowners and implementing conservation agreements or other collaborations (e.g., Landowner Incentive Program) should assist in establishment of viable metapopulations of BCVI.

The GCWA habitat issue is tied closely to BCVI habitat in some parks which contain both BCVI and GCWA. GCWAs nest in dense forests and woodlands ("brakes") dominated by mature juniper (*Juniperus ashei*) and various deciduous species, usually plateau live oak (*Quercus fusiformis*), Texas oak (*Q. buckleyi*), shin oak (*Q. sinuata* var. *breviloba*), and other hill country species (Pulich 1976, Kroll 1980, Wahl et al. 1990). This habitat overlaps with advanced seral stage BCVI habitat over much of the BCVI's central, eastern and northern range. In some parks, the BCVI habitat has overgrown to the point where it provides understory for GCWA habitat and is no longer useful for the BCVI. Restoration of BCVI habitat in these areas will be a matter of deciding what constitutes "take" under the Endangered Species Act (1973) of GCWA habitat and following appropriate consultation and mitigation measures. In some instances, BCVI habitat restoration may not be practical. BCVI may have abandoned the area completely and/or the potential restoration may not provide adequate habitat to "lure" a viable population back to the area. Each park with historical or current BCVI will be assessed individually.

Another option for increasing TPWD's BCVI habitat is acquisition of new properties, joint management with cooperating agencies, and establishment of a private landowners cooperative network. Recently, TPWD has purchased approximately 5000 ac. of GCWA, and possibly BCVI, habitat in Bexar county (Government Canyon SNA). Other areas known by researchers should be suggested as potential TPWD acquisitions in order to provide for expansion of existing BCVI populations. The Nature Conservancy of Texas owns property adjacent to Devil's River SNA, called Dolan Falls Ranch Preserve. This land is known to provide BCVI habitat and

harbor a maximum of approximately 50 adult birds during the breeding season (Farquhar and Maresh 1996).

In summary, the decision to manage for BCVIs on TPWD parklands should be based upon knowledge of the biology and ecology of the local population. Factors such as habitat quality and availability, reproductive success, mortality, and dispersal are important elements to consider when planning a management approach. Figures are available for use as goals toward which management practices may be directed, but these are subject to change as new data become available. Ultimately, there is some level of subjectivity which enters into the equation, especially when faced with a scarcity of data. In such cases, one has to rely upon an "instinctual" feel, but this does not render the manager unaccountable for unanticipated negative results.

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APPENDIX A

MAPS OF TEXAS PARKS AND WILDLIFE DEPARTMENT PARKLANDS SURVEYED FOR BLACK-CAPPED VIREOS

(CONNALLY 1993)

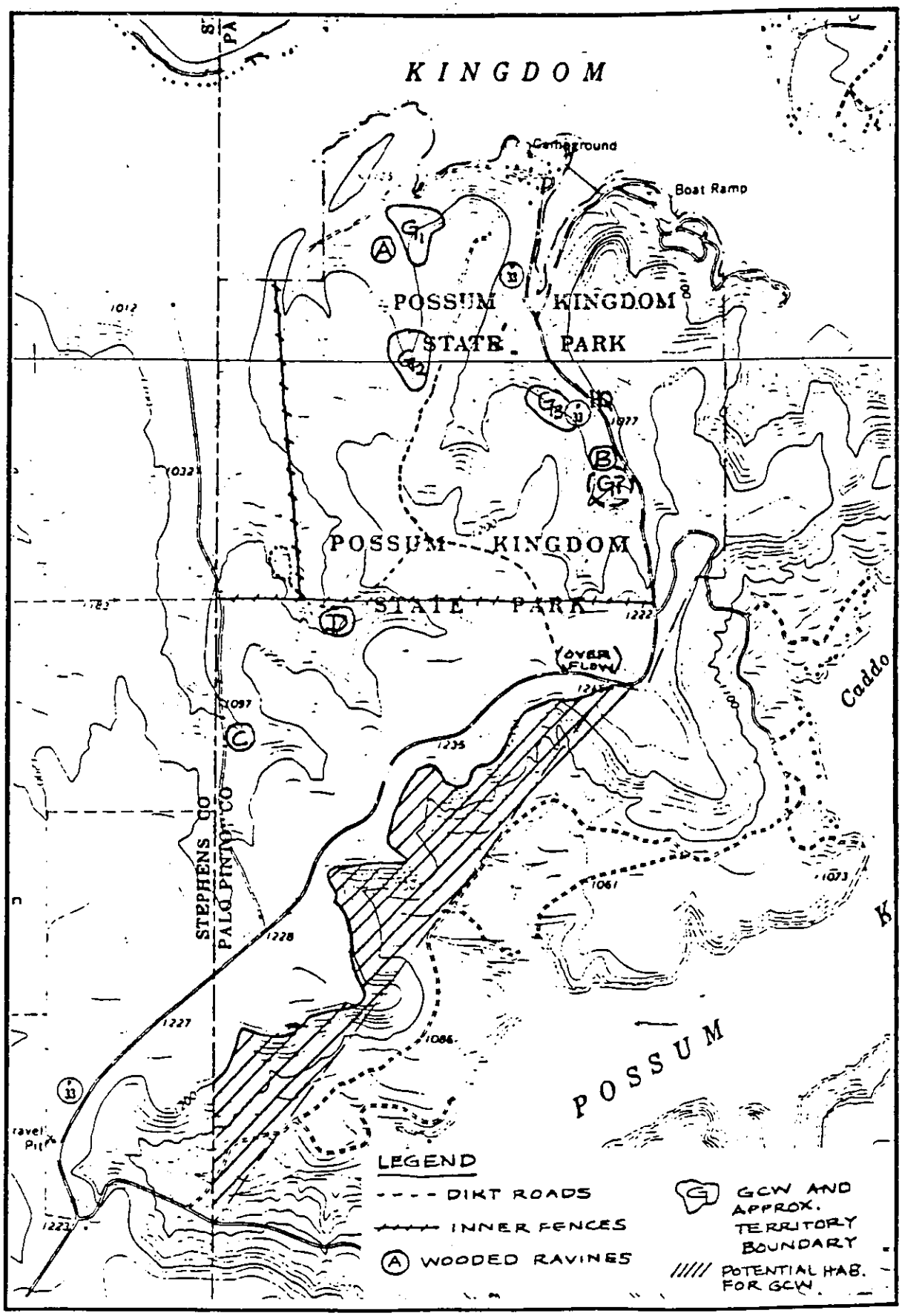


Figure A-1. Possum Kingdom SP

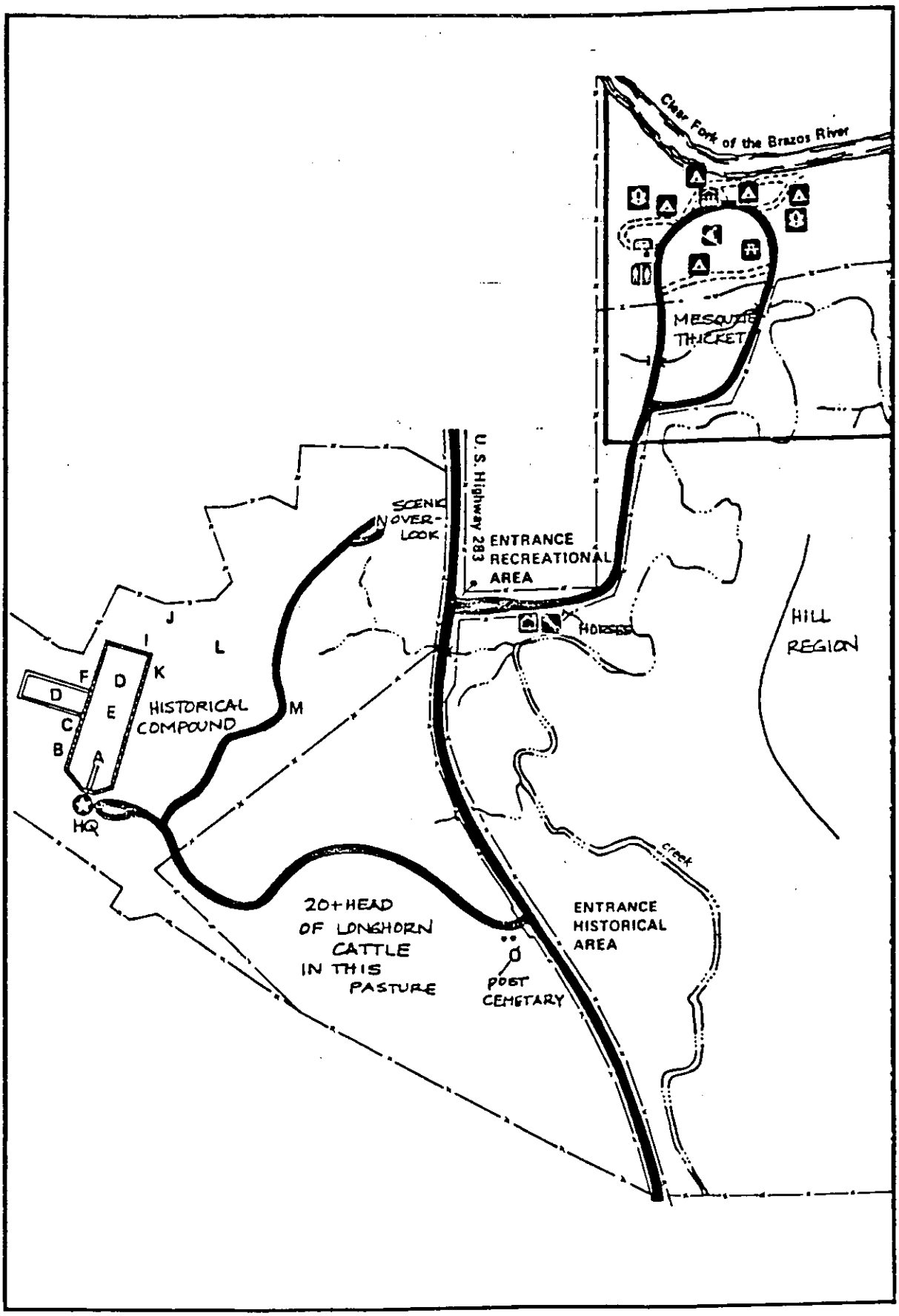


Figure A-2. Fort Griffin SP

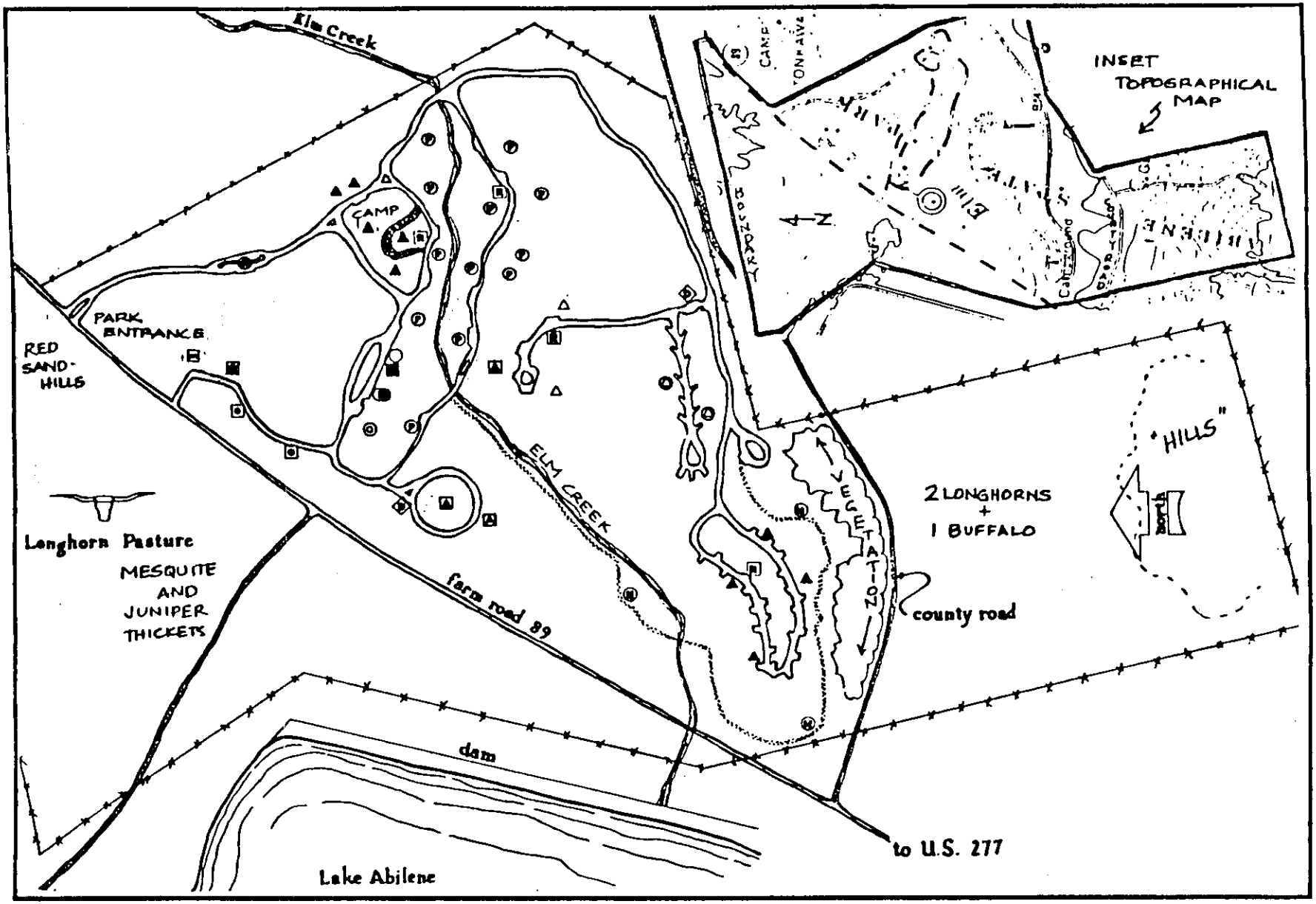


Figure A-3. Abilene SP

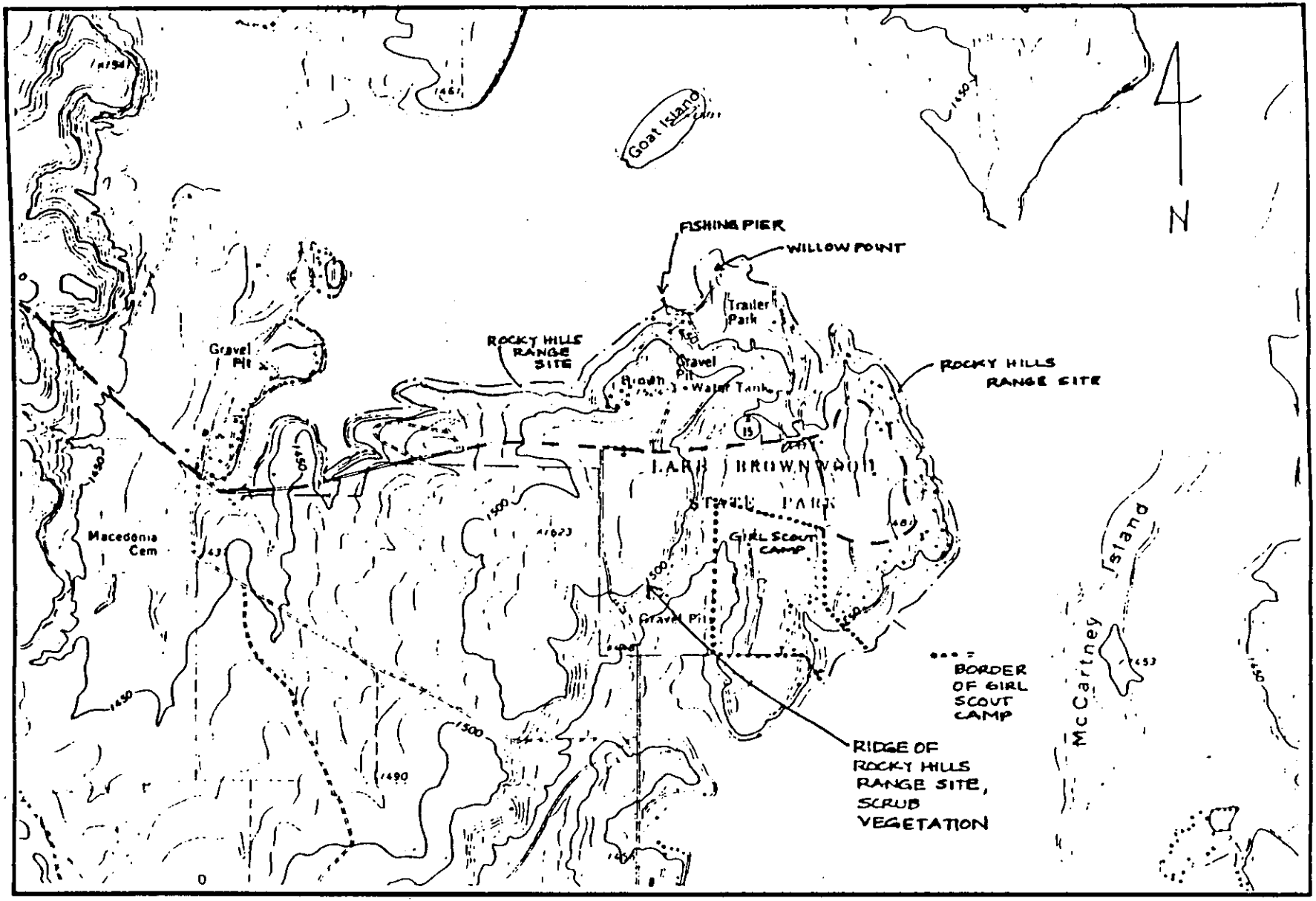


Figure A-4. Lake Brownwood SP

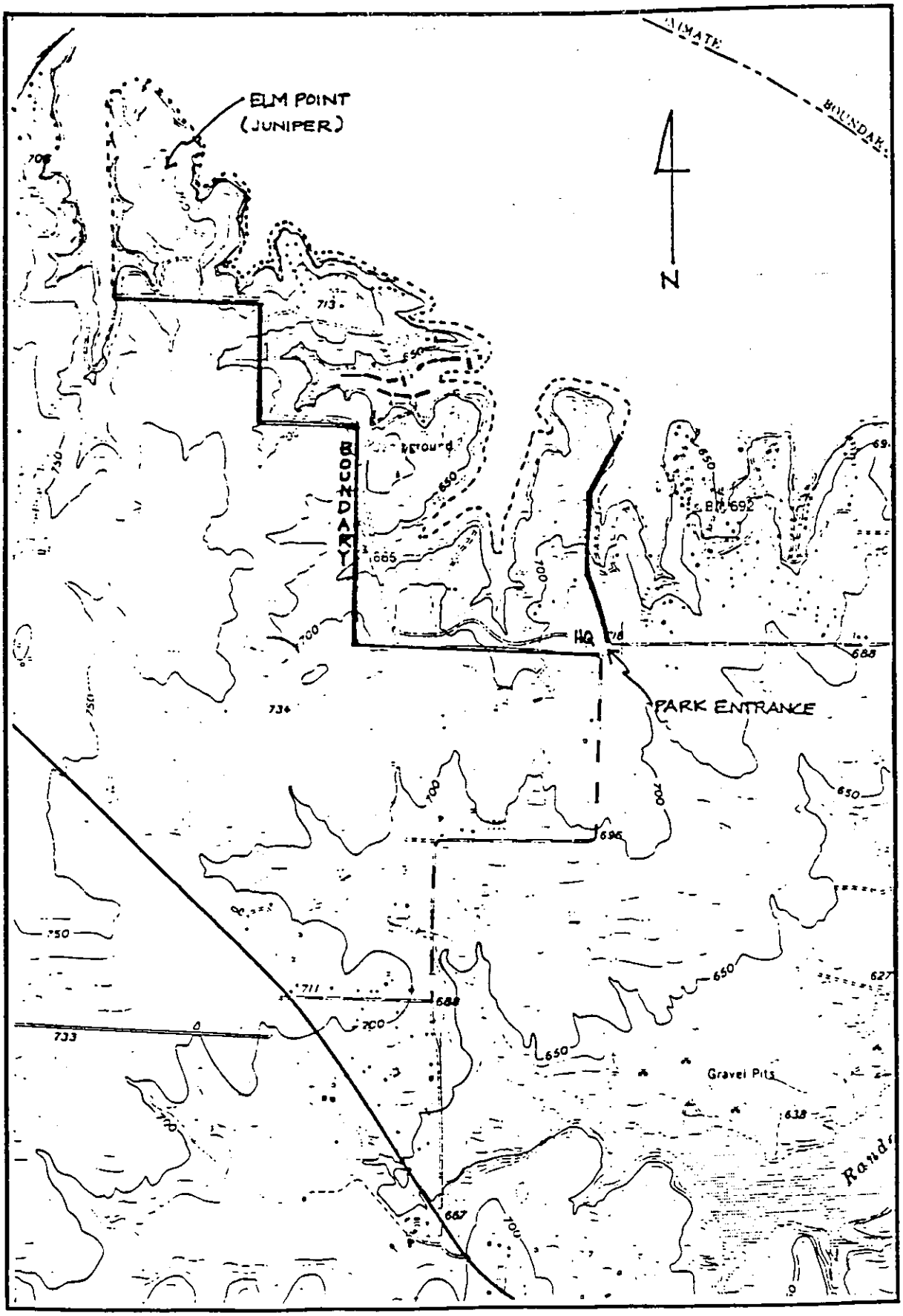
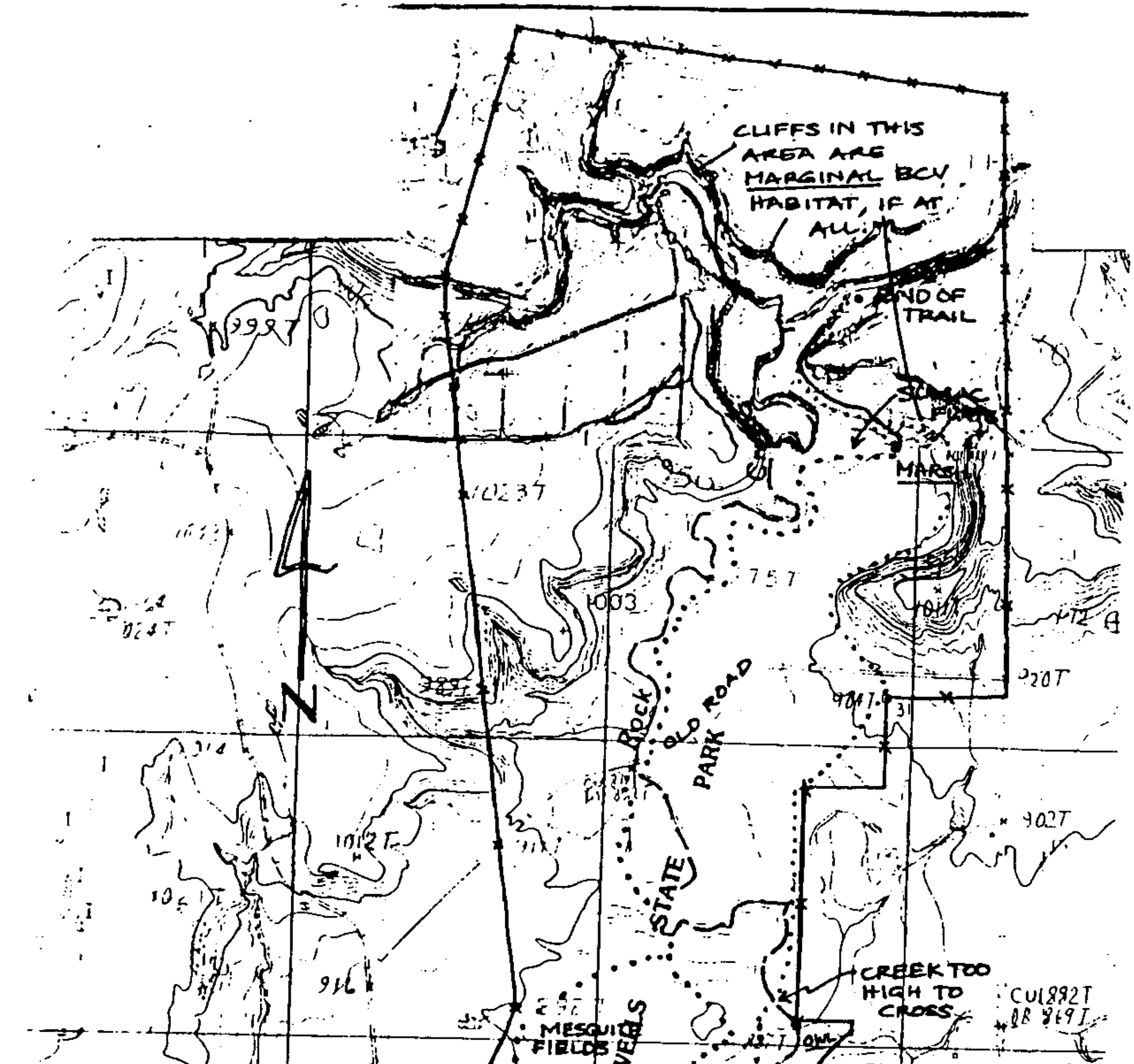


Figure A-5. Eisenhower SP



CLIFFS IN THIS AREA ARE MARGINAL BCV HABITAT, IF AT ALL.
END OF TRAIL
MARSH
OLD ROAD
ROCK
PARK
STATE
WELLS
MINERAL
LAKE
CREEK
MESQUITE FIELDS
CREEK TOO HIGH TO CROSS
•••• = HORSE AND HIKING TRAIL SYSTEM

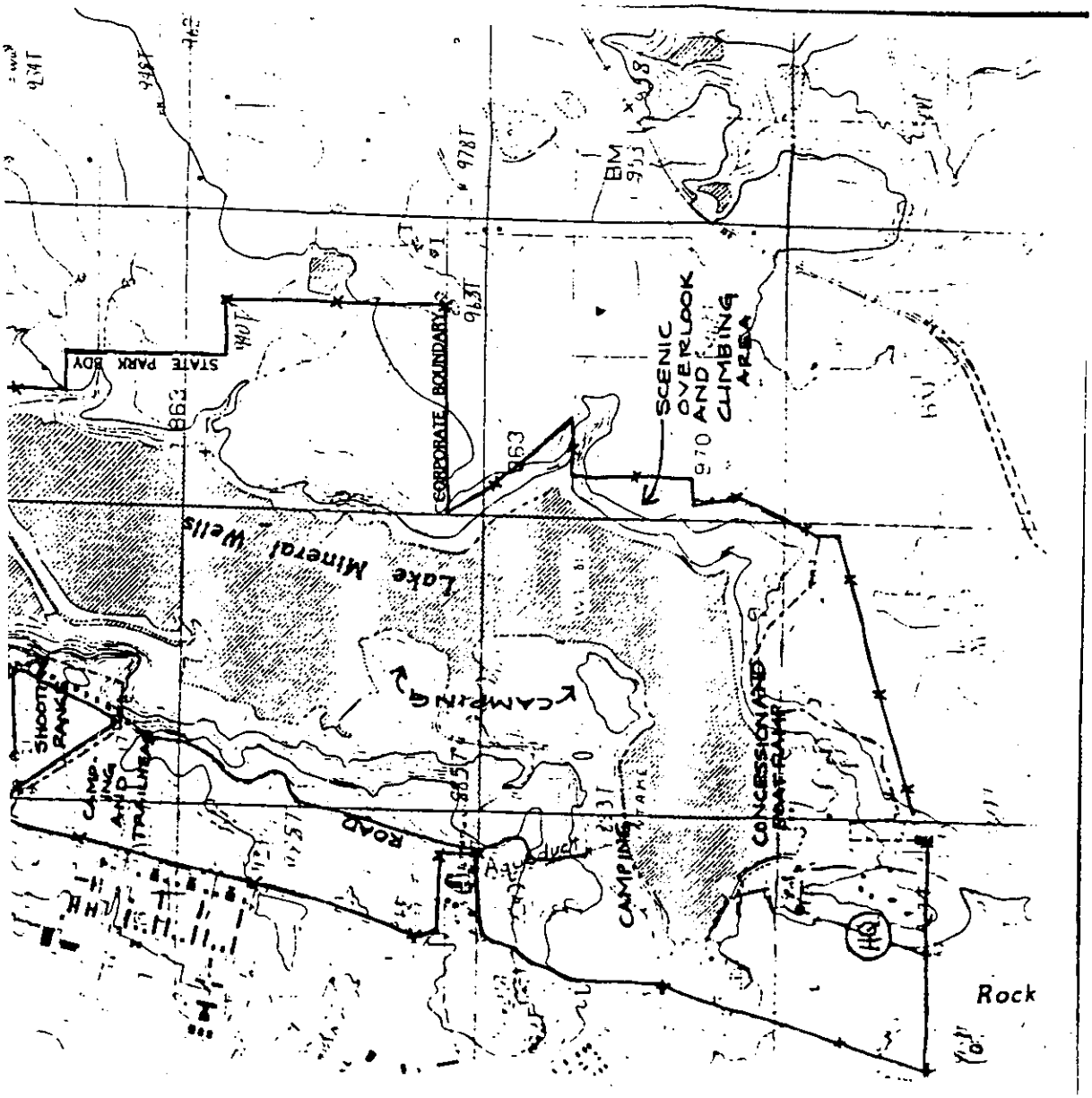


Figure A-6. Lake Mineral Wells SP

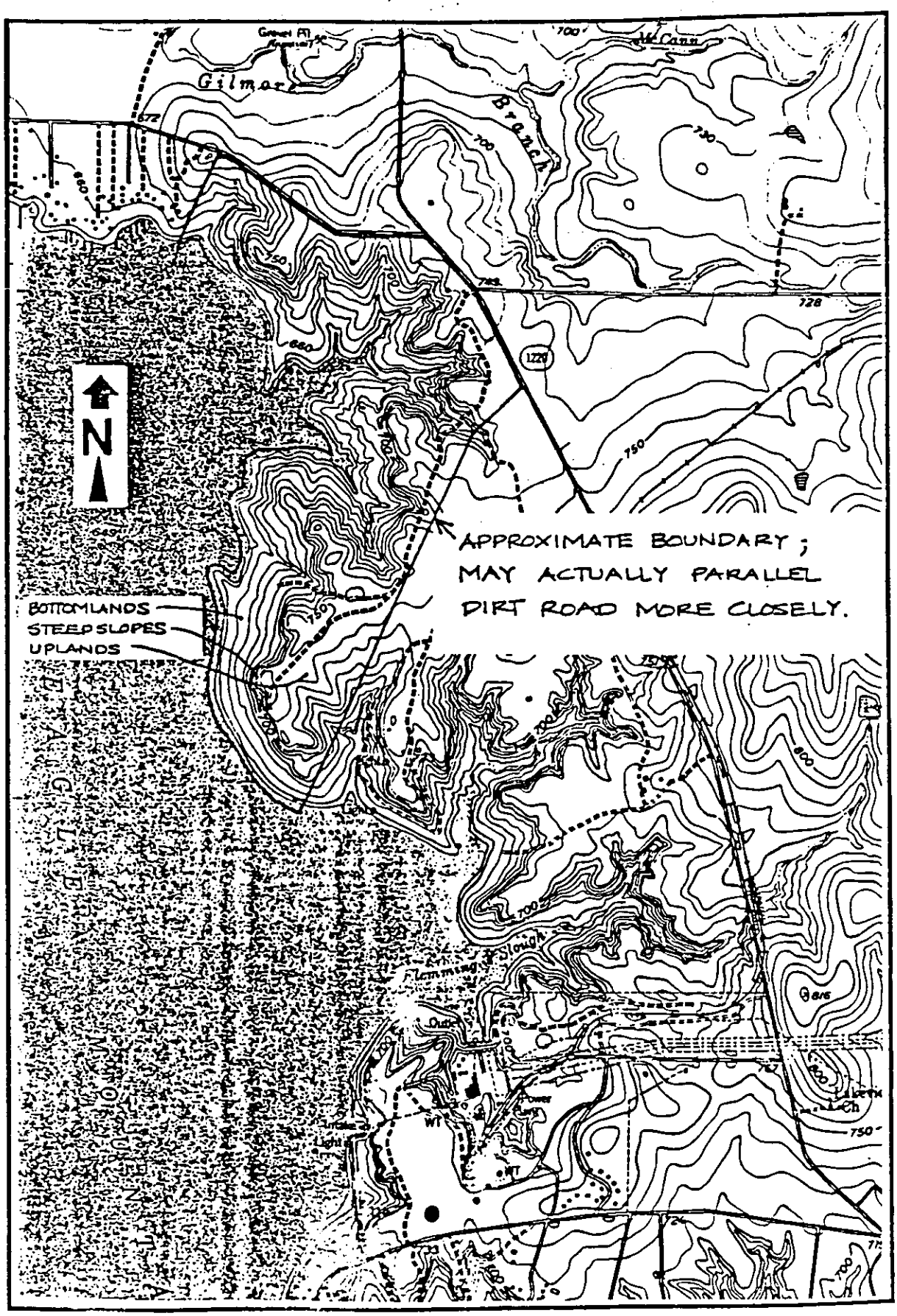
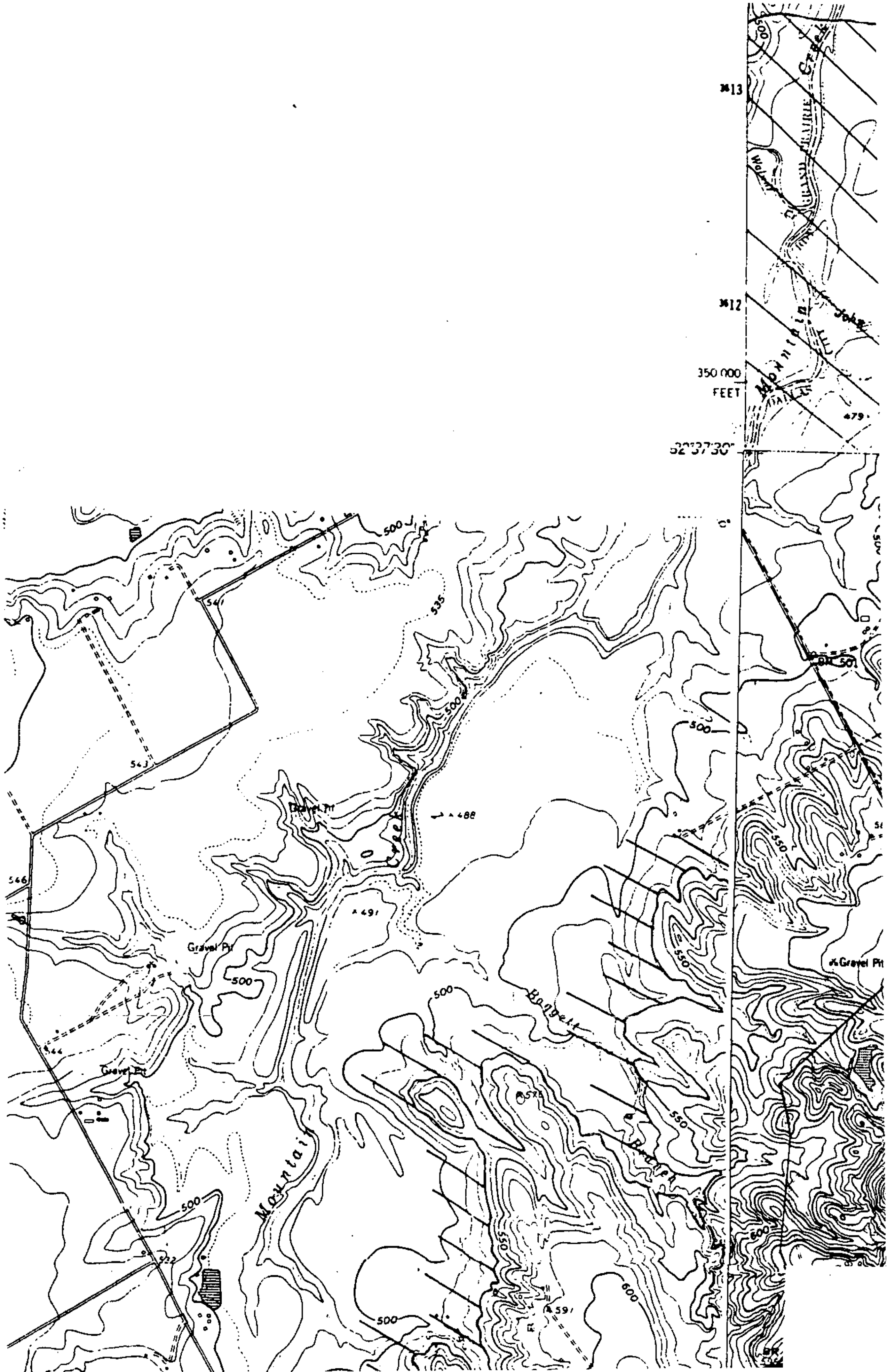


Figure A-7. Eagle Mountain Lake SRA


350 000
FEET
Mountain
Creek
Gravel Pit
Gravel Pit
Gravel Pit
500
550
600

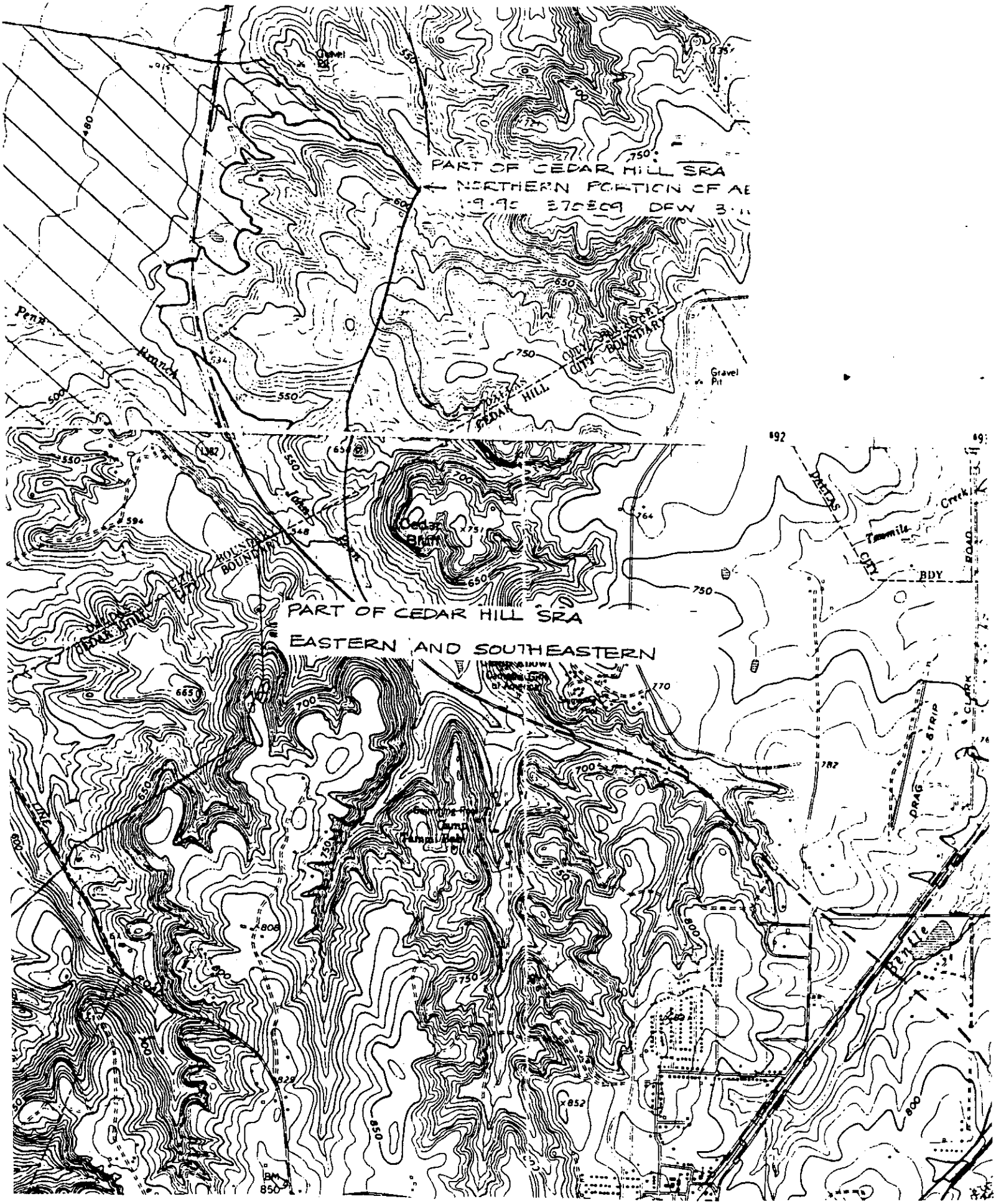


Figure A-8. Cedar Hill SP

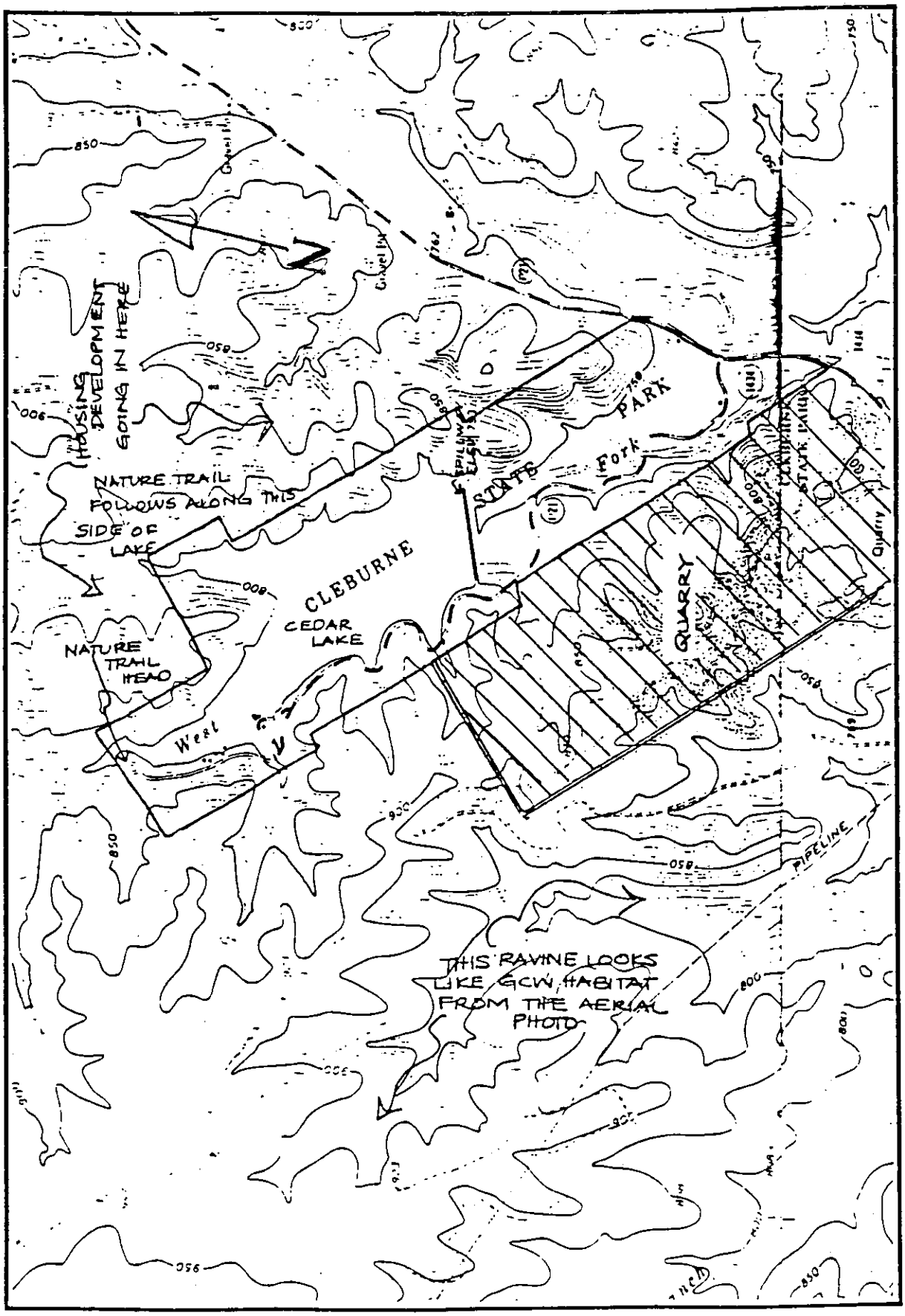


Figure A-9. Cleburne SP

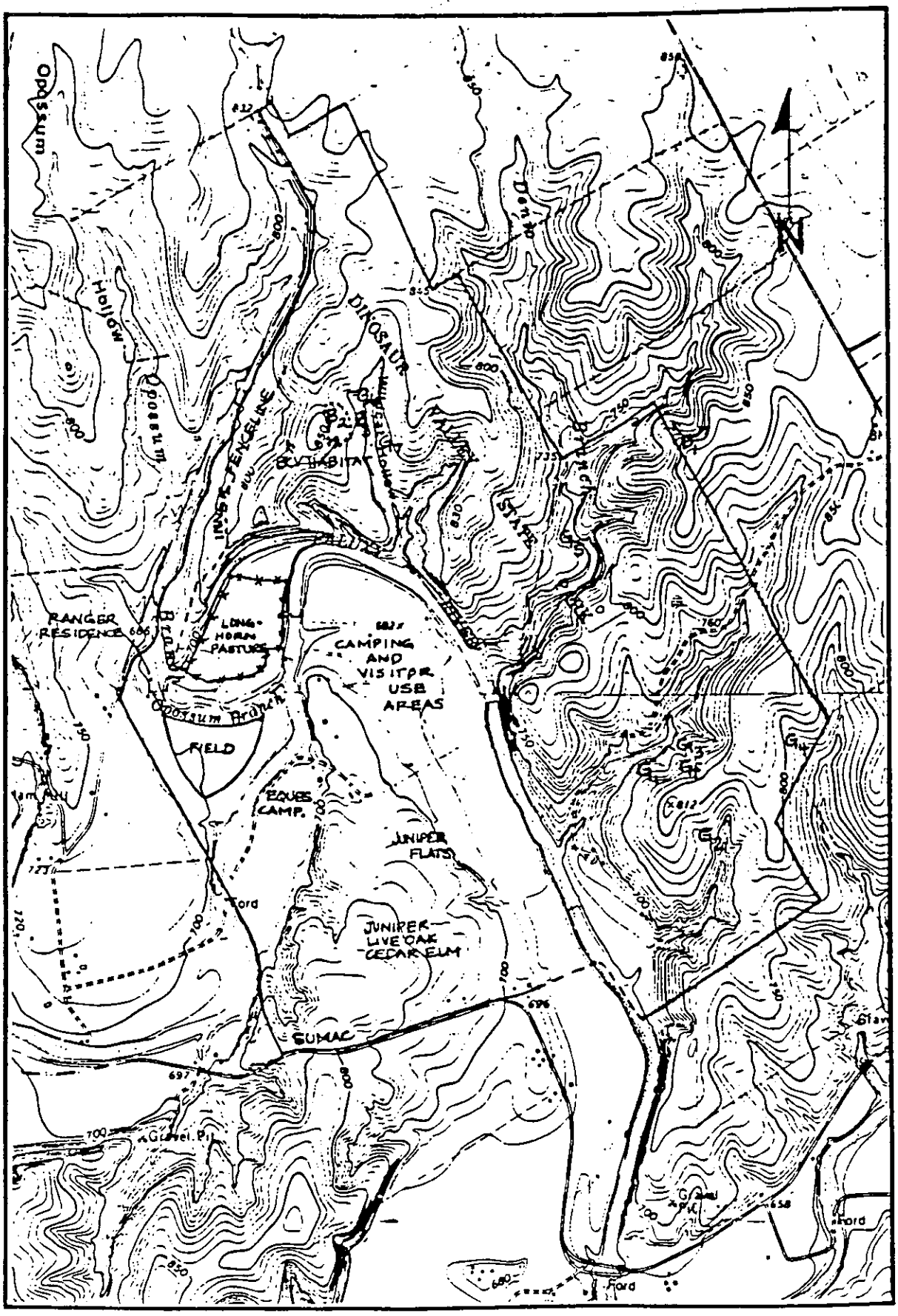


Figure A-10. Dinosaur Valley SP

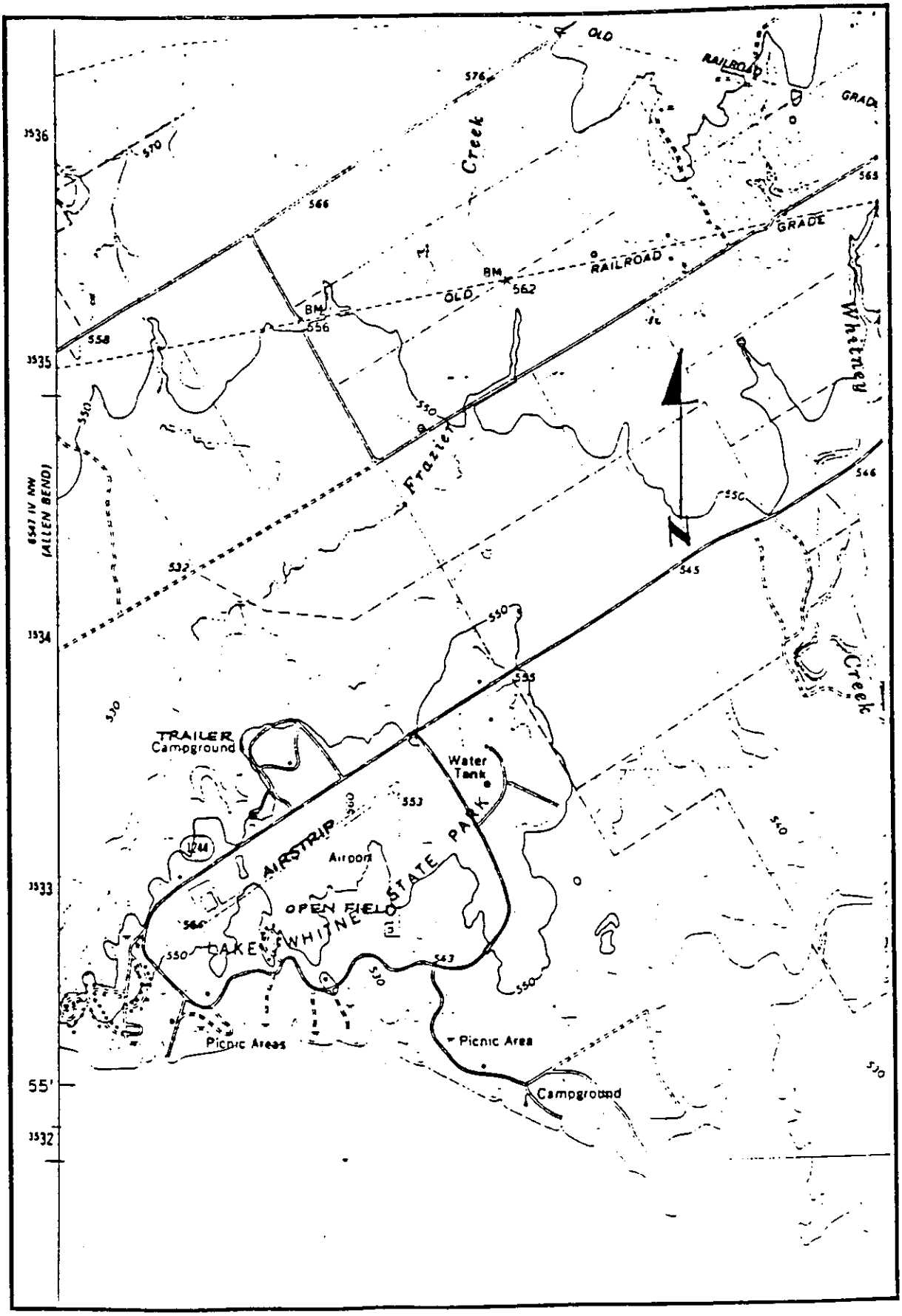


Figure A-11. Lake Whitney SP

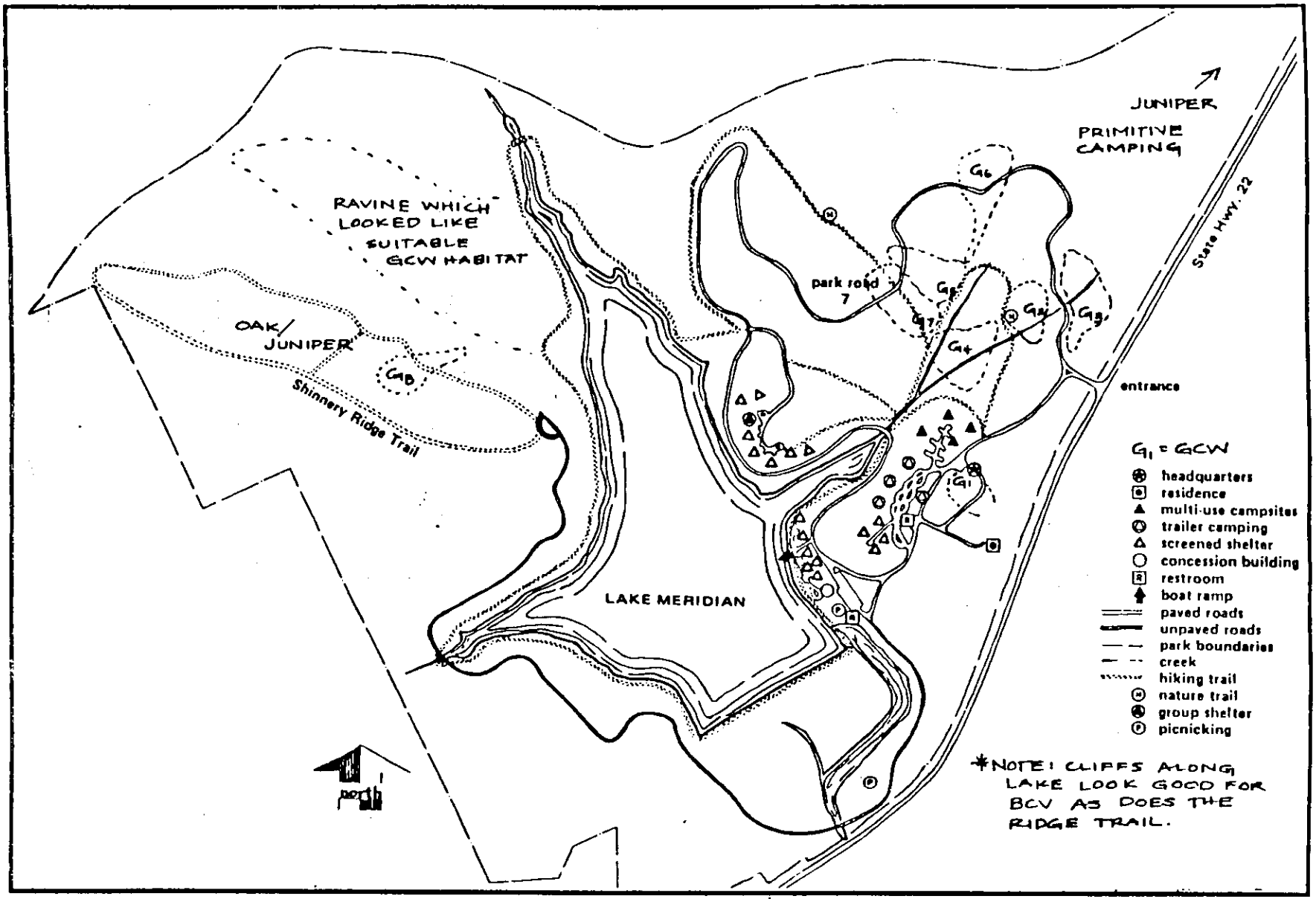


Figure A-12. Meridian SP

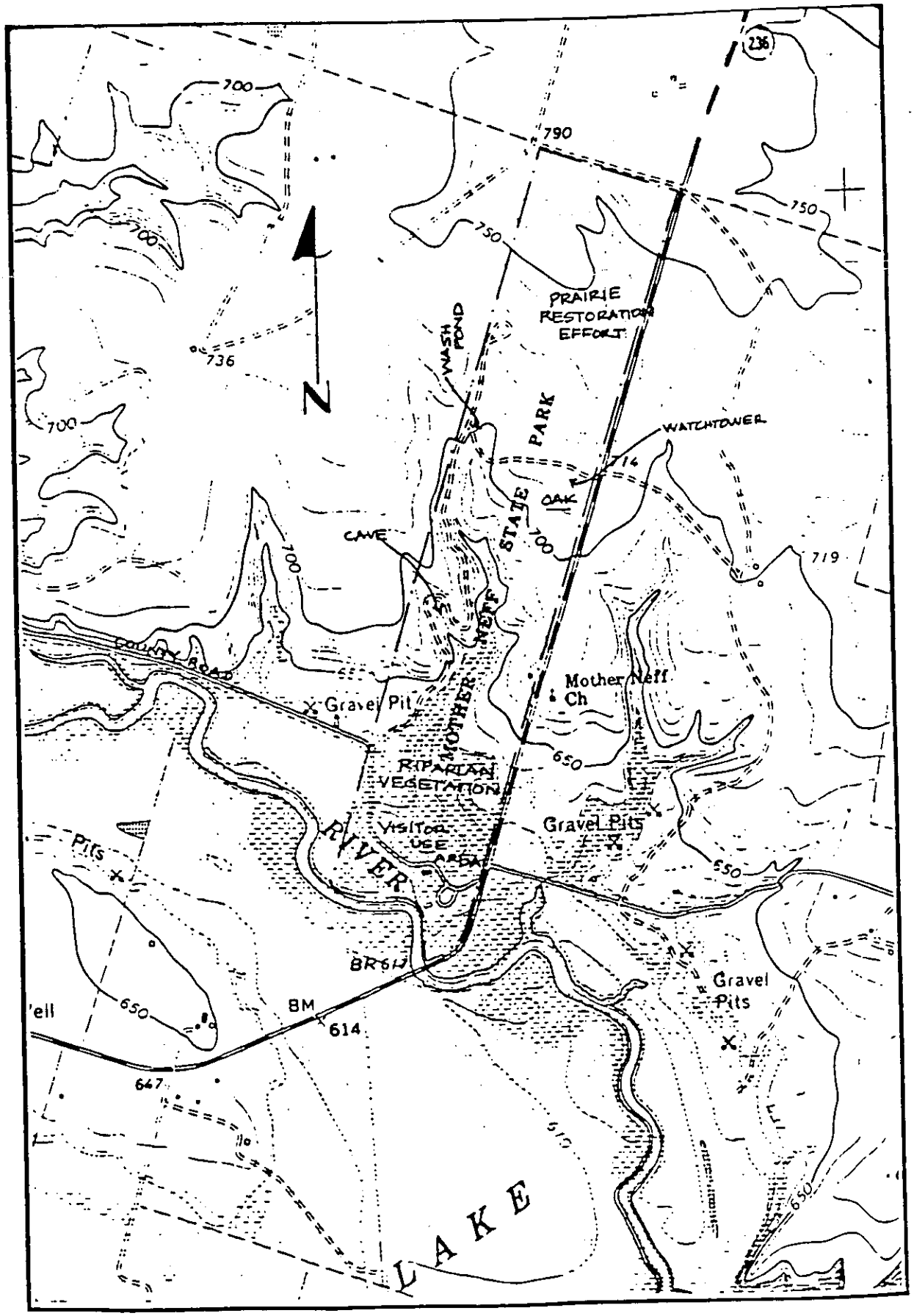


Figure A-13. Mother Neff SP

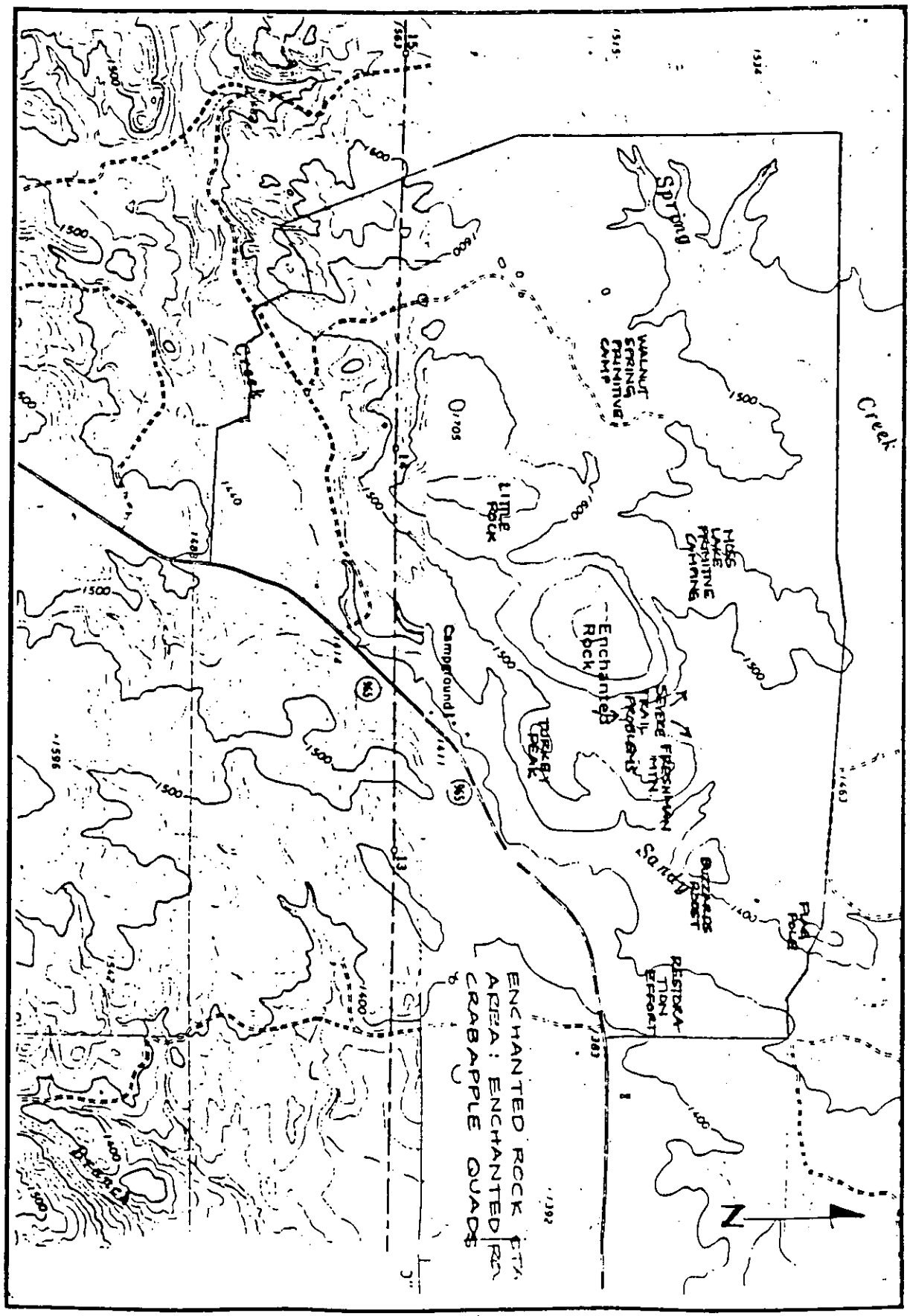


Figure A-14. Enchanted Rock SP

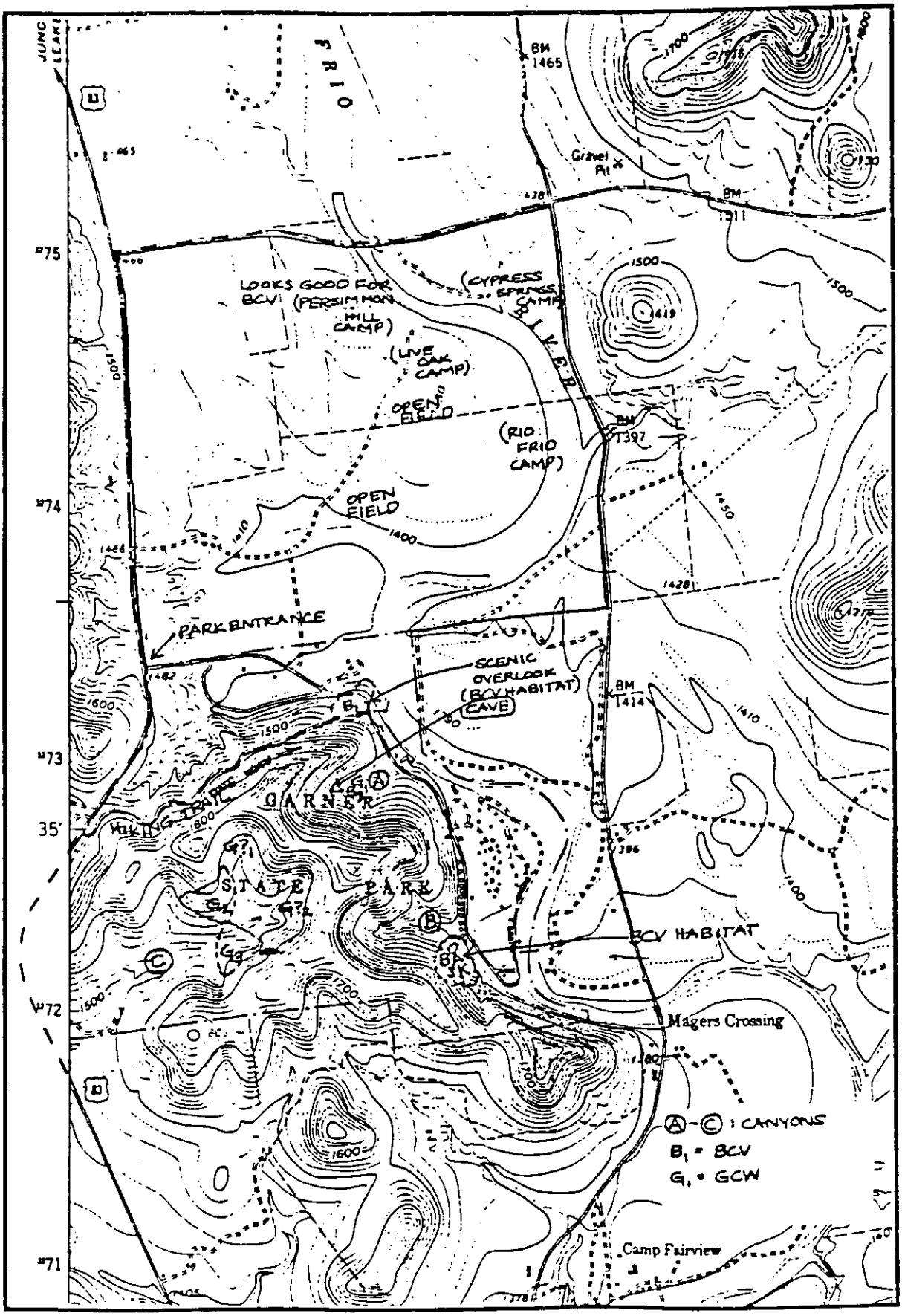


Figure A-15. Garner SP

1993 BCV OBSERVATIONS

LEGEND

—— TERRITORY BOUNDARY

- - - - BOUNDARIES NOT DEFINED (TERR. 41, 42, & 43)

FEMALES PRESENT IN TERR.'s : 1, 3, 5, 7, 14, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 32, 34, 35, 44, 45, 46, 48, 49.

SEEN ONLY ONCE = INDIVIDUALS 25, 33, 37, 38

HILL COUNTRY STATE NATURAL AREA

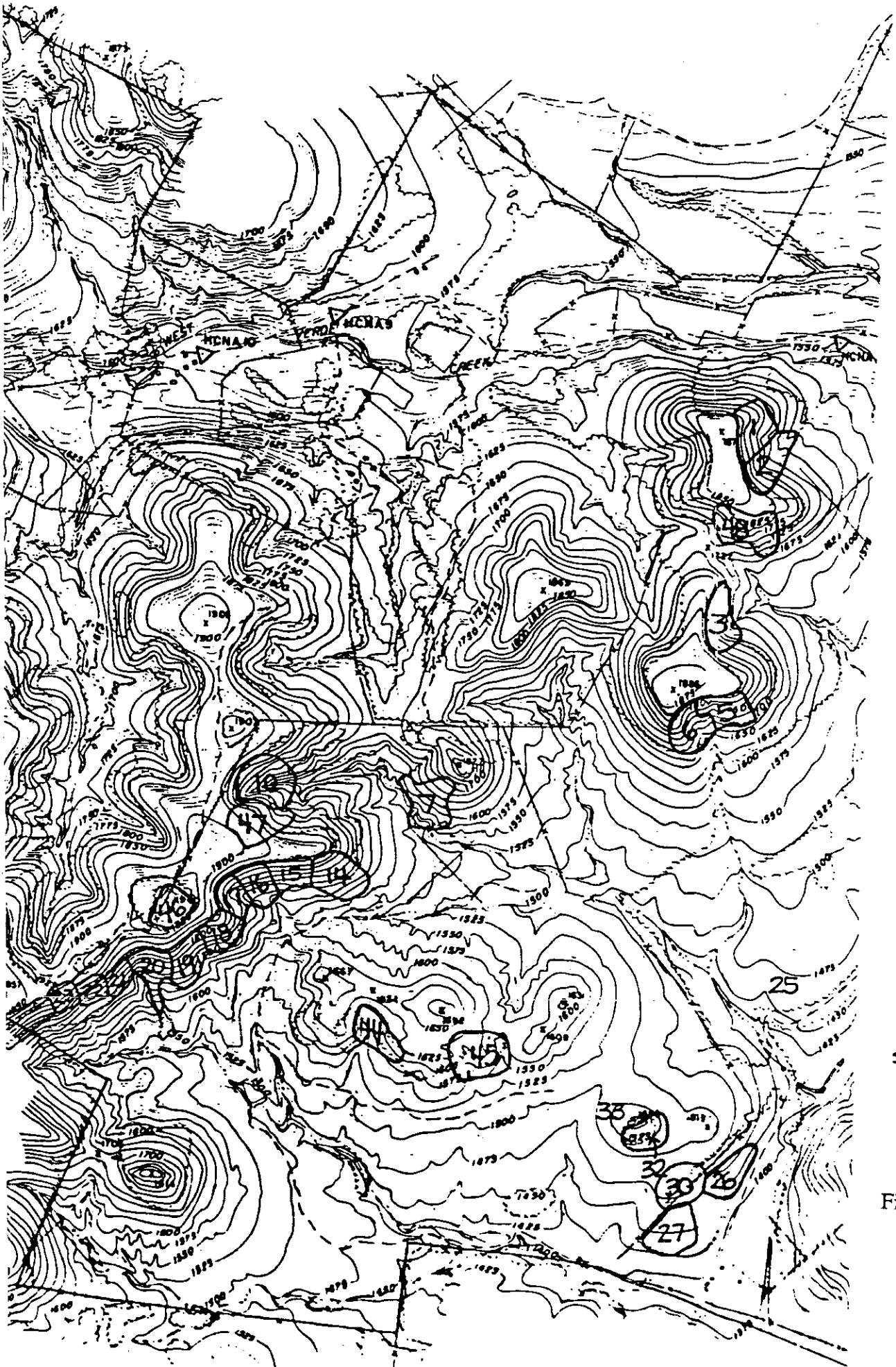


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Figure A-16. Hill Countr

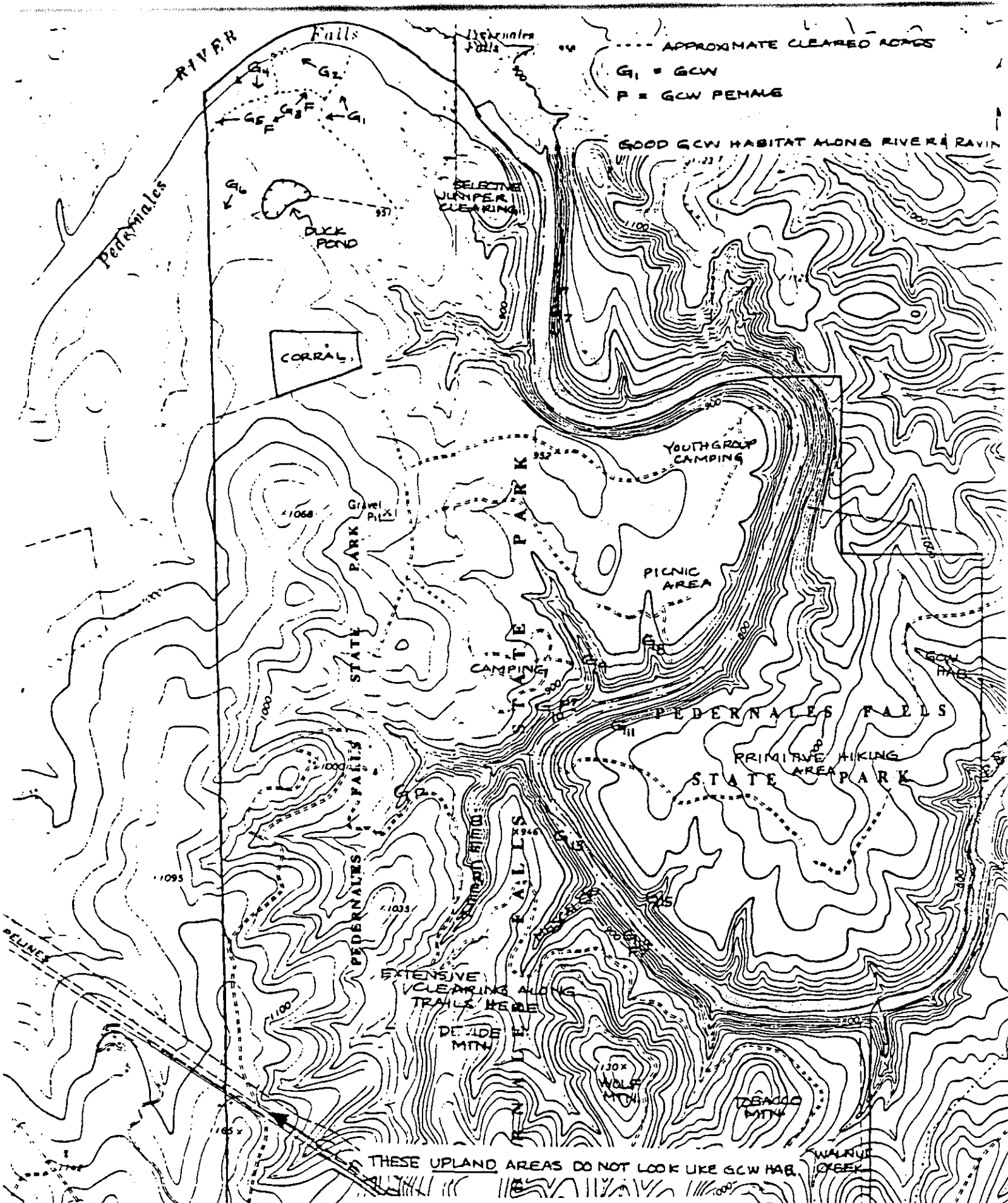


Figure A-17. Pedernales Falls SP

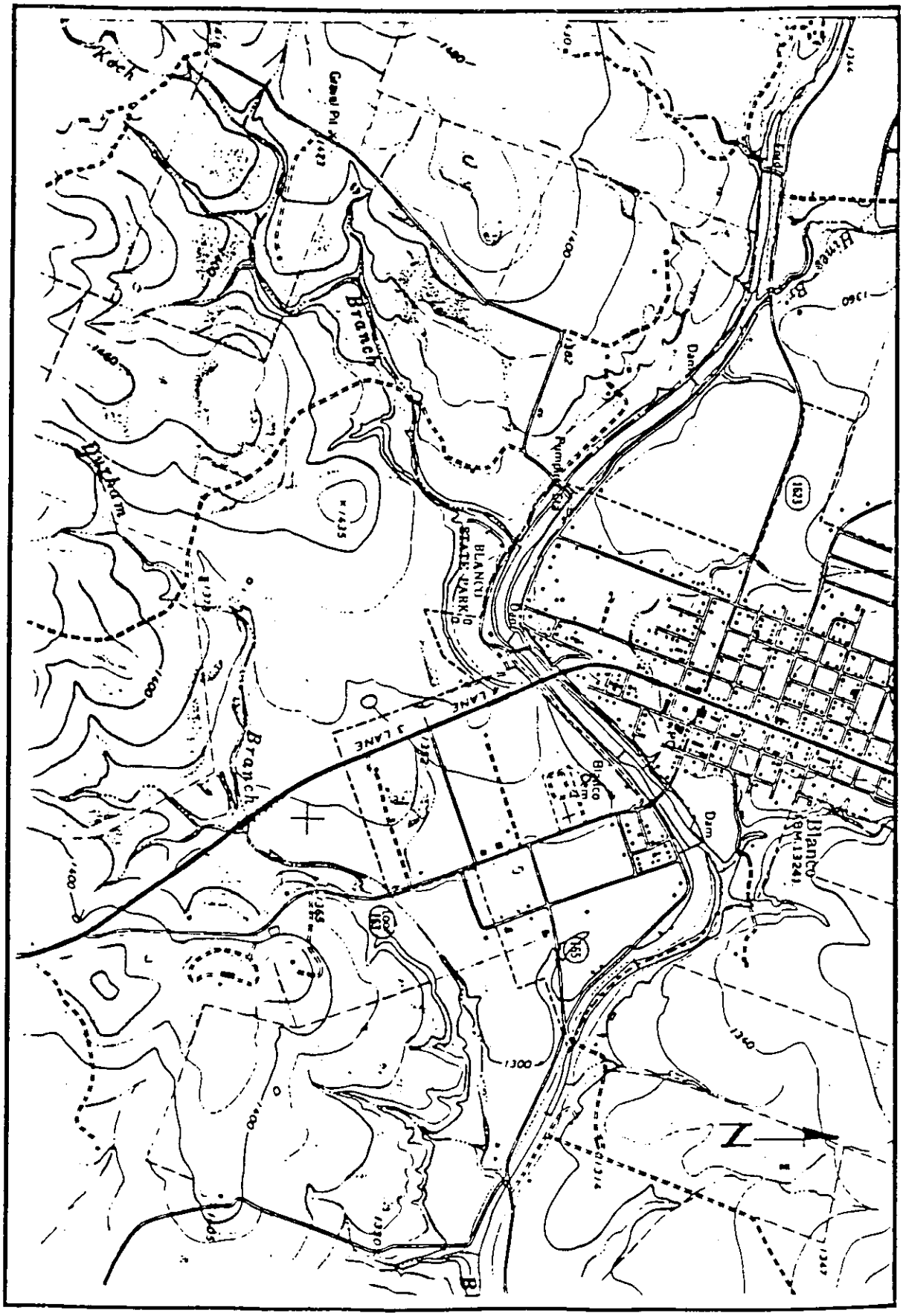


Figure A-18. Blanco SRA

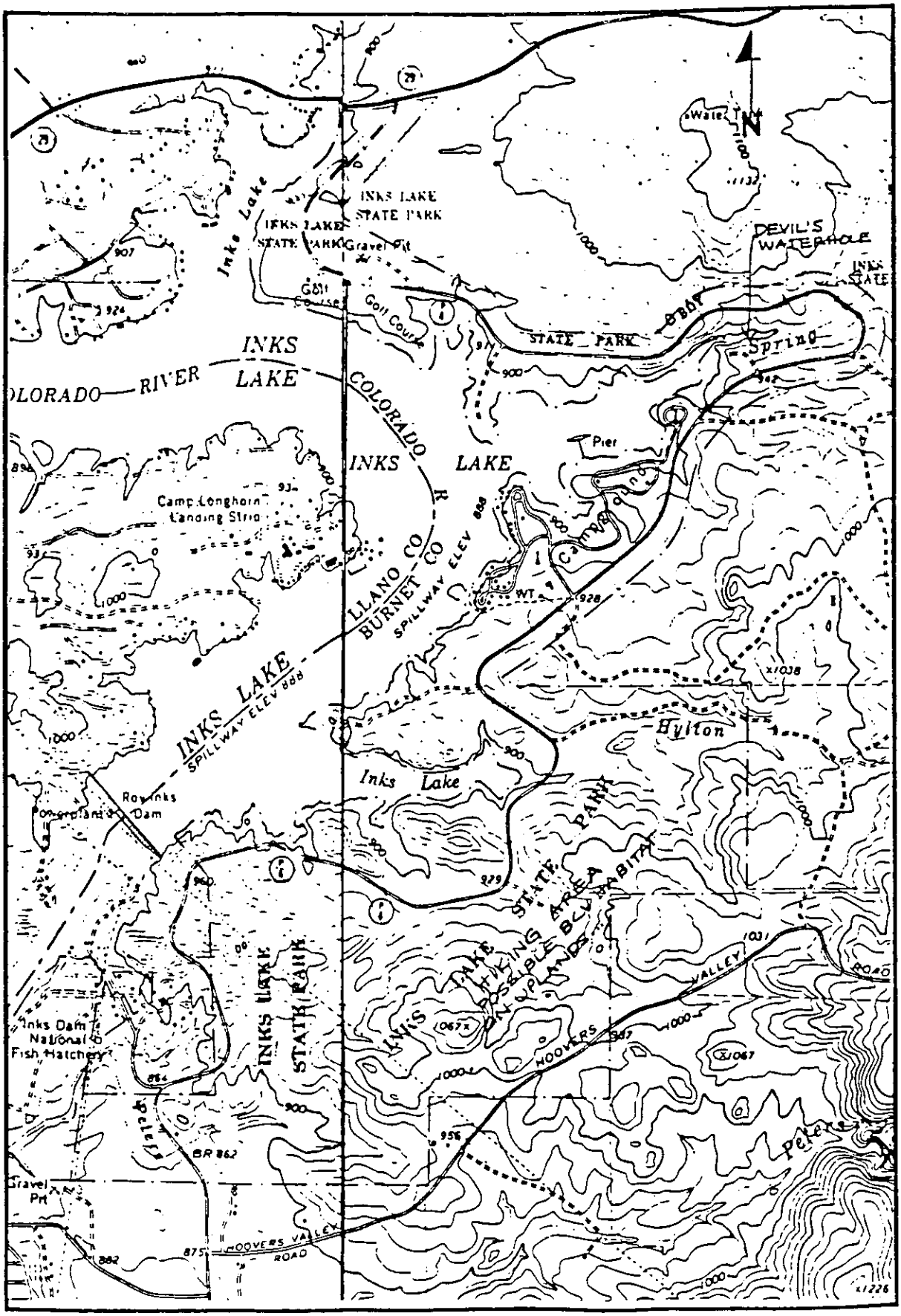


Figure A-19. Inks Lake SRA

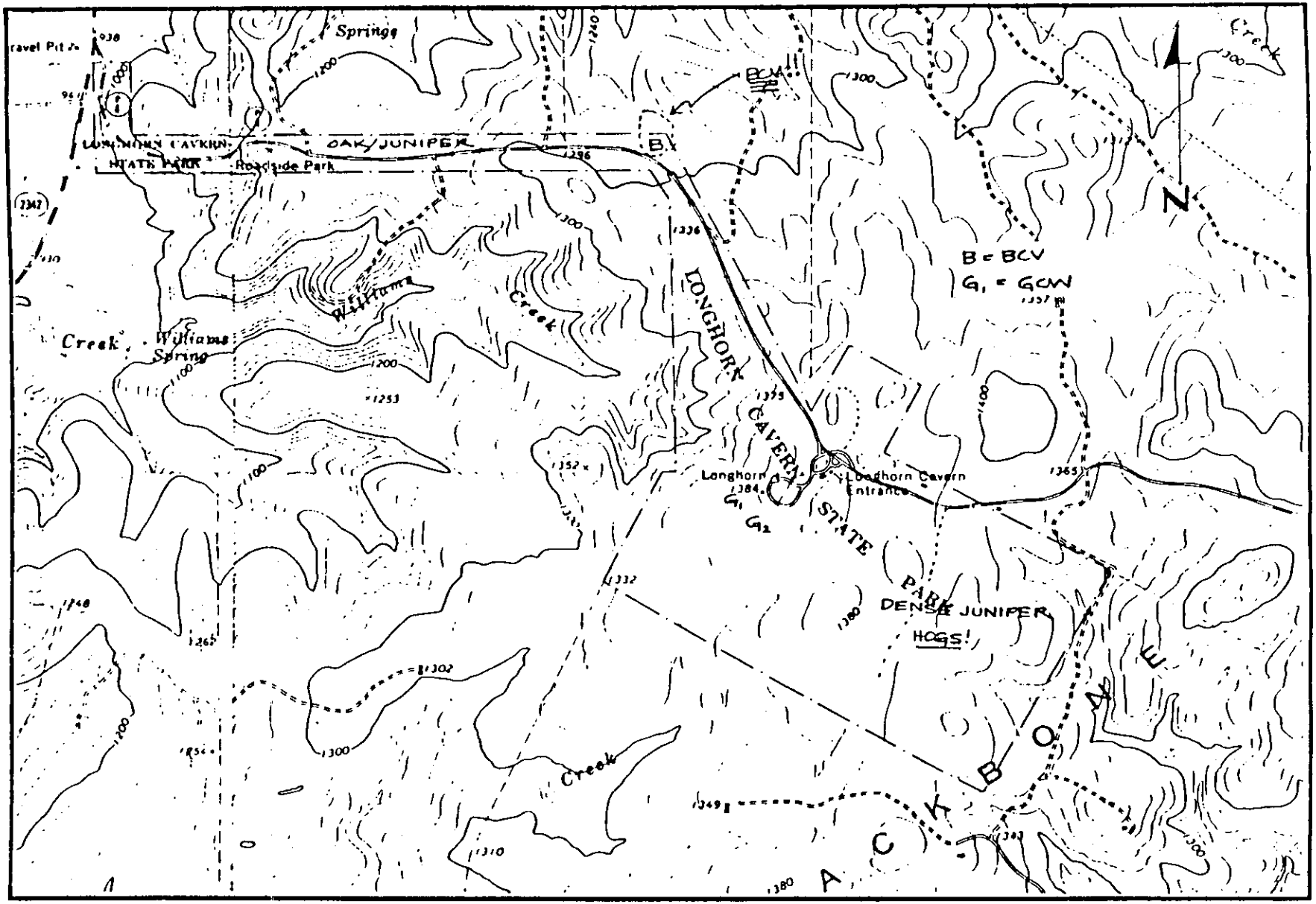


Figure A-20. Longhorn Caverns

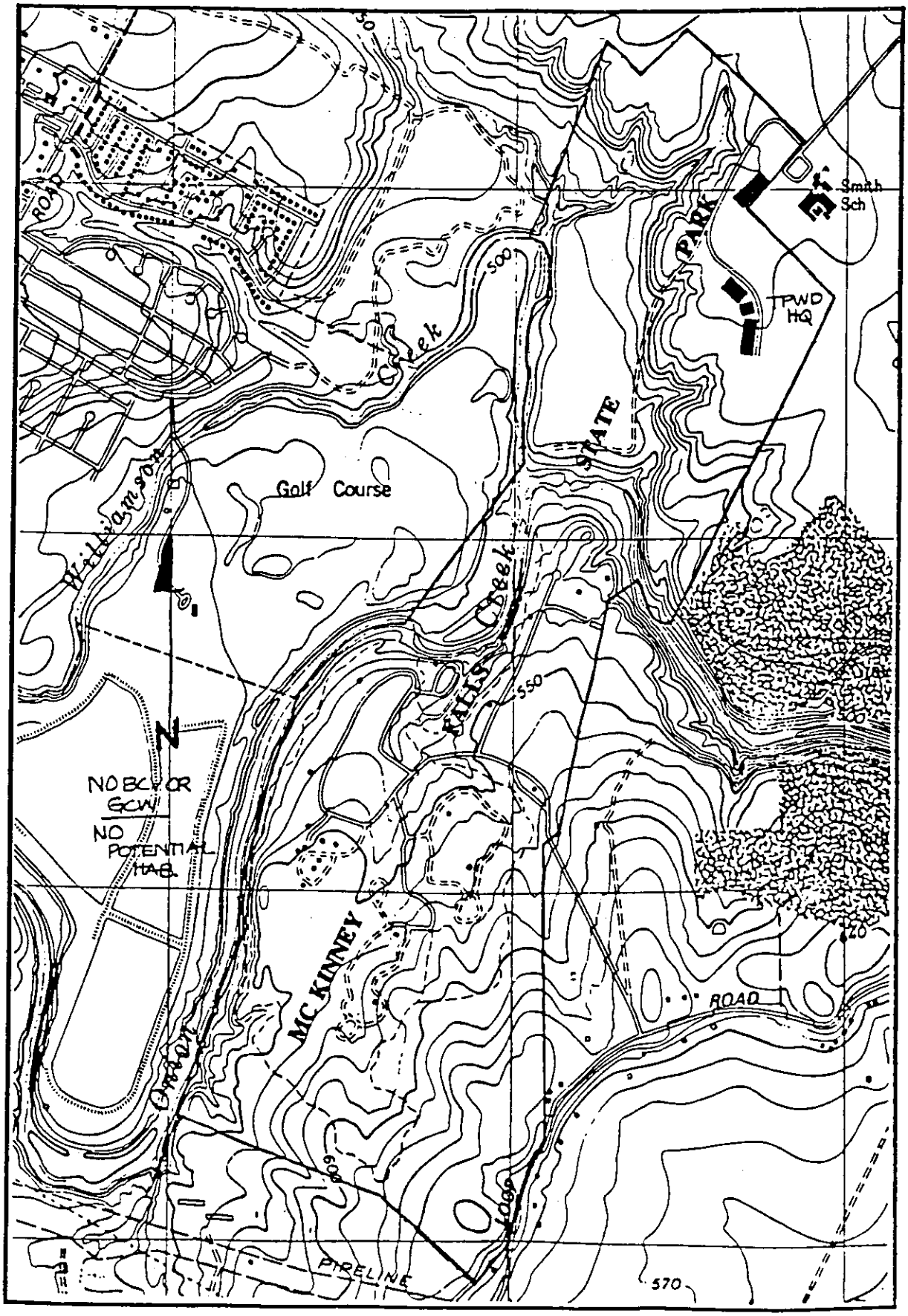
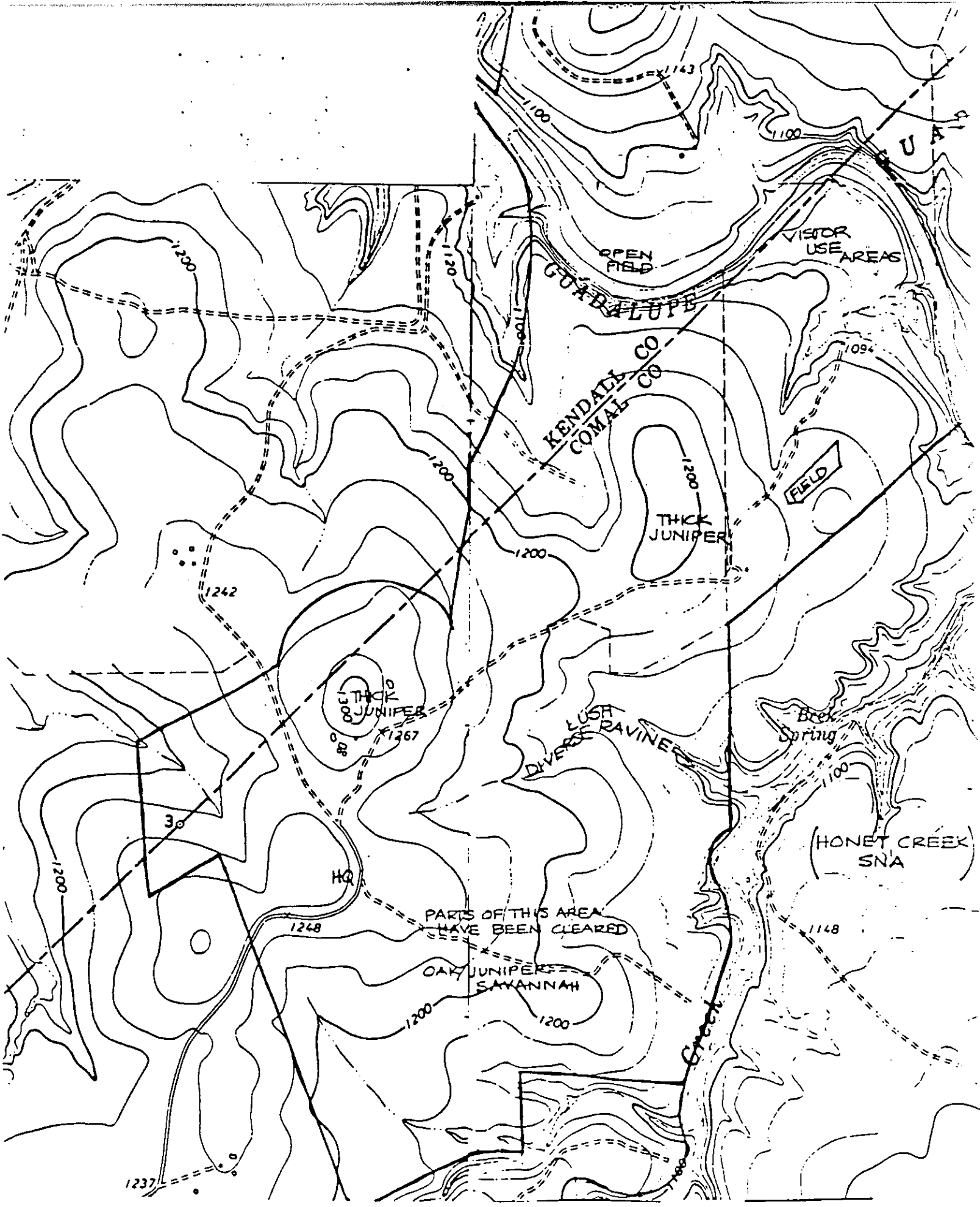


Figure A-21. McKinney Falls SP



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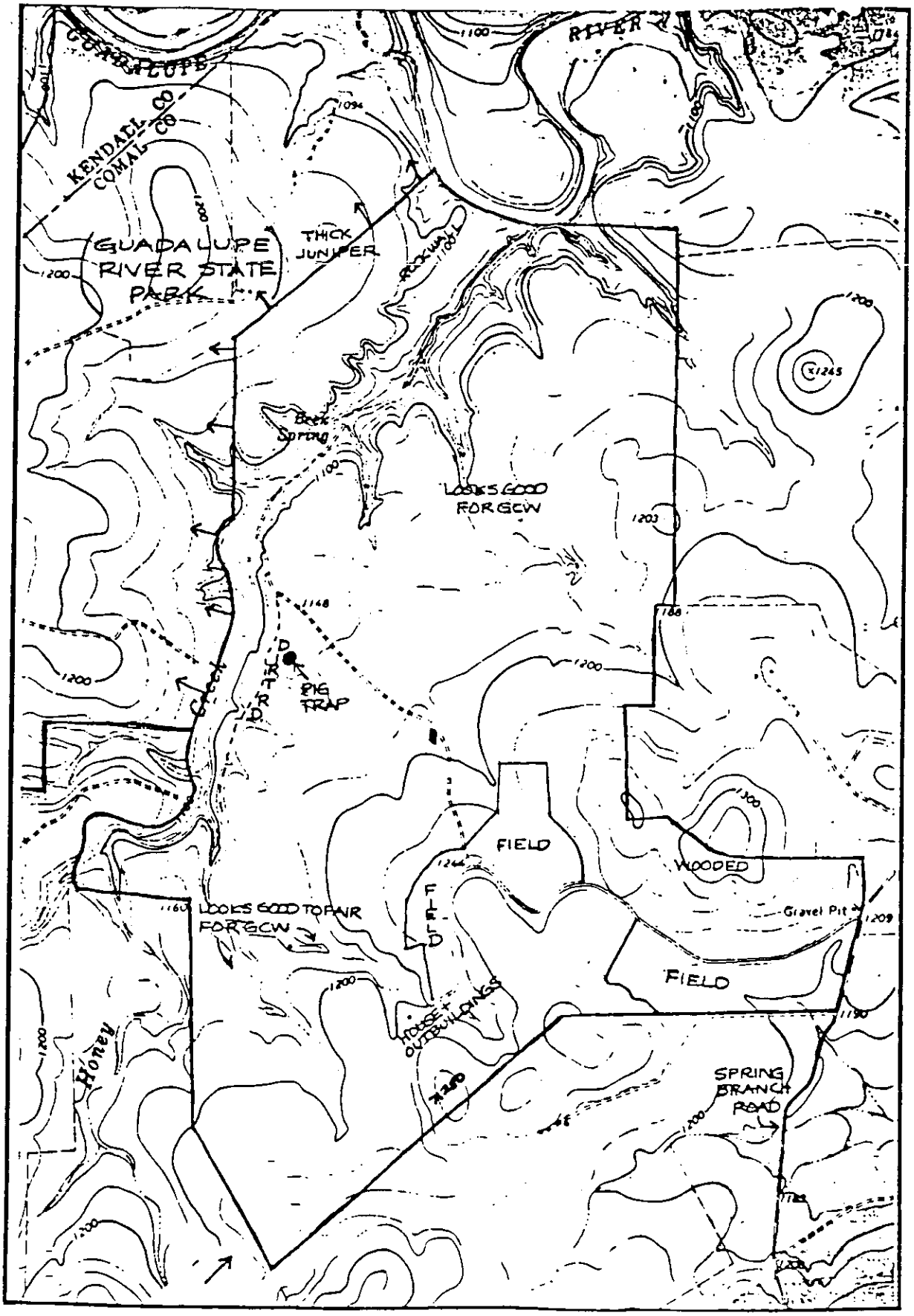

Figure A-23. Honey Creek SNA

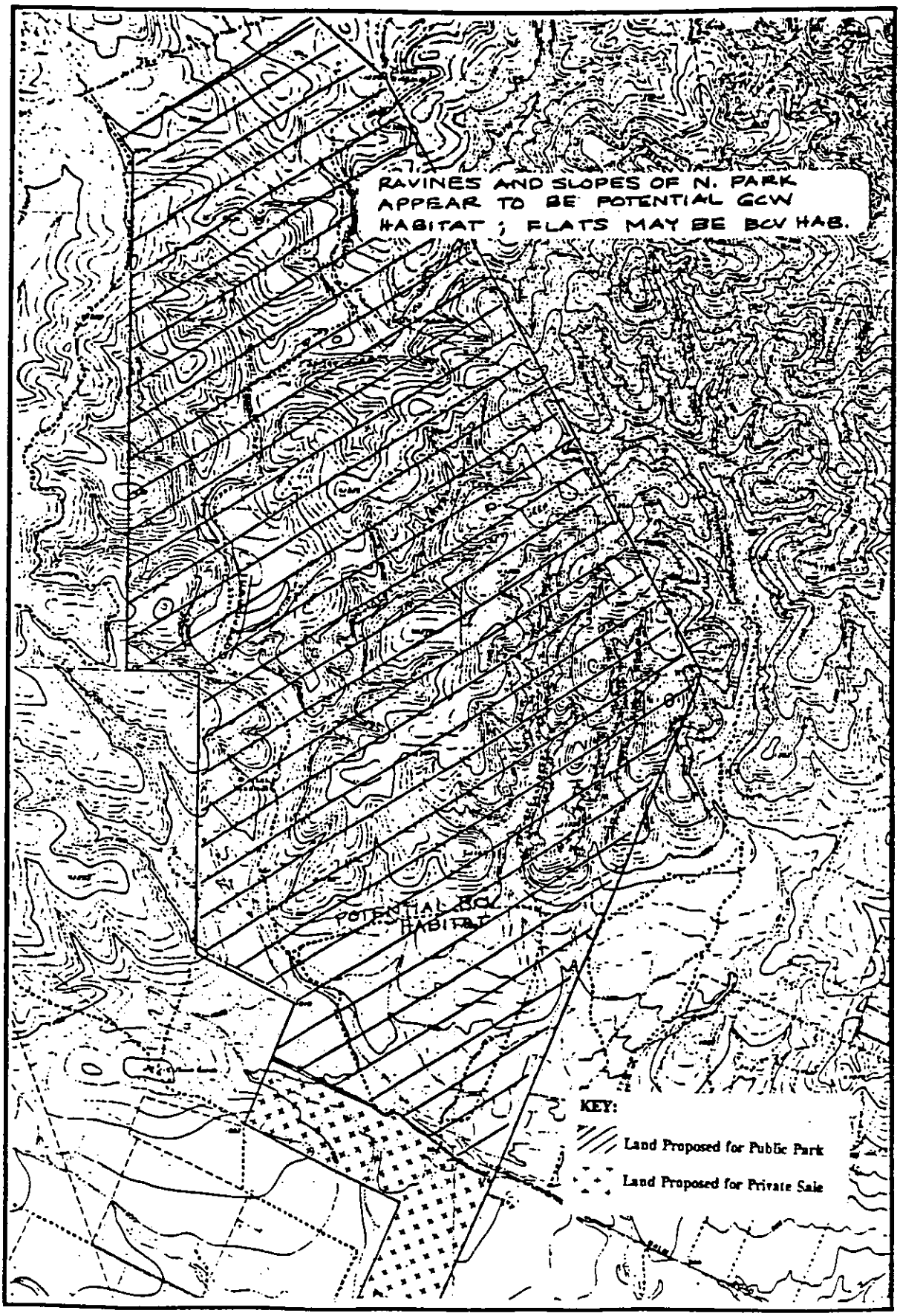

Figure A-24. Government Canyon SP

APPENDIX B

BLACK-CAPPED VIREO RECOVERY PLAN: OBJECTIVES, CRITERIA, RECOVERY OUTLINE

(USFWS 1991)

II. RECOVERY

From: USFWS 1991:36-38

A. OBJECTIVES AND CRITERIA

Objective: The prospects for complete recovery and delisting of this species are uncertain. Therefore, an interim recovery objective is being identified for this plan. The interim objective is downlisting the black-capped vireo to threatened status. Criteria for this interim objective are given below.

Criteria: The black-capped vireo will be considered for reclassification from endangered to threatened when:

(1) all existing populations are protected and maintained,
(2) at least one viable breeding population exists in each of the following six locations:
   - Oklahoma
   - Mexico
   - four of the six Texas regions (designated in Figure 7),
(3) sufficient and sustainable area and habitat on the winter range exists to support the breeding populations outlined in (1) and (2) above, and
(4) all of the above have been maintained for at least 5 consecutive years and available data indicate that they will continue to be maintained.

Pease and Gingerich (1989) conducted some viability analyses for this species, and their approximations are similar to general estimates (i.e., not specific to the black-capped vireo) by Franklin (1980) and Frankel and Soulé (1981). Using the Pease and Gingerich (1989) estimate, a viable population should comprise at least 500 to 1,000 breeding pairs. The median value of 750 pairs should be achieved for at least 50% of the target viable populations. This viable population estimate may change with additional analyses (called for in this plan) and may differ from region-to-region.

This recovery plan is intended to preserve, protect, and enhance (in some cases) the vireo populations that now occur until we can obtain a better understanding of whether full recovery is possible and, if so, what it will take to fully recover this species. The feasibility of total recovery and delisting will be examined as part of this plan. If found to be feasible, criteria for determining when delisting could occur, in terms of viable populations (including population sizes, locations, and configurations), will be developed as part of this plan, and the plan will be revised to incorporate these new objectives and criteria.

These reclassification criteria are preliminary and may be revised based on new information (including research specified as recovery tasks in this plan). The estimated date for attaining the objective of this plan (downlisting to threatened) is the year 2020.

B. RECOVERY OUTLINE

The following is an outline of the recovery tasks needed to attain the objective of this plan. The following section (C.) includes more detailed information on the tasks.

1. Specific research and information needs

1.1 Surveys

1.11 Regional surveys
1.12 Supplemental surveys

1.2 Determine population configurations needed for long-term species survival and viability

1.21 Obtain information necessary to develop viability model
1.22 Develop viability model and recommend areas where viable populations exist and should be maintained and areas that have potential for development of viable populations

1.3 Cowbird threat

1.31 Determine where cowbirds are a serious threat
1.32 Determine the role of cattle in cowbird threat
1.33 Determine if feasible, and if so how, to manage cattle so they will not negatively impact vireo viability
1.34 Develop a long-term solution to the threat

1.4 Habitat

1.41 Determine habitat use throughout the range
1.42 Develop methods for identifying probable habitat
1.43 Determine how to manage habitat for the vireo
1.44 Identify areas where vireo habitat can be most easily created and maintained
1.441 Habitat substrates
1.442 Successional changes in habitat
1.45 Determine if habitat management techniques for deer (and exotic ungulates) and black-capped vireos are compatible

1.5 Determine extent of other threats

1.6 Winter range

1.61 Distribution and threats
1.62 Habitat

1.7 Determine usefulness of age structure data as an index to population health of the vireo

2. Maintain existing populations and assure at least six viable populations as called for in the recovery criteria

    2.1 Habitat management

        2.11 Vegetation manipulation
        2.12 Manage browsers as needed

    2.2 Protection of areas

        2.21 Acquisition and lease
        2.22 Work cooperatively with private landowners
        2.23 Work with other agencies and organizations
        2.24 Regulatory

    2.3 Address cowbird threat

        2.31 Site-specific/local cowbird control
        2.32 Long-term solution to cowbird problem/threat

    2.4 Manage for other threats where necessary and warranted

3. Monitoring

    3.1 Develop monitoring techniques

    3.2 Monitor populations within areas deemed necessary for recovery

    3.3 Monitor habitat within areas deemed necessary for recovery

    3.4 Monitor threats

4. Winter range

APPENDIX C

BLACK-CAPPED VIREO SURVEY CENSUS DATA FROM TEXAS PARKS AND WILDLIFE DEPARTMENT PARKLANDS, WILDLIFE MANAGEMENT AREAS, SELECTED NON-TPWD LANDS

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk. terr. grps.	Tad.	Reference
TPWD Lands - Recovery Unit I							
Cedar Hill	Dallas	1985	1			1	Connally 1993
		1986					
		1987					
		1988					
		1989					
		1990					
		1991					
		1992					
		1993	0			0	?
		1994					
		1995					
		1996					
Eisenhower	Grayson	1954	1	1		2	Unknown
		1985					
		1986					
		1987					
		1988					
		1989					
		1990					
		1991					
		1992					
		1993	0	0	0	0	Connally 1993
		1994					
		1995					
		1996					
Cleburne	Johnson	1983	1			1	Unknown
		1984	0			0	Marshall and Clapp 1984
		1985					
		1986					
		1987					
		1988					
		1989					
		1990					
		1991					
		1992					
		1993	0			0	Connally 1993
		1994					
		1995					
		1996					
Possum Kingdom	Palo Pinto	1985					
		1986					
		1987					
		1988					
		1989					
		1990					
		1991	1	1		2	Scott 1991
		1992					
		1993	1	1		2	Connally 1993
		1994					
		1995					
		1996					
Lake Mineral Wells	Parker	1974	1			1	Oberholser 1974
		1985					
		1986					

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the maximum number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk. terr. grps.	Tad.	Reference
		1987					
		1988					
		1989					
		1990					
		1991	0	0		0	Scott 1991
		1992					
		1993					
		1994				0	Connally 1993
		1995					
		1996					
Fort Griffin	Shackelford	1985					
		1986					
		1987					
		1988					
		1989					
		1990					
		1991	0	0		0	Scott 1991
		1992					
		1993	0	0		0	Connally 1993
		1994					
		1995					
		1996					
Government Canyon SNA	Bexar	1985					
		1986					
		1987					
		1989					
		1990					
		1991					
		1992					
		1993					
		1994	0			0	Lockwood 1994
		1995					
		1996	0			0	Lockwood 1996
Meridian SP	Bosque	1985					
		1986					
		1987					
		1989					
		1990					
		1991	0	0		0	Scott 1991
		1992					
		1993					
		1994	0	0		0	Connally 1994
		1995					
		1996					
Inks Lake	Burnet	1985	0			0	Marshall and Clapp 1984
		1986					
		1987					
		1989					
		1990					
		1991	0	0		0	Scott 1991
		1992					
		1993	0	0		0	Connally 1993
		1994					
		1995					

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr. grps.	Tad.	Reference
		1996						
Longhorn Caverns	Burnet	1985						
		1986						
		1987						
		1988						
		1989	0	0			0	Sexton 1989
		1990						
		1991						
		1992						
		1993	1	0			1	Connally 1993, 1994
		1994						
		1995	0	0		0	0	Lockwood 1995
		1996						
Mother Neff	Coryell	1985	0				0	Marshall and Clapp 1985
		1986						
		1987						
		1988						
		1989						
		1990						
		1991						
		1992						
		1993	0				0	Connally 1993
		1994						
		1995						
		1996						
Dinosaur Valley	Somervell	1985				2	0	Marshall and Clapp 1985
		1986						
		1987					0	Sexton 1987
		1987	0	0			0	Pulich 1988
		1988						
		1989						
		1990						
		1991	8	2			10	Scott 1991
		1992						
		1993	3	0		8	2	3 Connally 1993/Armstrong 1992
		1994						
		1995						
		1996	3			3		3 Lockwood 1996
McKinney Falls	Travis	1985	0				0	Marshall and Clapp 1985
		1986						
		1987						
		1988						
		1989						
		1990						
		1991						
		1992						
		1993	0				0	Connally 1993
		1994						
		1995						
		1996						
Recovery Unit Total			14	4	0	8	2	18
Recovery Unit II								
Colorado Bend	San Saba	1985						
		1986						
		1987						

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk. terr. grps.	Tad.	Reference
		1988					
		1989	8	8	8	16	Wahl 1989
		1990					
		1991	31	5	31	36	Scott 1991
		1992	31		31	31	Armstrong 1992
		1993					
		1994	26	15	26	41	Lockwood 1994
		1995	22	1	22	23	Lockwood 1995
		1996	31		31	31	Lockwood 1996
Hill Country	Bandera	1985					
		1986					
		1987	0	0		0	Sexton 1987
		1988					
		1989	1			1	TxNHP 1989
		1990					
		1991	16	4	16	20	Scott 1991
		1992	28	13		41	Sparkman 1992
		1993	42	26	39	68	Sparkman 1993
		1994	22	10	22	32	Lockwood 1994
		1995					
		1996					
Lost Maples	Bandera	1985					
		1986					
		1987					
		1988					
		1989					
		1990	18	16	18	34	Bryan and Stuart 1990
		1991					
		1992					
		1993	23			23	Connally 1994
		1994					
		1995					
		1996					
Blanco SRA	Blanco	1985	0	0	0	0	Marshall and Clapp 1985
		1986					
		1987					
		1988					
		1989					
		1990					
		1991					
		1992					
		1993	0			0	Connally 1993
		1994					
		1995					
		1996					
Pedernales Falls	Blanco	1985					
		1986					
		1987	1	0		1	Sexton 1987
		1988					
		1989					
		1990					
		1991	0	0	0	0	Scott 1991
		1992					
		1993	0	0	0	0	Connally 1993

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr. grps.	Tad.	Reference
		1994						
		1995	0	0		0	0	Lockwood 1995
		1996						
Guadalupe River, Honey Creek	Comal	1978	1	1			2	Unknown
		1985	0				0	Marshall and Clapp 1985
		1986						
		1987						
		1988						
		1989						
		1990						
		1991						
		1992						
		1993	0				0	Connally 1993
		1994						
		1995	0	0		0	0	Lockwood 1995
		1996						
Enchanted Rock	Gillespie	1985						
		1986						
		1987						
		1988						
		1989						
		1990						
		1991	0	0			0	Scott 1991
		1992						
		1993	0	0		0	0	Connally 1993
		1994						
		1995						
		1996						
Kerr WMA	Kerr	1985	35	21		35	56	Gryzbowski 1990
		1986	28	19		28	47	Gryzbowski 1990
		1987	40	29		40	69	Gryzbowski 1990
		1988	42	28		42	70	Gryzbowski 1990
		1989	56	43		56	99	Gryzbowski 1990
		1990	62	58		62	120	Gryzbowski 1990
		1991	84	75		76	159	Armstrong 1991
		1992				79	158	O'Neal in: Coats 1996
		1993	70	10			80	O'Neal in: Coats 1996
		1994	78	44		108	122	O'Neal in: Coats 1996
		1995	83	36		104	119	O'Neal in: Coats 1996
		1996	103	30		135	133	O'Neal in: Coats 1996
Walter Buck, S. Llano River	Kimble	1985					0	Marshall 1985
		1986	12	4		12	16	Gryzbowski 1986
		1987	10	7		10	17	Gryzbowski 1987
		1988	12	8		12	20	Gryzbowski 1988
		1989	11	5		11	16	Gryzbowski 1989
		1990	11	9		11	20	Gryzbowski 1990
		1991	10	1	1	10	12	Scott 1991
		1992	11			11	11	Armstrong 1992
		1993	10				10	Connally 1994
		1994						
		1995						
		1996						
Kickapoo	Kinney/Edwar	1985						
		1986						
		1987						

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr. grps.	Tad.	Reference
		1988						
		1989	58	35	58		93	Wahl 1989
		1990	80	53	80		133	Bryan and Stuart 1990
		1991	89	68	89		157	Bryan and Stuart 1991
		1992	118	101	118		219	Lockwood and Stuart 1992
		1993	138	122	138		260	Lockwood and Stuart 1993
		1994	112	68	112		180	Lockwood and Stuart 1994
		1995						
		1996						
Garner	Uvalde	1971	1				1	Lane 1971
		1985	0				0	Marshall and Clapp 1985
		1986						
		1987						
		1988						
		1989						
		1990						
		1991						
		1992						
		1993	2				2	Connally 1993
		1994	3				3	Connally 1994
		1995						
		1996	2				2	Lockwood 1996
Recovery Unit Total			354	264	1 485	0	619	
Recovery Unit III								
Abilene	Taylor	1980					0	Unknown
		1985	0				0	Marshall and Clapp 1985
		1986						
		1987						
		1988						
		1989						
		1990						
		1991						
		1992						
		1993	0				0	Connally 1993
		1994						
		1995						
		1996						
Recovery Unit Total			0	0	0 0	0	0	
Recovery Unit IV								
Fort Lancaster	Crockett	1985						
		1986						
		1987						
		1988	1				1	Connally 1994
		1989						
		1990						
		1991						
		1992					0	USFWS 1992
		1993						
		1994						
		1995						
		1996						
Devils River	Val Verde	1985						
		1986						
		1987						
		1988						

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr. grps.	Tad.	Reference
		1989						
		1990	93	65		93	158	Bryan 1990
		1991	77	64		77	141	Bryan 1991
		1992						
		1993						
		1994						
		1995						
		1996						
Big Bend Ranch	Brewster	?	?	?			0	McKinney, Bryan, and Riskind
		1985						
		1986						
		1987						
		1988						
		1989						
		1990						
		1991	0				0	Connally 1994
		1992						
		1993						
		1994						
		1995						
		1996						
Black Gap WMA	Brewster	1985						
		1986						
		1987	1			1	1	McKinney and USFWS
		1988	3	2			5	McKinney and USFWS
		1989						
		1990						
		1991						
		1992	2				2	McKinney 1996
		1993	3	2			5	McKinney 1996
		1994	3	2			5	McKinney 1996
		1995	5	2			7	McKinney 1996
		1996	2				2	McKinney 1996
Elephant Mountain WMA	Brewster	1937	1				1	Sutton 1937
		1985						
		1986	1				1	McKinney 1986
		1987						
		1988						
		1989						
		1990						
		1991						
		1992						
		1993	0				0	McKinney 1993
		1994						
		1995						
		1996						
Davis Mountains	Jeff Davis	?	0				0	Bryan
		1985						
		1986						
		1987						
		1988						
		1989						
		1990						
		1991						

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr.	grps.	Tad.	Reference
		1992							
		1993							
		1994							
		1995							
		1996							
Recovery Unit Total			100	67	0	94	0	167	
Total (TPWD Lands)			468	335	1	587	2	804	
Non-TPWD public lands									
Recovery Unit I									
Fort Hood MR	Bell	1985							
		1986							
		1987							
		1988							
		1989							
		1990							
		1991							
		1992	300	275				575	Connally 1994
		1993							
		1994	300	275				575	Connally 1994
		1995							
		1996							
Balcones Canyonlands NWR	Travis	1985							
		1986							
		1987							
		1988							
		1989							
		1990							
		1991							
		1992							
		1993							
		1994	80					80	Connally 1994
		1995							
		1996							
Lake Georgetown RA	Williamson	1985							
		1986							
		1987							
		1988							
		1989							
		1990							
		1991							
		1992	15	0				15	Connally 1994
		1993							
		1994							
		1995							
		1996							
Recovery Unit Total			395	275	1	0	0	671	
Recovery Unit II									
Camp Bullis MR	Bexar	1985							
		1986							
		1987							
		1988							
		1989							
		1990							
		1991							
		1992	0	0				0	

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr. grps.	Tad.	Reference
		1993						
		1994						
		1995						
		1996						
Recovery Unit Total			0	0	0	0	0	0	
Recovery Unit IV								
Big Bend NP	Brewster	1985	8	8			16	Marshall and Clapp (1985)
		1986	4	4			8	Scott and McKinney
		1987	9	1			10	McKinney 1987
		1988						
		1989	10	6			16	McKinney 1996
		1990			13		13	Neighbors 1990
		1991			13		13	Neighbors 1991
		1992			14		14	McKinney 1996
		1993			19		19	McKinney 1996
		1994						
		1995			32		32	McKinney 1996
		1996			24		24	McKinney 1996
Recovery Unit Total			10	8	32	0	0	50	
Total (Non-TPWD public lands)			405	283	33	0	0	721	
PRIVATE LANDS								
Recovery Unit I								
Green Hills (Dallas) Nature Center	Dallas	1991	3	0			3	Connally 1993
Friedrich Park, San Antonio	Bexar	1989	3				3	Wahl 1989
Friedrich Wilderness Area	Bexar	1992	10				10	Connally 1994
Recovery Unit Total			10	0	0	0	0	10	
Recovery Unit II								
Davenport Ranch, Austin	Travis	1985	33	27		33	60	Gryzbowski 1990
		1986	32	26		32	58	Gryzbowski 1990
		1987	28	22		28	50	Gryzbowski 1990
		1988	16	13		16	29	Gryzbowski 1990
		1989	13	7		13	20	Gryzbowski 1990
		1990	11	4		11	15	Gryzbowski 1990
W. Frio Pasture, South Fork Ranch	Kerr	1986	4	2		4	6	Gryzbowski 1990
		1987	21	15		21	36	Gryzbowski 1990
		1988	16	16		16	32	Gryzbowski 1990
		1989	18				18	Wahl 1989
		1990	11	6		11	17	Gryzbowski 1990
Recovery Unit Total			33	27	0	33	0	60	
Recovery Unit III								
Sites in Sterling County	Sterling	1992	1				1	Connally 1994
Recovery Unit Total			1	0	0	0	0	1	
Recovery Unit IV								
Dolan Falls Ranch Preserve	Val Verde	1991	60				60	Connally 1994
TNC property (Diamond Y ??)	Brewster	1988	2				2	n/a
Pecos River ??	n/a	1989	4				4	Wahl 1989
Recovery Unit Total			60	0	0	0	0	60	
Total (Private Lands)			104	27	0	33	0	131	
GRAND TOTAL (all lands)			977	645	34	620	2	1656	

* ♂♂ and ♀♀ = hatch-year, second-year, or after second-year birds;
unk. = unknown sex;
terr. = number of territories;
Tind. = total number of individuals.

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr. grps.	Tad.	Reference

Census Data for BCV by Recovery Unit for properties owned by TPWD and for non-TPWD properties
(all totals are sums of the **maximum** number of BCVs observed per site)

LOCATION	County	Year	# BCV * ♂♂	♀♀	unk.	terr. grps.	Tad.	Reference

APPENDIX D

BLACK-CAPPED VIREO HABITAT CHARACTERIZATION PROTOCOL
(USFWS 1993)

APPENDIX D

DRAFT

Black-capped Vireo Habitat Characterization A Protocol

December, 1993

Standard plant community ecology techniques are used to describe the vegetation structure and composition in either unoccupied areas (survey-determined) or occupied vireo habitat (scientific permit needed). These techniques are used to monitor vegetation response to habitat manipulation or succession. A vireo monitoring protocol is also outlined to assess bird response to manipulation or succession. These methods are distinct from studies of nest site selection (Grzybowski 1988).

PRELIMINARY SURVEY

A preliminary survey of the site is needed to determine if BCVs are present. This survey should be at least as intensive as the Fish and Wildlife Service's minimum guidelines for presence/absence surveys and be conducted for 3 consecutive years to determine if vireos are using the site. If vireos are not found then habitat manipulation can proceed using the protocol.

If vireos are found using the site then the protocol can be used to monitor succession and vireo density or gather data needed to support a request for habitat manipulation through the scientific permitting process.

If birds are present and the intent of the project is to monitor succession or a scientific permit has been obtained then information about the distribution of BCV territories is necessary to allow the selection of a random or stratified random sample. If the site is small, all territories can be sampled. If BCVs on the site select a range of apparent habitat types, it may be necessary to stratify the various habitats used prior to sampling (e.g. talus slope/steep canyon vs. rolling topography habitat types). Samples should be drawn in the same relative proportion as the observed habitat variation.

Territory use is the basis of the subsequent vegetation sample, therefore careful attention must be given to determining the extent of each territory. The observer must be careful to avoid disturbing the territorial bird during observation to reduce harassment and bias (don't "push" the bird). An observation is the sighting or hearing of a vireo such that its location can be marked. Once the bird moves to another location that becomes another observation. The site of each observation can be marked (flagged or tagged) such that it can be found again. Plot the locations on large scale maps or aerial photos.

Emphasis will not be placed on locating the nest, however, knowledge of the nest outcome may be useful for other analyses.

Observations within any territory should be spread through each nesting phase to assure that the habitat used is adequately documented. In each territory a minimum of thirty (30) observations or six (6) hours observation time should be expended in each of three periods (March 20 to April 30, May 1 to June 30, July 1 to August 30).

Within any single period observation efforts should be spread throughout the day to avoid bias. Don't make all the observations for a period in the same day. For example, expend 2 hours in a single territory one day, then go on to another territory even if the first bird is still in sight. Return to the first territory on a different day and time, and resume making observations.

A minimum area polygon will be drawn around the observations within each territory. This polygon, or group of polygons, forms the external boundaries for sampling of vegetation structure. Within these boundaries stands of about 1 ha will be randomly located.

The goal is to make sufficient observations throughout the season to most fully capture the portions of the territory used by the bird.

VEGETATION DESCRIPTION

Within each stand vegetation will be sampled for frequency and canopy cover by means of nested circular plots (randomly placed).

A 1 sq. m circular plot (radius = .564 m) will be used to estimate ground cover (as grass, forbs, bare ground...) in the cover classes below.

20 sq. m plots (radius = 2.523 m) will sample woody vegetation < 2 m in height. Cover, by species will be visually estimated at two heights (the intercept at 1 m and 1.5 m) by cover class.

OPTIONAL A measure of foliage density can be made in the shrub layer by estimating the amount of surface of a board that is visible after it is placed a certain (fixed) distance from the observer.

50 sq. m plots (radius = 3.989 m) will sample woody vegetation > 2 m in height. The height of the tallest tree (or portion of tree) within the plot will be estimated to the nearest 0.5 m. Counts will be made of the number of stems, by species, within the plot. Maximum cover above 2 m, by species will be estimated in cover classes.

The cover classes are:

1. 0-5%
2. 6-25%
3. 26-50%
4. 51-75%
5. 75-95%
6. 96-100%

SAMPLE INTENSITY, SIZE

In each stand a total of 25 nested plots, randomly placed, will be read. A minimum of twenty (20) stands will be sampled in a given study area. The number of stands to be sampled may be reduced if there is little variation between stands in the above estimates. However, it is difficult to determine the number of samples needed for a given site without sampling due to variations between sites. This sample intensity should be adequate for most sites. In study areas where vireos exhibit a range of apparent habitat preferences an effort will be made to stratify the sampling of stands based on apparent differences in habitat types used.

REPORTING

Territory observations should be plotted on large scale aerial photographs or enlarged topographic maps of the study area (or portion of study area). The boundaries of the stand polygon should be shown on the same map. If Global Positioning Satellite (GPS) systems are used, supply the coordinates of the stand, and bird observations. The times of field visits to each territory should be recorded, to support the requirement of distributing observations through the day and nest phase. Record time of effort expended to locate birds in each territory, regardless of success in location of birds (record total effort expended). Vegetation measurement should take place after vireos have completed their breeding efforts (to minimize disturbance) and before leaves begin to fall.

Stand summaries should include:

1 sq. m. plots:

Cover by species or groups (graminoid, herbaceous, bare ground, rock, litter) and frequency by species.

20 sq. m. plots:

Frequency by species for woody species <2m tall and canopy cover by species in 2 height classes (1.0m and 1.5m intercepts) for woody species <2m tall.

50 sq. m plots:

Frequency of trees (woody vegetation >2m tall), stem density of trees by species, canopy cover of trees by species, and height of tallest tree within each plot.

Further analyses can be performed after considering the above summaries.

If this protocol is used to monitor succession, a baseline characterization should be conducted and then an interval should be selected to return to the site to conduct monitoring using the same technique. Depending on rainfall and other variables that affect vegetation growth, vegetation should be monitored at least every other year. In some cases, it may be necessary to monitor vegetation each year.

If this protocol is used to monitor vegetation response to manipulation, a baseline should be conducted prior to treatment(s) and then at an appropriate interval following manipulation. Treatments can be coordinated among workers within recovery units. Vireo response to treatments or succession should also be monitored.

MONITORING OF VIREO DENSITY AND REPRODUCTION

Vireo density should be monitored using a variable circular-plot (Reynolds et al. 1980, Condor 82:309-313) or transect (Emlen 1971, Auk 88:323-342) methodology. The interval at which vireo density should be measured depends on factors such as proximity to existing vireo colonies, vegetation response, etc. and could range from every year to every 2-3 years. Vireo density measurements should be continued after occupancy. However, more intensive data, particularly reproductive success, is needed once vireos have colonized a managed plot. Spot mapping of territories, estimations of mating, nesting, and reproductive success should be conducted.

APPENDIX E

CONTACTS FOR QUESTIONS
REGARDING BLACK-CAPPED VIREO RECOVERY

(FROM PARTICIPANTS IN 1995 BLACK-CAPPED VIREO POPULATION AND HABITAT VIABILITY ASSESSMENT WORKSHOP, AUSTIN, TEXAS; USFWS 1996)

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APPENDIX F

LAND USE HISTORIES FOR KICKAPOO CAVERN SP, DEVILS RIVER SNA, KERR WMA, LOST MAPLES SP, COLORADO BEND SP, WALTER BUCK WMA, AND FORT HOOD MR

(APPENDIX A, ARMSTRONG ET AL., 1992)

Appendix A (from: Armstrong et al. (1992)

During 1991, the following sites were visited to visually observe BCV habitat.

Kickapoo Caverns State Natural Area
Devils River Natural Area
Kerr Wildlife Management Area
Lost Maples Natural Area
Colorado Bend State Park
Walter Buck Wildlife Management Area
Fort Hood Military Reservation

The following are subjective comments based on observations of the above listed areas. Comments deal with past and present range management practicies that influenced/created BCV habitat.

Historical land management practicies were gathered for each site and are presented as Appendix A.

BCV colony locations were obtained from topographic maps for Kickapoo SNA, Devils River SNA, Lost Maples SNA, Kerr WMA, Walter Buck WMA and Fort Hood (Figures 1 - 5). Maps for the Kerr WMA, Walter Buck WMA, and Lost Maples SNA were taken from the 1990 and 1991 Population and nesting ecology of black-capped vireo reports written by J. A. Grzybowski. Maps for Kickapoo and Devils River State Natural Areas as well as Fort Hood were furnished by on site personnel.

Soil scientists from The Uvalde Soil Conservation Service Regional Office examined BCV colony locations on the Kerr, Devils River, and Kickapoo Areas. BCV colonies were associated with specific soil sites on these areas. However, they were not the same sites on each of these areas. Low stoney hills range sites were readily utilized on the Kerr WMA and were selected against on Kickapoo Caverns State Natural Area. Higher rainfall in the eastern plateau allows for structural differences in the developement of soil horizons different from the lower rainfall western plateau. Low stoney hills sites in the Kickapoo area had a layer of relatively solid leached limestone which prevented the establishment of desirable browse species. Higher rainfall in the eastern plateau evidently flushed the limestone layer and allowed for the establishment of browse species. BCV habitat was, however, associated with range sites that had a common structure of shallow, usually rocky, top soils with a hard base layer. This base layer was fractured to allow penetaration of roots of woody vegetation. These types of soil characteristics can support clumps of woody vegetation. It may be possible to determine potiential BCV habitat in

local areas based on soil mapping.

BCV colonies were located in areas that had a recent history (within the last 20 years) of some type of major vegetational disturbance such as fire, mechanical, or in the case of Devil's River, disturbance created when faces of clifts ocassionally flaked off. Vegetational disturbances resulted in growth of new low growth vegetation.

In the case of Kickapoo, Devils River, Lost Maples, and Colorado Bend heavy grazing by goats, deer, and/or exotics following the disturbance resulted in the establishment of low palatability plants such as persimmon, guyillo, and mountain laural, all of which were utilized by BCV for nesting. On the Kerr WMA and Fort Hood, removeal of sheep and goats and the reduction in deer and exotic numbers has resulted in a wider variety of low brush species such as liveoak, shinoak, spanish oak, hackberry, flameleaf sumac, and redbud. Again, when growth forms resulted in low, clumped vegetation, these plant species are utilized by BCV.

It was also noted that colonies seem to be associated with some type of break in vegetation such as a dry stream channel, cliff, road, fence line or tank trail (see topographic maps). Areas which are bisected with a combination of these breaks apparently were more preferred than just a single break. Because of the greater variety of low brush along streams, this seems to be the more preferred habitat. It is assumed that habitats with the greatest diversity of vegetation such as would be found along streams would offer a greater variety of insects in a smaller area and in any one year would supply some type of insect food source. These areas would provide for more stable colony areas. Similarly, ranges that are managed for variety, would be more stable than more monoculturally managed ranges.

Slope did not seem to directly affect the locations of colonies; however, there are three factors which could possibly influence the use of slopes by BCV. Fires burn hotter (preheating) when burning uphill, greatly increasing the top kill of trees on upslope burns. Top kill of trees leads to root sprouting and growth conditions favorable for nest sites. On Devil's River the flaking off of the clifts created rubble slopes favorable for low brush growth. The birds frequently used east and north facing slopes on Devil's River. These slopes were shaded from the afternoon sun and had the more favorable vegetation. A third factor could be related to secondary drainages created by slope

Appendix A

would create the "broken" vagetational aspect utilized by BCV.

As a general rule BCV were not found in areas which were dominated by cedar. This is a more true statement for the eastern plateau where regrowth cedar can become relatively dense in just a few years due to the higher rainfall patterns. In the western plateau, low rainfall retarded the processs to 20 to 30 years (subjective). Dryer sites remained relatively open and did not significantly affect BCV populations if other preferred brush species existed. There was one site on Kickapoo that had a few BCV in conjunction with encrouching cedar that was relatively dense. This site was one way chained in the 1960's. One way chaining will generally break off many cedars, however, just as many may be laid over with root systems still partially attached. Over time new stems will be produced form the "laid over" trunks creating dense stands of cedar. Band return studies of BCV on the Kerr WMA indicate some site fidelity by BCV. If this is true then colonies which were established with low cedar densities may tolerate cedar encrochment before abandament of the site. Studies of BCV populations at Fort Hood seem to confirm fidelity to site until cedars become too dense.

Areas which had browse lines where over 50% (subjective) of the leaves were removed were selected against. This was true in the southeast portion of Kickapoo which had been heavily grazed in the past by goats and is now an area in which aoudad sheep are sometimes observed. .

All recently purchased areas had a history of some deer/ exotic harvest prior to purchase by the state; however, with the exception of Fort Hood, based on the appearance of vegetation, it is doubtful that these harvests were sufficient to adequately control deer numbers. The real increase in low vegetational growth was the removal of sheep and goats. High sheep and/or goat numbers usually results in lower deer numbers. When livestock are removed, for a short period of time, the range is left with low deer numbers. The result is a release of browsing. Deer populations, however, will rapidly increase (1 to 2 years) to fill the void. This appears to be the case on most sites. With the exception of Fort Hood and the Kerr Area low deer browse plants were not present. Fort Hood and the Kerr Area were the only 2 sites that exhibited a wide diversity of browse plants. Unless deer populations are controlled annualy, the potiential for creation of browse lines exists.

Appendix A

Cattle are presently on the Kerr WMA and Fort Hood. Cowbird trapping programs on these sites have been instrumental in increasing BCV populations. Exotic deer in huntable numbers exist on Devils River State Natural Area. Lower numbers exist on Lost Maples. A reminate herd of approximately 60 feral goats are on the Walter Buck WMA. Kickapoo SNA has a small herd of Aoudad Sheep which are creating a browse line in the southeastern portion of the park.

The following is a summary of historical and observed vegetative conditions of each individual area visited.

Appendix A

KICKAPOO STATE NATURAL AREA

The now Kickapoo State Natural Area was purchased by the Seargeant family in 1870. It was sold to the Texas Parks and Wildlife Department December 1, 1986. The following is an account of the range management history as related to Texas Parks and Wildlife employees on May 24, 1991, by Mr. Tommy Seargeant.

Brush management practices

The ranch was purchased in the 1970,s by Mr. Seargeant's father. There was some minimal root plowing of the area in November, 1923. Cross fencing was built in 1927. This cross fencing cut the area into quarters. There was a 30 acre trap with a field around the house in addition to the cross fencing. This field was cabled in the 40's . There was also some root plowing at the south gate and creek pasture.

In 1941, 98 percent of the cedar posts were cut off the ranch. Cedar was handcut on 3,300 acres at a cost of $3.00 per acre. Most of the cedar was posted and the remainging cedar was cut and left laying. Pinyon Pine was not cut.

In the 1960's the house pasture and cave pastures were cabled. There were also some other small areas cabled.

A hydroaxe was purchased in 1979. The more level areas of the ranch were chopped in the 1980's. Besides the flatter bottom areas being cut, strips along fences were also cleared to aid in driving livestock. KR bluestem, buffelgrass, and blue panic in were planted in hydroaxed areas.
Fires:

There have been no major wildlifes on the ranch. Brush piles were burned in the Cave Pasture around 1939 or 1940. There was no prescribed burn program on the ranch.

Droughts and Floods:

There have been two major droughts that have influenced vegetation. There was a major drought between 1932 and 1937. Another major drought occurred in the 1950's that killed a lot of cedar.

In 1948, there was 30 inches of rain and a major flood in 1935.

Appendix A

Miscellaneous:

Porcupines were first seen on the ranch in the 1950's.

Deer and feral hogs were first seen in the 1950's.

Livestock History:

Since purchase, the ranch was in some type of sheep and goat operation. Initially, the ranch was nanny, kid and a ewe, lamb operation. Latter it went to a dry animal operation in which young animals were purchased and sold for gain. They also had a stocker cow operation with just a few cows. They tried a cow calf operation which didn't allow for range recovery.

Initially the ranch was stocked with 6,400 ewes and nannies but over the years was reduced to 3,000. The ranch ran about 100 calves when grass was available. The trend over the years was for fewer animals.

The ranch tried to run barbado sheep in the 1960's. The owners decided this was not a "good deal". It took 8 years to eventually remove the sheep because they multipled so fast.

The current watering system for livestock was constructed in the 1960's.

Axis deer were placed on the area in the 60's but did not do well and over the years they disappeared.

The ranch always had turkey use but had no winter roost. It has had a resident population of bobwhite quail and scaled quail.

In 1936 and 1937, there were more goats than sheep on the area. There were about 3,500 head of goats at this time. In the 1940's, there were more sheep and in the 1950's there were more goats. The ranch also ran some spanish goats over the years. Prior to purchase by TPWD, stock had been reduced to 2,000 head of sheep and goats. Income was supplimented with revenue from deer hunting which started in 1973. It was at this time that sheep and goat numbers were reduced.

Trapping: The ranch was continuously trapped over the years. Animals trapped included ringtail, foxes, and raccoons. No coyotes were trapped off the ranch.

Appendix A

Since purchase by TPWD, the area has not been grazed by domestic livestock. Aoudad sheep have been seen on the southeast portion of the Area. White-tailed deer hunts were held in 1991 and 1992 to assist in controlling deer numbers. Present estimated deer populations are 1 deer per 8 acres which is considered a high population density for the region.

Appendix A

DEVILS RIVER STATE NATURAL AREA

The Devils River State Natural Area was owned by the Finnegan family from 1883 until it was purchased by the Texas Parks and Wildlife Department in 1988.

Livestock:

The ranch was continuously grazed by sheep and goats at approximately 1 AU per 15 acres from 1883 to 1987. Livestock were removed from the ranch between 1987 and 1988.

Brush Managemnt:

There has been no cedar control programs on the ranch. According to the former owner, many cedars died during the drought of the 50's. Cedars are scattered and no motts or 'cedar breaks' are present. The flats were root plowed in the 1940's and 1950's. The root plowed brush was stacked and burned and the areas planted to grasses. When the drought broke in 1954 much soil was lost to erosion according to the former owner.

Fires:

There have been no major wildfires on the Area.

Exotics:

Exotics were placed in the Exotic Pasture in 1971 and 1972. These were aoudad sheep, axis deer, sika deer, barbado sheep, fallow deer, and red deer. Exotics were commerically hunted until 1985. These animals are now found over much of the park. An exotic hunt was held in 1991 by the Texas Parks and Wildlife Department. Ninety-one exotics were harvested. Exotics, especially aoudad sheep, are still abundant.

Present Range Conditions:

Bottoms/flats (old root plowed areas) are covered with low persimmon and guajillo. In most cases, these persimmons have not clumped enough to form the type of motts associated with BCV habitat that are found on Kickapoo or Colorado Bend. This is probably a function of low rainfall.

The hillsides are relatively bear and rocky. There apparently has been a great deal of erosion. Thicker brush is found in drainages which have formed on the hillsides.

Appendix A

Brush species consist of liveoak, vaseyoak, hackberry, guajillo, turkey pear, and prickley pear.

Areas around springs or seeps have larger liveoaks, sycamores, bumelia, and pecans.

East facing slopes along drainages have more liveoak, scyamore, guajillo, large cedars, bumelia, vasey oak, and hackberry. West facing slopes tend to be more bare with less vegetation.

A complete BCV census has not been accomplished due to the size and ruggedness of the area.

From available BCV territory data, BCV habitat seems to be found along the rubble slopes which support the oak, scycamore, and cedars and on the east facing slopes which receive evening shading. These areas appear to have vegtation similar to that found in the Edwards Plateau region while other slopes have more of a Sonoran desert vegetative appearance.

BCV territories are found along drainages with the greater variety of vegetation which also supports some oaks. Territories have not been located away from these drainages.

The tops of the larger hills which have the deeper soils do support some persimmon. There are some clumps which appear to be large and thick enough to support BCV nest sites; however, there are not enough of these clumps to support colonies. Most are single clumps and are more scattered than at Kickapoo.

On the slopes where BCV colonies are found, The vegetation is thick and in bands 20 to 100 yards wide and 1/4 to 1/2 mile long rather than in clumps. The vegetation is mature yet stunted and does form a closed canopy, much like the inside of a mature oak mott. The colonies are located between the clifts and dry drainages leading into the Devils River. According to those persons involved in nest location, most nest sites are located in the lower portion of the slope. (Specualtion-- the dominate BCV seem to use taller trees in their territory for singing perches. The upper trees on the slope may serve the same purpose).

Root plowing in the 1950's could have distroyed the oaks in the deeper soil flat areas giving rise to the mesquite and persimmon flats. BCV do not seem to be located in the formaly root plowed area.

Appendix A

Deer Populations: Since the area was purchased by the state, no white-tailed deer hunts have been conducted. White- tailed deer are estimated to be 1 deer per 25 acres.

Appendix A

KERR WILDLIFE MANAGEMENT AREA

The Kerr Wildlife Management Area was purchased by The Texas Parks and Wildlife Department in 1950. It consists of 6,494 acres. At the time of purchase, range conditions were very poor.

Cedar Removal:

Approximately 4,000 acres was dominated by mature cedar (ashe juniper). Approximately 2/3 of this cedar was chained and stacked in the mid 1960's. Chained cedar was bulldozed into piles. It was estimated that 15 acres of every 100 was under a pile of cedar.

Livestock:

The area was grazed with cows, sheep, and goats until 1967. Goats were removed from the Area in 1967 and sheep were removed in 1973. Today the Area is grazed with cattle only. A Three Pasture One Herd and a Four Pasture Three Herd rotational grazing system were utilized to control livestock grazing until 1977. At this time the Four Pasture Three Herd System was replaced with an HILF System. In 1984, both systems were replaced with a 28 pasture, one herd short duration grazing system.

Deer:

Excessive deer numbers existed on the Area at the time of purchase. Attempts to reduce the deer population had limited success until a deer proof fence was constructed around the area in 1968. Populations were reduced following fence construction. The deer population at present is at or below the proper carrying capacity of the land.

Prescribed Burns:

A prescribed burn program was initiated in 1979 to control regrowth cedar. The first prescribed burns were primarily designed to remove the brush piles created in the 1960's with the cedar removal program.

Regrowth Cedar Control Programs:

Following the initial clearing of cedar in the 1960's, it has been necessary to control reinvading cedar. This was accomplished by handcuting until 1979. A combination of

Appendix A

handcutting and prescribed burning has been utilized since that time.

Wildfires:

Two major wildfires have occurred on the Area since 1950. The first was in 1971 when approximately 1,200 acres on the north end (Turkey, Rock, and Love Pastures) was burned. It burned in January under low humidity and high wind conditions. Numerous brush piles were present. The result was that many older trees were top killed.

The second major wildfire occurred in March, 1984, when approximately 300 acres of mature cedar burned. It was an extremely hot fire in which nearly all trees were top killed.

BCV Populations:

The original major colony of BCV was located in that portion of the Rock Pasture that burned in 1971.

With the advent of the prescibed burn program in conjuction with deer herd reduction, rotational grazing systems to control livestock movement, removal of sheep and goats, and cowbird trapping programs, BCV populations have steadly increased on the Area.

Growing colonies have generally established along drainages where there was a variety of low brush species. Low brush species were established when prescribed fires top killed root sprouting species such as liveoak. Other low brush species such as redbuds and sumacs increase germination following prescribed burns and add to the low brush.

The 1984 burn came back rapidly in low brush and by 1986 BCV were attempting to establish in the burned area. This population has increased each year following 1986.

Low brush was able to reestablish on the Area because of reduced browsing by deer and controlled grazing by livestock in rotational grazing systems.

Slope:

Although there is a very definate correlation of BCV colony locations to drainages and slopes, there are territories that are found on relatively flat areas. It is felt that more favorable soil moisture conditions in

drainages adds to the variety and establishment of brushy species that are more favorable for BCV. Slopes in association with drainages also contribute to the more broken aspect that BCV seem to prefer.

Soils:

BCV on the Kerr Area seem to be associated with drainages within low stoney hills range sites. This is by far the most dominated range site on the Area. Low stoney hills range sites are charaterized by shallow soils overlaying rock. Where this rocky layer has become fractured, it has provided an area for the establishment of deeper rooted woody species. The pattern of the fractures also contributes to the patchy establishment of woody species that seems to attract BCV.

Appendix A

WALTER BUCK WMA

The Walter Buck Area located in Kimble County is 2,100 acres in size. It was obtained from the Walter Buck Estate in 1977. Prior to ownership by TPWD, the area was a working sheep, goat, and cattle ranch. According to the present manager, the area was heavily grazed by all classes of livestock prior to purchase by the state.

Brush management: Cedar was apparently cleared from much of the ranch while some of the area was left in mature cedar. See Map. Since the area was obtained by TPWD, no clearing of regrowth cedar has been allowed. As a result, much of the area is being dominated by increasing regrowth cedar. This increase in regrowth cedar is affecting establihment of new browse species. Where the alluvial soils along the Llano River meet the low stoney hills sites, algarita grows abundantly. The algarita has functioned as a vegetative exclosure for the establishment of various browse species. This is one of the areas being utilized by BCV.

Livestock: The area was formally heavily grazed by cattle, sheep, and goats. These were removed prior to the state obtaining the land. Today there is a herd of feral goats consisting of approximately 60 animals grazing the range.

Deer Numbers: Prior to ownership by TPWD, deer populations ranged between 4-6 acres per deer. This is a high population of deer. Since ownership by TPWD, the area has been heavily hunted and the deer population reduced to 1 deer per 10 acres. Encroaching cedar has more than offset desirable browse increase that should have resulted in favorable BCV habitat.

Other Endangered Species: The presence of the Tobush fishhook cactus has negated cedar control practices being employed. If cedar control is not practiced then the majority of the WMA will revert to a thick canopy of regrowth cedar and will preclude BCV habitat.

BCV Populations: BCV populations have remained stable since 1986 with approximately 12 territories being recorded yearly.

Appendix A

COLORADO BEND STATE PARK

The now Colorado Bend State Park consisted of two purchases. The Gormans Falls area was purchased by the Parks and Wildlife Department in December 1984 and the Lemon Fish Camp area was purchased in 1987. The park now consists of approximately 5,300 acres.

Cedar Control: In the 1940's, much of the ranch was evidently covered with mature cedar. A railroad was built to the ranch in the 1940's to haul cedar from the ranch. This cedar was used to furnish wood for cedar furniture. A small village of cedar choppers was established. There is a grave yard on the ranch near where the village used to be located. Numerous stumps of the old cedars are found on the ranch. There is evidence from charring on the stumps that suggests the trimmed cedar was slash burned. Cedar reinvaded the ranch following burning and apparently was spot controlled. Some areas were allowed to reestablish with larger cedars. The Southland Corporation cut cedar posts from these areas in 1986. Some of these second cut regrowth areas were slash burned with fairly hot fires. Attempted regrowth of root sprouting species such as liveoak and shinoak indicated extremely heavy grazing by white-tailed deer with few rootsprouts being produced.

Depending on the humidity and ground moisture, slash burns may or maynot burn hot enough to topkill large trees. Top killing of large trees occurrs more readily with fires moving upslope on the steeper hills. This apparently was the case in the park in the 1940's. Spotgrazing following the burns promoted growth of unpalatable persimmon plants. These slopes are the present sites of the BCV territories.

Livestock. Originally the ranch was an operational ranch being grazed by cattle and sheep until about 1986 when livestock were removed. Stocking rates are unknown but based on appearance of the range, the stocking rates were excessive. This is typical of most ranches in the area. There are relatively large numbers of feral hogs on the property at present.

Deer Populations: The Park has high deer numbers with TPWD estimates of 1 deer per 4 acres. It is has been hunted to reduce deer numbers since 1988 until the present time. Deer populations are still excessive with little evidence of root sprouting of browse species.

Other: Persimmons at one BCV site near the boat ramp

apparently had been winter killed (frozed top kill) and were resprouting from the thicher limbed portions of the plant. A known BCV territory was in this area.

Range Conditions: Years of over grazing by livestock and deer have reduced the variety of grass, forb, and browse species. Dominate overstory vegetation was liveoak, cedar, and persimmon. Texas wintergrass, curley mesquite, and threeawns were the dominate grasses. Few forbs were present. In general, the range conditions are poor. BCV sites appear to be decadent and, in my opinion, will further deterioate without new disturbance and reduced browsing.

Appendix A

LOST MAPLES STATE NATURAL AREA

Lost Maples State Natural Area consists of two former ranches. The back portion of the Park was an operating exotic ranch and was purchased in 1973. The front portion of the Park was an operational ranch that was grazed primarily with goats. It was purchased in 1974. BCV as well as GCW are found on the Park. The topography of the Park is extremely steep canyons which limit direct sunlight to the north facing slopes. The cooler north facing slopes are the areas where most of the GCW are located according to the Park Manager while the south facing slopes are those slopes that contain the most BCV.

Livestock: The east portion of the park was an operational ranch that was heavily grazed by goats.

Exotics: The West portion of the Park was an exotic ranch that was grazed by axis, sika, blackbuck, fallow deer, aoudad sheep, moufloun sheep, and hymalayan tair. Most of these animals were trapped from the area at the time of purchase. Untrapped animals were subquently removed from the park.

Deer: Deer census on the Lost Maples State Natural Area indicates one deer per 6 acres. This indicates a saturated deer population on the Area. The park was hunted for the first time in 1991.

Range Conditions: The parks vegetation shows a history of heavy past use. Over population of deer on the park has hampered reestablishment of many of species of low brush. Both persimmon and mountain laural are common as these are undersirable deer browse plants. Regrowth cedar is inter mixed with the mountain laural and persimmon on the slopes and could become the dominate brush species within several years.

Topography: In the east portion of the park most flat bottomland areas have been cleared for park use, leaving the brushy areas on the sides of slopes. The western portion of the park is steep canyon areas with little bottom area. The tops of the hills are relatively flat.

BCV Populations: BCV are found on the overgrazed slopes (See Map). Many of the BCV sites appear to be in overly mature vegetation which is losing much of its lower leaves.

Appendix A

FORT HOOD MILITARY RESERVATION

Fort Hood is located on the north eastern edge of the Edwards Plateau in Bell and Coryell counties. It is a 217,176 acre military reservation used primarily to train armor and mechanized infantry personnel. Located in the Lampasas Cut Plains, it is a mixture of prairie valleys intermixed with ridges of limestone hills which are extensions of the Edwards Plateau. It was purchased by the military in the 1940's. Prior to that time it was a mixture of small farms and ranches. Extensive training with heavy armor consists not only of manuvering but also livefire exercises.

Livestock: The area is leased for cattle grazing. The base is, for practical purposes, an open range with no cross fencing. Control of livestock numbers is difficult. The range appears to be moderately to heavily spot grazed due to limited water access and lack of fencing as well as human activity.

Brush Management: Due to heavy vehicle use on the bottomland sites, brush species are restricted to the hillsides and hill tops. Some organized cedar cutting has been allowed but not on a large scale. Over the years, various flat areas on the tops of hills have also been bulldozed to provide firing lanes for tanks. This has resulted in low regrowth of many brush species.

Fire: Fires due to military activities are very common. These fires keep the wooded sides of hills in various stages of low brush regrowth. Upslope burned areas appeared to have a greater percentage of top killed vegetation than more level areas. The area has a very mosaic appearance with a wide variety of brush species.

BCV: Due to the extensive area covered by the military post not all BCV populations can be surveyed. However, present surveys indicate that BCV populations are in association with those distured areas that are returning to low brush. The areas used by the BCV are dissected by tank trails which due to the shallow soils are often cut to parent material giving the appearance of dry stream areas. Past research by Fort Hood biologists have indicated that BCV select against sites where regrowth cedar begans to dominate the vegetation.

Soils: BCV were found primarily on Low Stoney Hills (Eckrant-Real-Soils) range sites.

Appendix A

Deer : Fort Hood has been in a formal deer management program since 1959. At the start of the program deer populations were calculated to be 1 deer per 12 acres. These populations have been reduced to 1 deer per 50 acres.

Vegetation: There was a wide variety of vegetation available to BCV to include flameleaf sumac, shinoak, liveoak, redbud, carolina buckthorn, elbowbush, Texas oak, bumelia, hackberry, and juniper. Due to frequent fires, military activities and reductions in deer numbers, all stages of growth of these species can be found in close proximaty.

APPENDIX G

General Management Guidelines for Black-capped Vireos on Texas Parks and Wildlife Department Parklands

General Management Guidelines for Black-capped Vireos on TPWD parklands.

I. Habitat.

Vegetational communities change across a moisture and temperature gradient that spans the range of the BCVI in Texas. Concerning BCVI habitat, the western portion of the range (see Fig. 1; RU IV; Trans-Pecos, Stockton Plateau; and, western edges of RU II Edward's Plateau, and RU III Concho Valley) typically is drier and exhibits lower growth forms, whereas the central, eastern and northern portions (RU I North-Central Texas; and, eastern portions of RU II, III) are wetter and generally have taller growth forms. In the central, eastern, and northern part of their range in Texas, BCVIs occupy heterogeneous, woody vegetational communities during early to mid succession leading some to suggest that there are temporal constraints to habitat use ("successional habitat window," Grzybowski et al., 1994). Twenty to twenty-five years has been hypothesized to be the upper limit of time for which these habitats may be useful to BCVIs, beyond that vegetation becomes too tall, closed and relatively devoid of understory cover (Tazik et. al 1993, Grzybowski et al., 1994, Grzybowski 1995). Grzybowski et al. (1994) has suggested the BCVI's preference for earlier stages of succession is related to avoidance of competition from other foliage gleaners (e.g., White-eyed Vireos, *V. griseus*; Blue-gray Gnatcatchers, *Polioptila caerulea*), and predation from animals (e.g., squirrels, jay, crows) which are typically found in communities with taller (hence older) vegetation. Desirable characteristics for habitat in the central, eastern, and northern portions of the BCVI range (RU I, II, III) are outlined in Grzybowski et al. (1994). Thus, dense deciduous vegetation up to three meters in height with a foliage "apron" extending to the ground should be maintained at between 35 % and 55% cover. Open spaces should be interspersed throughout, and juniper (e.g., *Juniperus ashei, J. pinchotii*) should be kept at densities below 10%, although this figure is variable especially in the western range where BCVI may use juniper for nesting (Grzybowski 1995). Floristic composition throughout appears not to be a factor, although further study on foraging and diet requirements are needed to bear this out.

It is quite apparent that there are forces different from those operating in the central, eastern, and northern range shaping vegetational communities in the western range. However, little documentation of this phenomenon exists in the literature. In western areas physiognomically and floristically appropriate habitat can be found in eroded gullies, drainages, creek beds and slopes. Such habitat is generally not maintained by disturbance as in eastern and northern parts of the range, but by edaphic and climatic conditions, where generally thin or eroded soils and scant precipitation preclude what would be considered "late" succession vegetation (e.g., closed canopy with little or no understory) from becoming established. Hence shrubland associations may persist and predominate in this habitat, especially in the absence of major disturbances. When disturbances do occur the plant associations in seral stages to follow would be those of "early" succession, which is habitat deemed favorable for use by BCVIs. Therefore, in such landscapes, habitat suitable to BCVIs could persist indefinitely, effectively negating the notion of a limited "temporal window" of opportunity as suggested previously (Tazik et. al 1993, Grzybowski 1995).

The often used term "habitat mosaic" associated with BCVIs is thus accurate and useful when weighing alternative management strategies, and no single habitat management design will be effective on a regional basis (west or east).

Habitat management alternatives. In all cases, habitat manipulation should occur during the non-breeding season or in areas having had no breeding activity for at least three breeding seasons (C. Beardmore, pers. comm.).

A. Prescribed burning. For the central and northern RU prescribed burning is an efficient, economical tool for manipulating:

- Vegetation structure suitable for BCVI breeding requirements.
- The density and invasion of small juniper (< 3 ft. tall).

Both of these objectives, when met, increase the heterogeneity in size and abundance of open spaces which when interspersed among stands dense of vegetation, provide the characteristic habitat "mosaic" suitable for BCVI reproduction and viability. See O'Neal et al. (1996) for further information on how burning affects territory establishment in BCVIs.

Cool season (prior to 15 March) burns are recommended for controlling size and density of small junipers as well as small stands (mottes) of vegetation. Hotter season burns conducted during the growing season usually are effective against larger, denser stands. Burning should only occur in unoccupied habitat, whether during the non-breeding period or during the active breeding period.

Frequency of burns is dependent upon regional differences in moisture, vegetation type, and fuel load. For most areas, 4 to 10 years is a reasonable interval for controlling juniper invasion and allowing sufficient regrowth of broad-leaved shrubs. Special care should be taken to avoid damage, particularly from "hot" fires, to GCWA habitat which may be in or near BCVI habitat. Firelanes, both internal and peripheral, should be restricted to the more open portions of the area to be burned. Construction of new firelanes in wooded areas should be avoided so as to minimize fragmentation of the habitat.

In grazed rangeland, in order to prevent overgrazing and overbrowsing of new regrowth, burning in should be limited to the smallest areas possible. Fire is not usually recommended in western portions of the range except in the more mesic riparian areas where closed canopy and diminished understory vegetation is expected.

B. Selective Brush Management. In certain areas (e.g., adjacent to other sensitive species or some private land, areas with inadequate fuel load, etc.) prescribed burning is not a option. Rather, a strategy of selective plant removal is advised. This is often a more labor intensive approach but has the benefit of allowing much greater precision and control of the manipulated area. Extreme changes in canopy cover from one year to the next, especially over large areas, is inadvisable.

(1) Mechanical. Plans carefully designed to eliminate certain species and/or encourage regrowth (e.g., basal sprouting) in others can include any of the following methods:

(a) hand-cutting with saws, chain saws, loppers, etc.

(b) shredding with brush hogs or hydroaxes, or similar machinery.

Larger machinery (e.g., roller choppers, bulldozers) have traditionally been used but are discouraged here due to the high potential for severe negative impacts such as destruction of desirable oaks and other woody species.

(2) Chemical. Herbicides should be applied during the non-breeding period and then only to target species. Care must be exercised to diminish disturbance to adjacent desirable species, particularly nest substrates such as Texas oak (*Quercus texana*), Mohr'sshin oak (*Q. mohriana*), scaleybark shin oak (*Q. breviloba* var. sinuata), Vasey oak (*Q. pungens* var. vaseyana), sumac (*Rhus sp.*), Texas persimmon (*Diospyros texana*), Texas mountain laurel (*Sophora secundiflora*), and redbud (*Cercis canadensis*). Strict adherence to label instructions is advised as is proper disposal of the containers.

II. Grazing and Browsing Management.

Moderate stocking rates and wise livestock management can result in reduction of woody plant invasion and reduce the need for more expensive brush control measures. However, some animals, especially goats, exotic ungulates, and white-tailed deer can have profound adverse effects on the deciduous apron (i.e., browse line) required by nesting and foraging BCVIs. Only minimal browsing should be allowed on woody plants during the breeding season (spring and summer). A conservative approach would be to ensure browsing be kept below 50% of the total annual growth (young, tender twigs) for any given plant. For adequate BCVI habitat, a good "rule of thumb" is that one should not be able to see through the plant foliage. A stable balance between optimal BCVI habitat and grazing and browsing pressure can be achieved, as has been the case at the Kerr WMA.

For sensitive plant species (e.g., listed species, or species of concern) it is recommended that exclosures be erected to prevent excessive herbivory. Adequate fencing must be maintained in order to ensure proper rotation or exclusion of livestock.

III. Cowbird Management.

Brood parasitism by Brown-headed Cowbirds represents the top ranking threat to the reproductive success of BCVIs (USFWS 1991, USFWS 1996). Controlling cowbird densities should thus be a manager's top priority when managing for BCVI. Research by Rothstein et al. (1984) and Cook et al. (1996) using telemetry have demonstrated that BHCO, which naturally exhibit strong flocking behaviors, partition their home range into discrete feeding, roosting, and breeding sites. Their numbers are greatest in winter when thousands may congregate at roosting and feeding sites. In some parts of the range cowbirds are partial residents in others they are absent in winter. Cowbird dispersal is not well understood but there is some suggestion that they utilize river corridors upon return to their breeding grounds (Connally, pers. comm.). If true, BCVI habitat along these landscapes may be more severely impacted than those farther upland or away from traditional roosting sites.

Options for controlling cowbirds include:

(1) Grazing management. Because cowbirds are easily attracted to cattle and large sources of grain, feedlots, granaries and farmland represent major potential congregation sites and, as such, are serious threats to BCVI populations. Therefore, managers should consider removing these areas or greatly limiting their size in the vicinity of BCVI habitat on TPWD lands. Preliminary evidence (USFWS 1996) suggests that breeding and feeding areas for BHCO be kept at least 2 km, and in extreme cases 15 km, away. Allowing pasture to revegetate with mid or tall grasses may deter cowbird foraging.

Some grazing systems appear to be better than others for managing cowbird densities. Because BHCO are attracted to cattle, off-season grazing (in areas where BHCO are not winter residents) might have a beneficial effect on reducing BHCO impact on BVC. Continuous grazing is not recommended, but high-intensity, short-duration systems using multiple, well-fenced pastures might serve to limit cowbird densities and facilitate other control measures (e.g., trapping).

(2) Physical removal. Two approaches have demonstrated the most success:

(a) Trapping. Cage-type traps of variable size placed near cowbird congregation sites and stocked with live decoy birds, food and water have proved very successful in trapping BHCO. Several trap designs are currently being implemented by area managers (e.g., Kerr WMA, also contact Lisa O'Donnell, USFWS, 512-490-0057, or John Cornelius, Fort Hood, 817-287-3114) with great success. Portable trap designs may be used for local trapping efforts, whereas larger, more permanent systems may be erected at sites designed to affect large-scale. Before erecting permanent traps it is advised that several smaller portable traps be set in different areas to gauge the effectiveness and trap-success (e.g., "hot spots") of a given area. Traps should be placed in open areas dominated by short-grasses but with a few perch sites nearby, and near concentrations of cattle. The design should be set up to allow efficient monitoring of traps.. This is essential because non-target species (e.g., northern cardinals, *Cardinalis cardinalis*, northern mockingbirds, *Mimus polyglottos*, and loggerhead shrikes, *Lanius ludovicianus*) frequently enter the traps. GCWA have also been documented entering BHCO traps (K. Terpening, pers. comm.), therefore careful and continuous monitoring of the traps is required.

(b) Shooting. If shooting is an option, female BHCO should be targeted. This strategy complements trapping, especially for small, localized settings. A taped recording of the female's "rattle" call can be used to attract females and is best done within the first two hours of daylight.

(c) Chemical.

(i) Sterilization. Currently being investigated.

(ii) Avicides. Because these chemicals affect non-target species they are not advised. However, they may have some value at large roosts.