City of Austin

2002 Golden-cheeked Warbler and Black-Capped Vireo Monitoring Program

Balcones Canyonlands Preserve Annual Report

Fiscal Year 2001-02



Photo Steve Maslowski, U.S.F.W..S.

The City of Austin
Water and Wastewater Utility
Wildland Conservation Division
Balcones Canyonlands Preserve Program

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The City of Austin

2002 Golden-cheeked Warbler Monitoring Program

Balcones Canyonlands Preserve

I. GOLDEN-CHEEKED WARBLER MONITORING

INTRODUCTION

Golden-cheeked warbler (*Dendroica chrysoparia*) populations within the Balcones Canyonlands Preserve (BCP) are being monitored through a standardized, system-wide program which includes both the BCP and the Balcones Canyonlands National Wildlife Refuge (BCNWR). Participants in this monitoring program are the BCNWR, City of Austin (COA), Travis County, and the Lower Colorado River Authority (LCRA). This report summarizes the 2002 GCW monitoring program on City of Austin BCP lands.

The 2002 field season was the fifth year of territory monitoring on the City of Austin BCP properties. A five-year trend analysis is in process on the five years of data, and will be included as a separate report in the 2003 annual report.

METHODS

S*ystem-wide Monitoring*

Because the entire acreage of the BCP is too extensive for complete surveying of golden-cheeked warbler (GCW), a monitoring program was developed by a BCP biological monitoring committee in 1997. The program employs a series of 100 acre plots to sample a subset of the population. The monitoring program is described below.

Plot Selection

Golden-cheeked warblers were monitored on COA-owned land by mapping territorial males within 8 permanent, predesignated plots (Table 1; Refer to figures 1-6 for maps of prime plots). Plots were selected as randomly as practical, using habitat rather than warbler density as a guide. However, some consideration was given to plot accessibility and ease of establishment. For example, marked boundaries or fence lines were sometimes used as boundaries.

The plots are approximately 100 acres in size, and the shapes are as square as is reasonably achievable. Of the 8 plots, 6 were established in prime habitat and 2 in transitional habitat.

Prime sites are defined as sites containing excellent GCW habitat with at least 70% canopy cover (See Pulich 1976 for a description of GCW habitat). Prime sites contain at least 75% to 80% excellent warbler habitat, however optimal sites have greater than 90% such habitat. Transitional habitat is defined as habitat which may have zero to a few warbler territories and has the potential to improve as GCW habitat (within the next 30 years).

Territory Mapping

Warbler territories were mapped using methods described by the International Bird Census Committee (IBCC 1970). Surveys were conducted on "days when weather conditions are suitable for the detection of bird singing" (USFWS 1994). Warbler surveys were conducted when the ambient temperature was above 55° F, as GCWs are thought to sing less frequently below this temperature (DLS 1994). All GCW monitoring was undertaken by personnel who are familiar with local bird vocalizations, and are adept at orienteering and mapping. Visits were equally distributed throughout the field season, including late season visits to obtain brood counts. Singing males were often best differentiated from one another by following individual males and by listening for countersinging between nearby males. Locations of target birds were mapped on 7.5' USGS topographic maps. Locations of birds were then transferred to a digital topography map, which was superimposed on an aerial photo using Arcview 3.2. Prime plots were visited ten times while transitional plots were visited three times each; each for six hours per visit. For each visit the time, temperature, wind direction, wind speed, and percent cloud cover were recorded at the beginning and ending of each visit (Weather data is available upon request). Playback of taped GCW or eastern screech-owl vocalizations were not used to elicit a response. Fieldwork was conducted by the following personnel; Scott Haywood (Barton Creek), Daniel Thompson (Emma Long), Mark Sanders (Ivanhoe), Carlo Abbruzzese (Bohls and Forest Ridge), and Jackie Davis (3M/St Eds). Because transitional plots were to be surveyed every other year the Canyon Creek and Double J and T plots were not surveyed in 2002.

Analysis of territories differs slightly in this report from IBCC recommendations. IBCC methodology recommends that edge territories "be counted as belonging to the plot only if more than half of the registrations lie within the plot or on the boundary. Otherwise they will not be counted"(IBCC 1970). However, since observers tend to spend more time within plot boundaries, the number of edge territories may be overestimated (Verner 1985). Verner (1985), suggests that this bias can be reduced by assigning only half of the edge territories to the plot. We follow Verner's recommendation and we also provide a low estimate (a count of territories that fall entirely within the plot or "full territories") and a high estimate (counts of

both "full" and edge territories) for each plot. These procedures were also followed during the four previous survey years.

Productivity and Mated Status

Researchers also recorded observations of females and numbers of fledglings produced within territories. Because females and juveniles are often difficult to detect, estimates of their numbers are minimum estimates at best. In addition, because young warblers tend to wander outside of their territories as they age and become independent from their parents, observers were more confident that fledgling groups came from a particular territory if the young observed had recently fledged. Productivity and mated status was estimated only for territories that were entirely within the plot. Fecundity was estimated by dividing 50% of the total number of fledglings produced by the number of territories that were entirely within the plot boundaries. This gives an estimate of the number of male or female fledglings per singing male.

Enumeration

In addition to territory monitoring, observers also enumerated GCW territories in several other sites (see figures 7-15). Territory enumeration is a count of the total number of singing males in a given area. Because of the limited number of visits, GCW territory boundaries are approximate and the number of males found is likely a minimum number of the total actually present. Enumeration of territories required 3-4 visits per study area during good weather conditions. Warbler territories were enumerated around or adjacent to 100 acre plots in Emma Long Park and Lower Bull Creek. Enumeration also occurred on the Reicher Ranch, Coldwater, Lime Creek, Double J and T, Franklin, Hanks, Bohls and Commons Ford tracts. Warbler enumeration was conducted by Daniel Thompson, Jackie Davis, Melody Lytle, Carlo Abbruzzese, and Mary Ruth Holder, Rachel Zierzow, Charlie Davis, and Amy Sugeno.

Site and Plot Descriptions

The topography and vegetation throughout the study site typify the eastern edge of the Edwards Plateau. Drier uplands are intermixed with humid, steep, canyon slopes and riparian habitats. Most of the streams that flow through these canyons are intermittent, though a few have a permanent water source like a perennial spring. It is thought that woodlands in western Travis county were logged in the late 1800s and early 1900s and are in various stages of recovery (Keddy-Hector 1996). In addition, after clearing, much of the topsoil was lost due to chaining and subsequent goat and cattle overgrazing. On some steep slopes this soil loss has greatly reduced the revegetation potential. Also, current and past overbrowsing by white-tailed deer (*Odocoileus virginianus*) has greatly reduced the understory and a distinct

browse line is visible throughout. Conspicuously absent in the study area are saplings of deciduous trees such as oaks (*Quercus* sp.), escarpment black cherry (*Prunus serotina serotina*), rusty black-haw (*Viburnun rufidulum*), cedar elm (*Ulmus crassifolia*), Texas ash (*Fraxinus texensis*) and Texas mulberry (*Morus microphylla*).

The forest canopy in the study area is primarily composed of Texas oak (*Quercus texana*), Ashe juniper (*Juniperus ashei*), plateau live oak (*Quercus fusiformis*), escarpment black cherry, Texas ash (*Fraxinus texensis*), and cedar elm (*Ulmus crassifolia*). Common understory species include Ashe juniper, Carolina buckthorn (*Rhamnus caroliniana*), yaupon holly (*Ilex vomitoria*), red buckeye (*Aesculus pavia pavia*), white shin oak (*Quercus sinuata* var. *breviloba*), Mexican buckeye (*Ungnadia speciosa*), Lindheimer silk-tassel (*Garrya Lindheimeri*) and elbow bush (*Foristiera pubescens*). Ashe juniper is one of the most common understory species.

Individual plots can be described as follows:

Barton Creek (Prime Habitat). The Barton Creek plot lies roughly 2 km northwest of the intersection of Capital of Texas Highway and Mopac. The Barton Creek hike and bike trail runs roughly though the center of the plot. This area experiences high numbers of hikers, joggers, swimmers, tubers, and mountain bikers with peak use occurring on weekends and after 5pm. Approximately 85% of the plot is composed of closed canopy juniper-oak woodland, while portions of the uplands are more open (65% canopy cover).

Emma Long (Prime Habitat). The Emma Long plot straddles the Turkey Creek trail near the center of Emma Long Metropolitan Park. The eastern boundary runs parallel to and within 10-30m from City Park Road. The majority of this plot contains unfragmented, full canopied, juniper-oak woodland that appears to be excellent GCW habitat. The understory throughout much of the plot, particularly the uplands, is very dense and difficult to walk through. Terrain varies from steep canyon slopes along Turkey creek to relatively gentle slopes. Approximately 5% of the plot was cleared in the past and is in early stages of plant succession. The riparian habitat along Turkey creeks contains fairly high numbers of exotic plants such as heavenly bamboo (*Nandina domestica*), Japanese privet (*Ligustrum japonicum*) and Chinaberry (*Melia azedarach*). The Turkey Creek trail receives light use by hikers (some with dogs) mostly on weekends.

Ivanhoe (Prime Habitat). The Ivanhoe plot occurs approximately four km to the northwest of the intersection of Spicewood Springs road and Capital of Texas Highway. With a few minor exceptions, the canopy remains intact throughout the plot. The northern plot boundary is marked by a powerline and its' associated 20 m wide clearing.

St. Edwards/ 3M (Prime Habitat). This plot occurs on both the St. Edwards and 3M tracts located about 3 km west of the intersection of Spicewood spring road and Capital of Texas Highway. Three powerlines and their associated 20 m wide cleared areas beneath, cross the center of the plot. Recreational hiking and biking takes place on designated trails in the northwest corner of the plot (roughly 20% of the entire plot). Unauthorized hiking and biking occasionally occur on the rest of the plot. Roughly 1-2% of the plot contains cleared open areas that were probably used for livestock grazing in the past.

Forest Ridge (Prime Habitat). This plot occurs on the Forest ridge tract and is approximately 0.5 km southwest of the intersection of Spicewood Springs Road and Capital of Texas Highway. Roughly one quarter of the plot contains drier upland habitat containing primarily plateau live oak, Ashe juniper and white shin oak. In the early 1980's, portions of the plot were hydroaxed in preparation for road and waterline construction. This hydroaxed portion accounts for approximately 5% of the total plot. These areas are currently recovering and vegetation stands at about 3-4 m. This plot also contains numerous largely unauthorized trails which are used by mountain bikers and hikers. Recreational use of the two authorized trails takes place primarily after 5 p.m. and on weekends.

Bohls Hollow (Prime Habitat). The Bohls Hollow plot lies approximately 2 km northeast of the City of Bee Cave. Roughly 60% of this plot is made up of full canopied, steep canyon slopes and drainage bottoms. The remaining 40% of uplands contain more open juniper-oak woodland (canopy closure of about 70%). The uplands appear to have undergone some type of clearing in the past. The majority of this area is composed of more than 90% juniper trees which are probably less than 20 years old.

Double J and T (Transitional Habitat). The Double J and T plot occurs roughly one km to the East of the intersection of FM 620 and Kollmeyer Rd. Currently, approximately 40-50% of the plot is woodland, which is primarily made up of young juniper. For the most part, deciduous hardwoods occur in drainage bottoms. Past chaining and overgrazing appear to have greatly reduced the density of deciduous trees in this plot. Though the land is no longer grazed, oak regeneration appears to have been hindered by deer browse for many years.

Canyon Creek (Transitional Habitat). The Canyon Creek plot can be found approximately 3.5 km from the intersection of RR 2222 and FM 620. In the mid 1980's, in preparation for development, most Ashe juniper within the plot was hydroaxed while the oak component was left largely untouched. Regrowth juniper is approximately 2-3 m in height. One section of the plot (roughly 10%) appears to have been chained and heavily grazed and is now largely covered with Ashe juniper, King Ranch bluestem (*Bothriochloa ischaemum*), and prickly pear

cactus (*Opuntia macrorhiza*). Approximately 5-7% of the plot has not been recently hydroaxed and contains closed canopied juniper oak woodland. In general, the canopy closure throughout the plot is roughly 40-50%. Most of this plot is upland habitat though it is adjacent to heavily wooded canyons.

RESULTS AND DISCUSSION

Overall Distribution and Abundance

A total of 88 male GCWs held territories either fully (53) or partially (35) within the six study plots. This represents an average of 11.8 territories per 100 acres (29.4 per 100 hectares) in prime habitat. This constitutes a 77% increase in the number of territories over 2001 and is the highest density recorded on City of Austin properties since the beginning of the monitoring program in 1997. This density estimate is also higher than the density of 24 territories per 100 ha reported from Ft. Hood in 2001 (Anders 2001). While this increase in the number of singing males appears promising it may be due to the fact that the increasing destruction of warbler habitat is causing birds to leave altered or fragmented habitat and immigrate to already occupied areas.

In general, higher warbler densities were found in larger tracts of full-canopied, mature woodland such as the Ivanhoe, Forest Ridge, and St. Edwards/3M plots. This is not surprising since most authorities consider the GCW a forest interior species which requires large blocks of unfragmented habitat (Biological Advisory Team 1990, Wahl et. al. 1990).

Of the six prime plots, the Barton Creek plot had the lowest density with two full territories while Emma Long had the highest with 18 full territories. The Emma Long, Ivanhoe, Forest Ridge and St. Edwards/3M plots experienced an increased territory density while estimates for the Barton and Bohls plots were similar to 2001.

Figures 1-8 illustrate locations of GCW territories, females and fledgling groups. See Table 1 and 2 for an analysis of territories.

Table 1. 2002 City of Austin Golden Cheeked Warbler Surveys - Summary of Findings
Analysis of Territories on Prime Plots

Plot Name	Number of Full Territories[1]	Number of Full and Edge Territories[2]	Number of Full Territories plus 50% of edge Teritories[3]	Number of Territories per 100HA
Prime Plots				
Barton Creek				
1998	2	8	5	12.5
1999	6	12	9	22.5
2000	5	9	7	17.5
2001	3	7	5	12.5
2002	2	8	5	12.5
Emma Long				
1998	6	11	8.5	21.3
1999	7	12	9.5	23.8
2000	12	21	16.5	41.3
2001	15	23	18.5	46.3
2002	18	22	20	50
Ivanhoe				
1998	7	13	10	25
1999	8	17	12.5	31.3
2000	7	19	13	32.5
2001	2	14	8	20
2002	9	22	15.5	38.8
St. Eds/3M				
1998	6	12	9	22.5
1999	7	15	11	27.5
2000	7	17	12	30
2001	3	8	6	15
2002	9	16	12.5	31.3
Forest Ridge				
1998	7	14	10.5	26.3
1999	11	17	14	35
2000	7	14	10.5	26.3
2001	8	14	11	27.5
2002	11	15	13	32.5
Bohls Hollow				
1998	3	6	4	10
1999	1	4	4	10
2000	1	5	3	7.5
2001	4	8	6	15
2002	4	7	5.5	13.8
TOTALS				Avg.
1998	31	64	47	19.6
1999	40	77	60	25.0
2000	39	85	62	25.9
2001	35	74	54.5	22.7
2002	53	88	70.5	29.4

[1] Entire territory boundary fell within plot.
[2] Includes territories whose boundaries may have occurred outside plot.
[3] Includes %50 of edge territories. See Verner 1985 .
[4] Presence of female was inferred by the presence of juveniles.

Table 2. 2002 City of Austin Golden Cheeked Warbler Surveys - Summary of Findings

Analysis of Territories on Transitional Plots

Plot Name	Number of Full Territories[1]	Number of Full and Edge Territories[2]	Number of Full Territories plus 50% of edge Teritories[3]	Number of Territories per 100HA
Transitional Plots				
Double J and T				
1998	0	1	.5	1.3
1999	0	1	.5	1.3
2000	0	1	.5	1.3
2001	4	6	5	12.5
2002	na	na	na	na
Canyon Creek				
1998	0	8	4	10
1999	2	7	4.5	11.3
2000	0	8	4	10
2001	3	12	7.5	18.8
2002	na	na	na	na
TOTALS				Avg.
1998	0	9	4.5	5.7
1999	2	8	5	6.3
2000	0	9	4.5	5.7
2001	7	18	12.5	15.7
2002	na	na	na	na

[1] Entire territory boundary fell within plot.

[2] Includes territories whose boundaries may have occurred outside plot.

[3] Includes %50 of edge territories. See Verner 1995.

[4] Presence of female was inferred by the presence of juveniles.

Pairing, Nesting, and Productivity

Of the 53 territories which occurred fully within the six plots, at least 31 contained females. Assuming that all females seen were paired, this represents a minimum estimate of 58% warblers paired. However, the number of fledgling groups observed on several plots was higher than the number of females observed. The number of fledgling groups observed suggests that the number of females in all plots was at least 34. Thus, of the 53 males whose territories fell entirely within plot, at least 64% were paired. This rate is considerably less than the mean of 87.8% found on Fort Hood study sites in 2001. Again, this is likely an underestimate of pairing success as females are difficult to detect.

Overall, a minimum of 49 fledglings from 20 fledgling groups were observed on all six plots. This represents .46 male fledglings per singing male (assuming a 50:50 male/female sex ratio). This figure is considerably less than the fecundity estimate found at Fort Hood in 2001 of 1.42 (when considering only first broods: listed as the number of juvenile females per adult female) and 1.61 (when considering two broods)(Anders 2001). This figure is also less than the fecundity estimate (defined as the number of male fledglings per singing male) of 0.75 for second year GCWs and 1.08 for after second year GCWs used in a model to estimate the probability of extinction in 100 years in the GCW population and habitat viability assessment (US Fish and Wildlife Service 1996). Thus, while our productivity estimates are likely underestimates, it appears that productivity on the City Owned BCP is still alarmingly low when compared to Fort Hood.

Six warbler nests were found during the study; three in Emma Long Metropolitan Park, two on the Ivanhoe tract, and one on the Forest Ridge tract and one on the Forest Ridge tract. While these nests were checked infrequently, it was believed that four of the six nests successfully fledged at least 10 young. A fifth nest may have fledged young. However, since the outcome was uncertain, we considered the nest failed. This represents a 66% nesting success rate and 2.5 fledglings per successful pair.

See table three and four for a summary of pairing and productivity.

Nest Predators and Parasites

For the most part, observers found little evidence of parasitism by brown-headed cowbirds (*Molothrus ater*). There was only one sighting of an adult GCW feeding a fledgling brown-headed cowbird. This took place on the Barton Creek plot. Brown-headed cowbirds were observed on numerous occasions in both prime and transitional plots and were most often seen following utility corridors, trails or in open fields. In 2002, three cowbird traps were employed on the Ivanhoe, Canyon Creek, and Cortaña tracts.

Table 3. 2002 City of Austin Golden Cheeked Warbler Surveys - Summary of Findings

Paring and Productivity on Prime Plots

Plot Name	Females Observed (inferred)	Number of Fledgling Groups	Number of Fledglings Per Successful Pair	Number of Fledglings per Territory
Prime Plots				
Barton Creek				
1998	1(1)	1	2	1.3
1999	3(6)	6	2.2	2.2
2000	4(4)	2	1.5	.6
2001	0(3)	2	2.5	1.67
2002	2(2)	1	2	1
Emma Long				
1998	3(6)	6	2.3	1.3
1999	3(6)	6	2.3	2.0
2000	5(5)	2	2	.33
2001	10(10)	9	1.78	1.06
2002	12(12)	7	1.7	.66
Ivanhoe				
1998	2(3)	3	2.7	1.3
1999	3(4)	4	2.8	1.3
2000	1(1)	1	3	.43
2001	2(2)	2	3	3
2002	6(6)	5	3	1.7
St. Eds/3M				
1998	5(5)	2	2.5	0.8
1999	4(5)	3	1.7	0.7
2000	1(3)	2	2.5	.71
2001	0(0)	0	0	0
2002	1(2)	1	1	.1
Forest Ridge				
1998	4(4)	3	2.3	1.1
1999	5(7)	6	2.7	1.5
2000	6(6)	5	2.8	2.0
2001	7(7)	4	2.5	1.25
2002	7(9)	5	2.6	1.2
Bohls Hollow				
1998	0	0	0	0
1999	0	0	0	0
2000	3	0	0	0
2001	2(3)	1	3	.75
2002	3(3)	1	3	.75
TOTALS				
1998	15(19)	15	1.97	.97
1999	18(28)	25	1.95	1.3
2000	17(19)	12	1.97	.68
2001	21(25)	18	2.13	1.3
2002	31(34)	20	2.38	1.3

Table 4. 2002 City of Austin Golden Cheeked Warbler Surveys - Summary of Findings

Paring and Productivity on Transitional Plots

Plot Name	Females Observed (inferred)	Number of Fledgling Groups	Number of Fledglings Per Successful Pair	Number of Fledglings per Territory
Transitional Plots				
Double J and T				
1998	0	0	0	0
1999	0	0	0	0
2000	0	0	0	0
2001	0	0	0	0
Canyon Creek				
1998	0(0)	0	0	0.6
1999	1(1)	1	2	1.0
2000	0(1)	0	0	0
2001	0(0)	0	0	0
TOTALS				
1998	0	0	0	0.3
1999	1(1)	1	2	0.5
2000	0	0	0	0
2001	0	0	0	0

Several potential nest predators were observed in survey areas including, blue jay (*Cyanocitta cristata*), western scrub jay (*Aphelocoma coerulescens*), great-tailed grackle (*Quiscalus mexicanus*), common grackle (*Quiscalus quiscula*), Texas rat snake (*Elaphe obsoleta lindheimeri*), and red imported fire ant (*Solenopsis invicta*). Many of these predators thrive in urban and edge habitat and their numbers are likely unnaturally higher than they would be in less disturbed settings (Wilcove 1985). Large flocks of common grackles, a bird which is typically uncommon in western Travis county, were often seen near the Jester Estates subdivision on the Forest Ridge and Ivanhoe plots.

II. BLACK-CAPPED VIREO MONITORING

INTRODUCTION

Black-capped vireos (BCV) have been known to occur on several City of Austin BCP properties in the past 15-20 years. Probably the best known and studied vireo colony occurred at the Black-capped Vireo Research Area (BCVRA) off Loop 360. This group declined steadily from a high of 60 adults in 1985 to just one pair in 1997 (DLS 1988, Abbruzzese 1997). Other recent records (i.e. the past 10 years) of BCVs on COA land include sightings on the Forest Ridge, Park West, and Cortana tracts.

Approximately 80 acres of an upland portion of the Cortana tract was managed for vireo habitat in the winter of 1995. Juniper-oak woodland was cleared using both hand clearing and hydroaxing. In the past 3-4 years several vireos have been observed by City of Austin and SWCA inc. staff in this managed area. In 2001 three males defended territories in this managed area.

METHODS

Black-capped vireos were surveyed throughout the manipulated area of Cortana and the BCVRA following methods described in the "Minimum Procedures for Determining the Presence/Absence of Golden-cheeked Warblers and Black-capped Vireos" (USFW 1984). When a BCV was encountered its territory was mapped using methods described by the IBCC (1970). For each visit the time, temperature, wind direction, wind speed, and percent cloud cover were recorded at the beginning and ending of each visit (weather data is available upon request). Playback of taped BCV or eastern screech-owl vocalizations were not used to elicit a response except on the BCVRA to verify an absence of BCV on this property. See Figures 16 and 17 for a maps of the Cortaña and BCVRA tracts.

Part of the Forest Ridge tract (including the area where a BCV had been seen in recent years) was visited 10 times during Golden-cheeked Warbler surveys.

RESULTS AND DISCUSSION

Three male BCVs were observed defending territories on the managed portion of the Cortana tract and adjacent Riverplace mitigation tract. Based on plumage coloration all three males were determined to be at least two years old (Grzybowski 1995). All three males were mated and nested, however only one male successfully produced three fledglings. The nest of the northernmost male was believed depredated. It is unknown whether this pair attempted to renest as they could not be relocated after their nest failed. Other regionally declining species like painted bunting (*Passering cirus*), black-chinned hummingbird (*Archilochus alexandri*), rufous-crowned sparrow (*Aimophila ruficeps*), and northern bobwhite were also observed on the managed area of Cortana (Shackleford and Lockwood 2000).

One male black-capped vireo was heard singing from private land adjacent to Commons Ford Park. This male sang frequently and appeared to be defending a territory though it is not know whether he was mated. See figure 15 for the location of this vireo.

No black-capped vireos were observed on the BCVRA property during the 2002 field season. This is not surprising considering the continual decline of BCV on that preserve and the fact that only one pair remained in 1997. In addition, the male of this pair (nicknamed "Switchbags") was banded as an adult in 1986 so he was at least 11 years old: making him one of the longest lived BCVs known. This decline is likely caused by a number of factors which have degraded the habitat, including encroachment of surrounding development leading to high numbers of potential predators such as feral and tame cats, raccoons, and jays. Natural regrowth of the vegetation may have also been a factor in the decline of the colony. These same factors are probably responsible for the general decline of BCVs throughout Travis County and may explain the lack of BCV on other COA properties.

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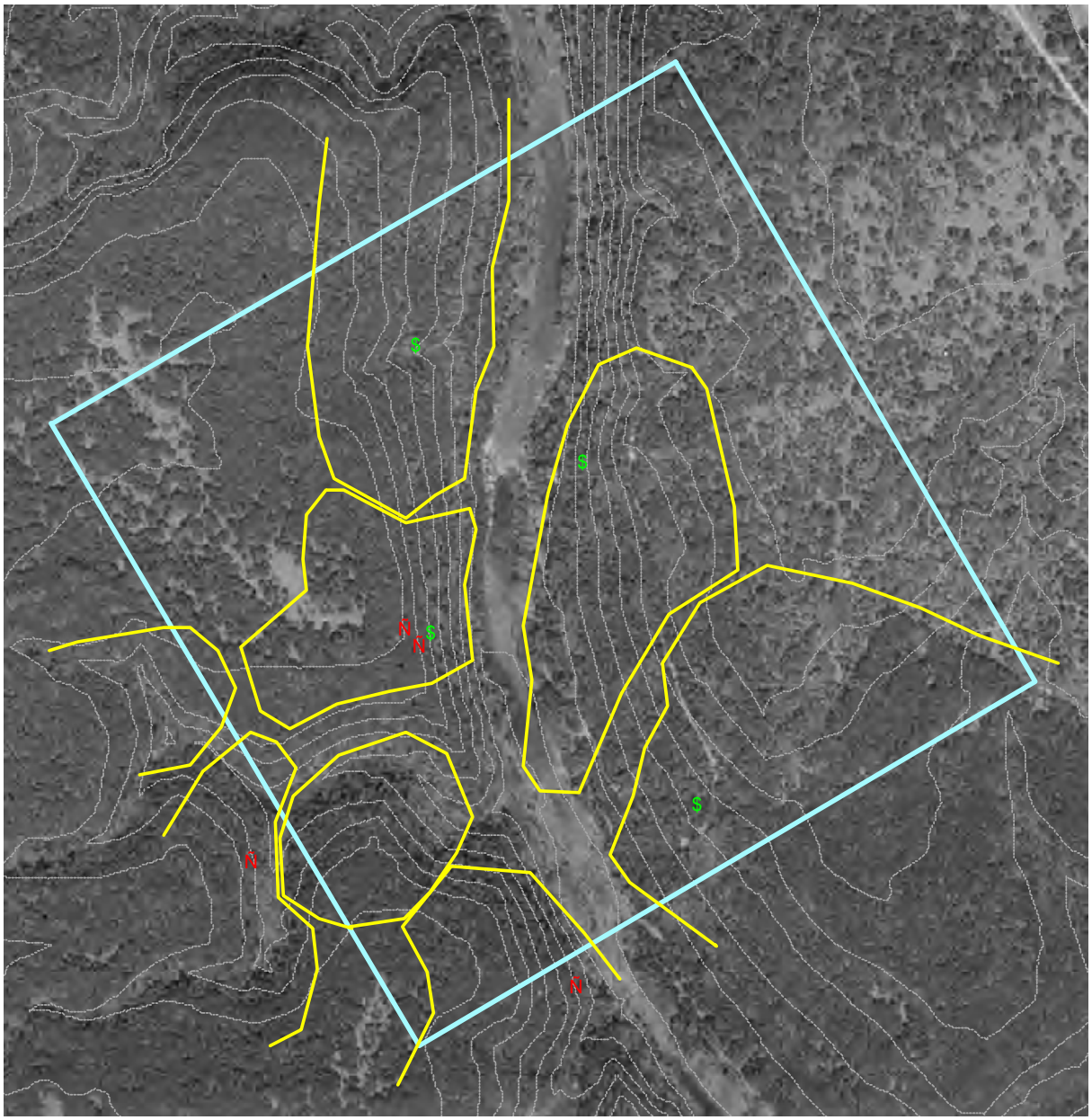


2002 Golden-Cheeked Warbler Surveys
Barton Creek 100-acre Plot

Figure 1

Legend

Ñ GCW Fledglings

$ GCW Females

GCW Territory Boundary

Plot Boundary

N

W E

S

Scale

300 0 300 600 Feet

Base Map: USGS 7.5' Austin West, Tex.
Observer: Scott Haywood



2002 Golden-Cheeked Warbler Surveys
Emma Long 100-acre Plot

Figure 2

Legend

% GCW Nest
Ñ GCW Fledglings
$ GCW Females
GCW Territory Boundary
Plot Boundary

N
W E
S

Scale

300 0 300 Feet

Base Map: USGS 7.5' Austin West Tex.
Observer: D.Thompson



2002 Golden-Cheeked Warbler Surveys
Ivanhoe 100-acre Plot

Figure 3

Legend

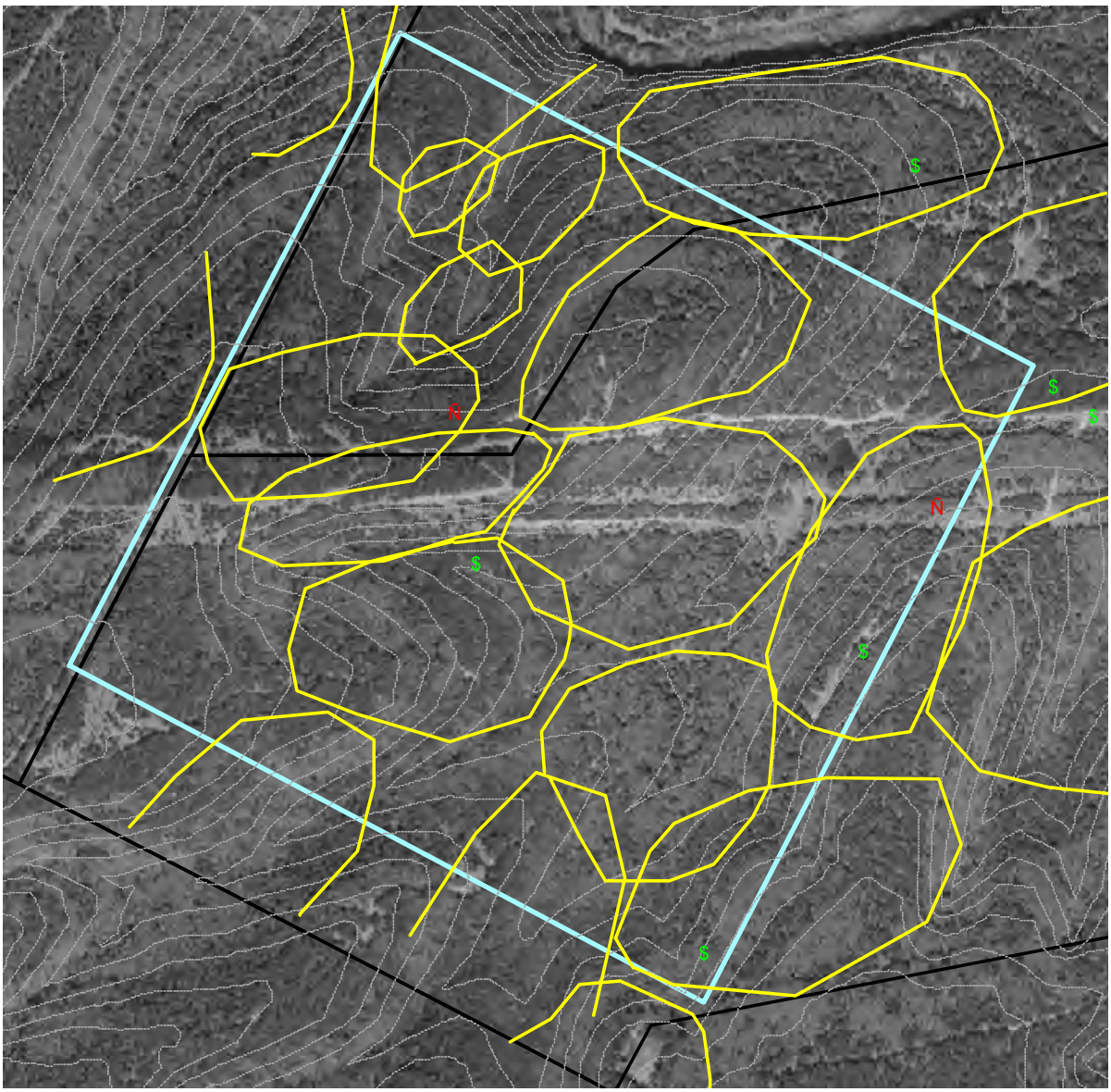
- Plot Boundary
- Ñ GCW Fledglings
- $ GCW Females
- GCW Territory Boundary
- Plot Boundary

N W E S

Scale

800 0 800 1600 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: Mark Sanders



2002 Golden-Cheeked Warbler Surveys
3M/St. Edwards 100-acre Plot

Figure 4

Legend

- Property Boundary
- GCW Fledglings (Ñ)
- GCW Females ($)
- GCW Territory Boundary
- Plot Boundary

N W E S

Scale

300 0 300 600 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: Jackie Davis



2002 Golden-Cheeked Warbler Surveys
Forest Ridge 100-acre Plot

Figure 5

Legend

- Property Boundary
- GCW Fledglings
- GCW Females
- GCW Territory Boundary
- Plot Boundary
- GCW Nest

N W E S

Scale

900 0 900 1800 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: Carlo Abbbruzzese



2002 Golden-Cheeked Warbler Surveys
Bohls 100-acre Plot

Figure 6

Legend

- Ñ GCW Fledglings
- $ GCW Females
- Property Boundary
- GCW Territory Boundary
- Plot Boundary

N
W E
S

Scale

400 0 400 Feet

Base Map: USGS 7.5' Bee Cave, Tex.
Observer: Carlo Abbruzzese



2002 Golden-Cheeked Warbler Surveys
Emma Long Enumeration

Figure 7

Legend

% GCW Nest

Ñ GCW Fledglings

$ GCW Females

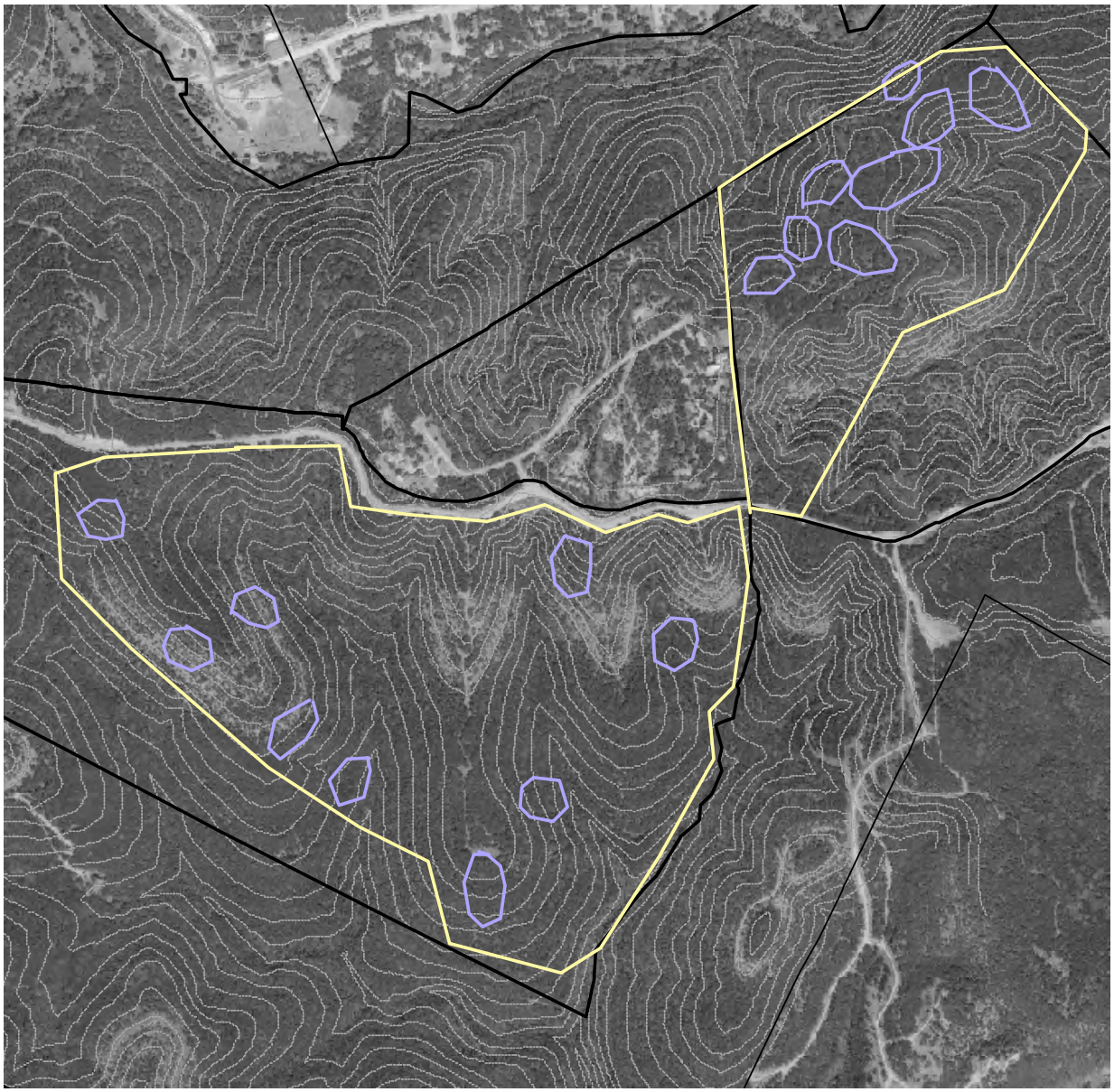
GCW Territory Boundary

N
W E
S

Scale

400 0 400 800 Feet

Base Map: USGS 7.5' Austin West Tex.
Observer: Mary Ruth Holder



2002 Golden-Cheeked Warbler Surveys
Coldwater Enumeration

Figure 8

Legend

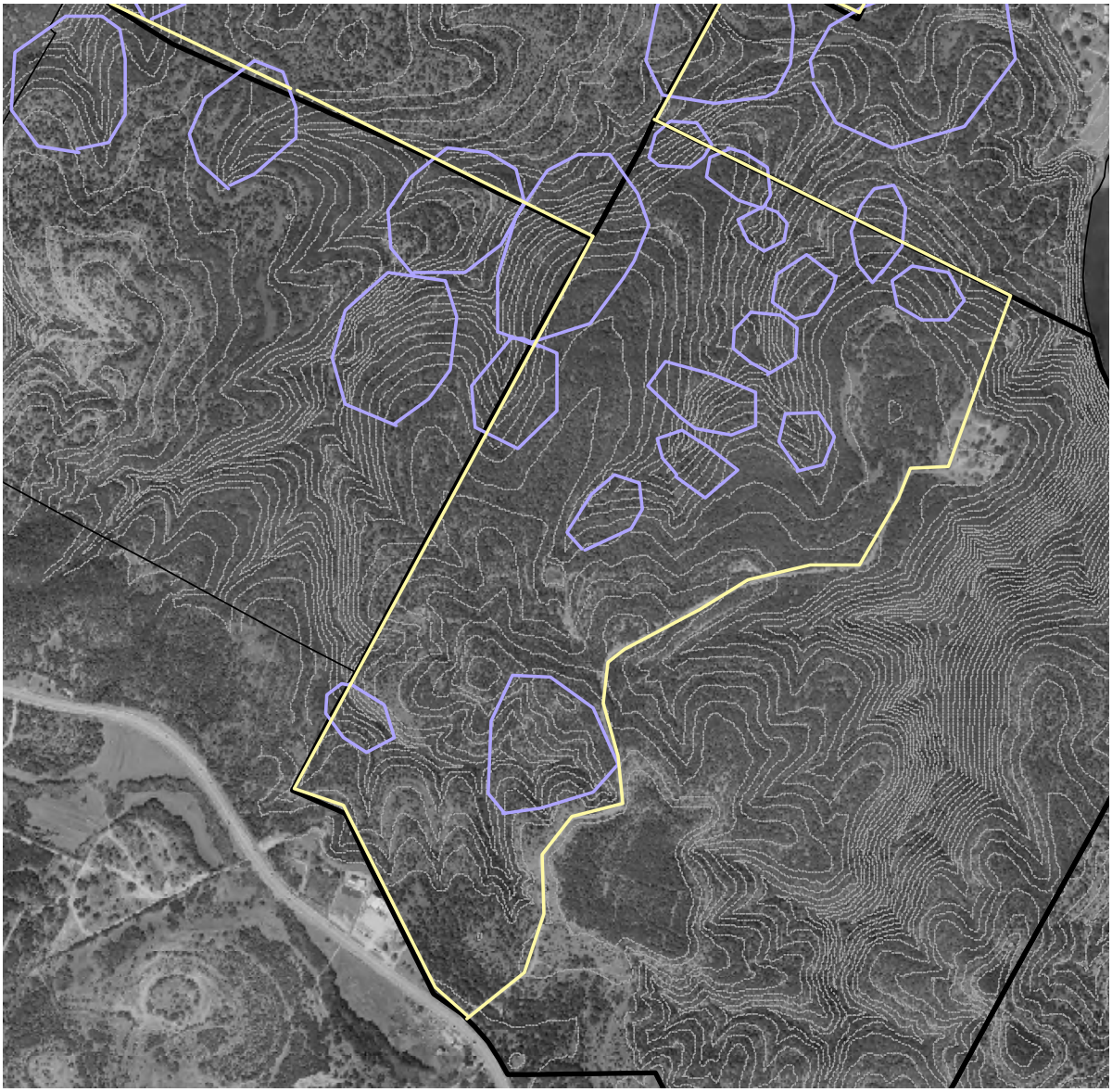
- Property Boundary
- GCW Fledglings
- GCW Territory Boundary
- GCW Females
- GCW Enumeration

N W E S

Scale

2000 0 2000 Feet

Base Map: USGS 7.5' Austin West, Tex.
Observer: Rachel Zierzow



2002 Golden-Cheeked Warbler Surveys
Reicher Ranch Enumeration

Figure 9

Legend

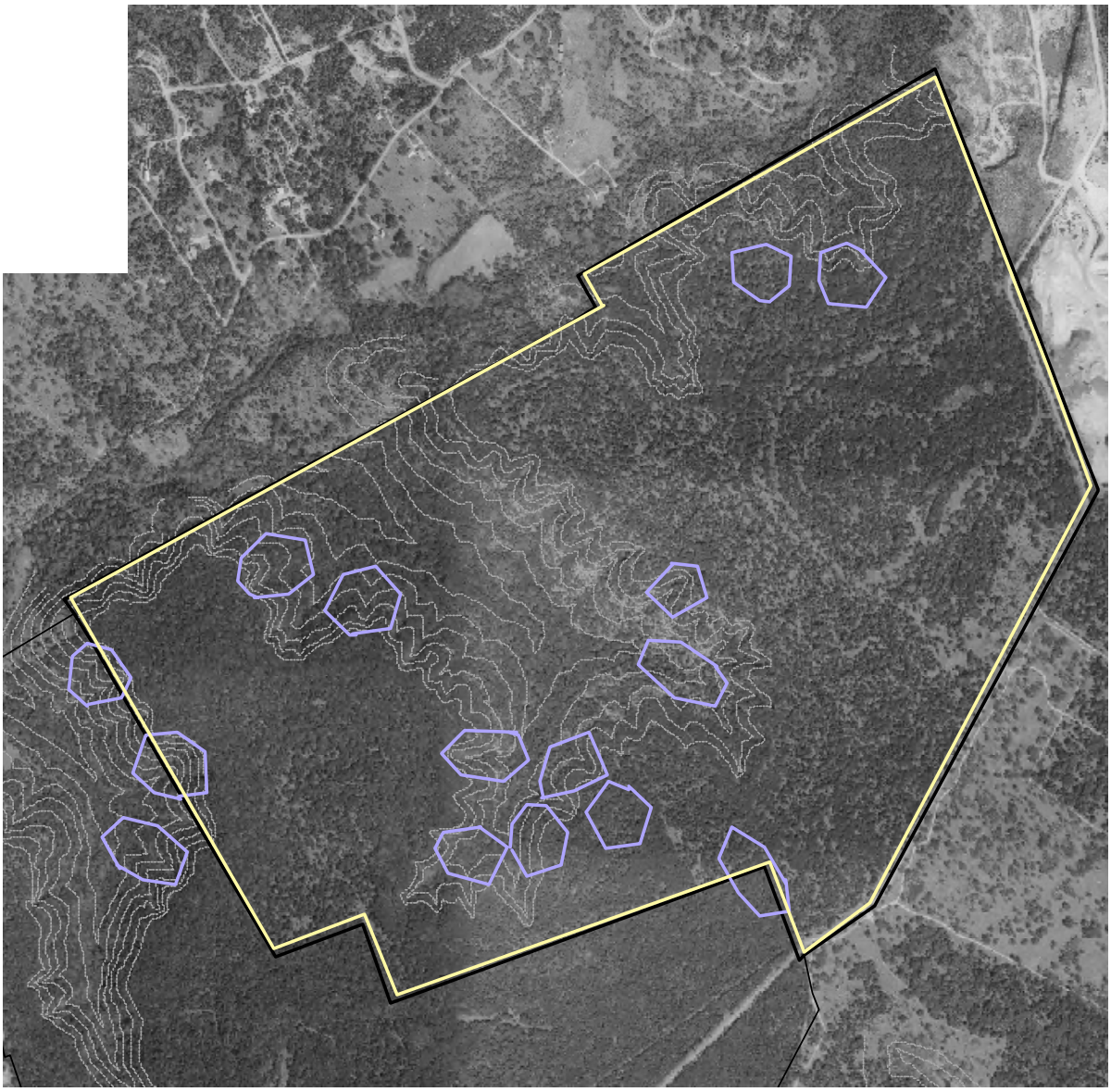
- Property Boundary
- GCW Fledglings
- GCW Females
- Warbler Territory
- Survey Area

Scale

N
W E
S

900 0 900 Feet

Base Map: USGS 7.5' Bee Caves, Tex.
Observer: Carlo Abbruzzese



2002 Golden-Cheeked Warbler Surveys
Lime Creek Tract

Figure 10

Legend

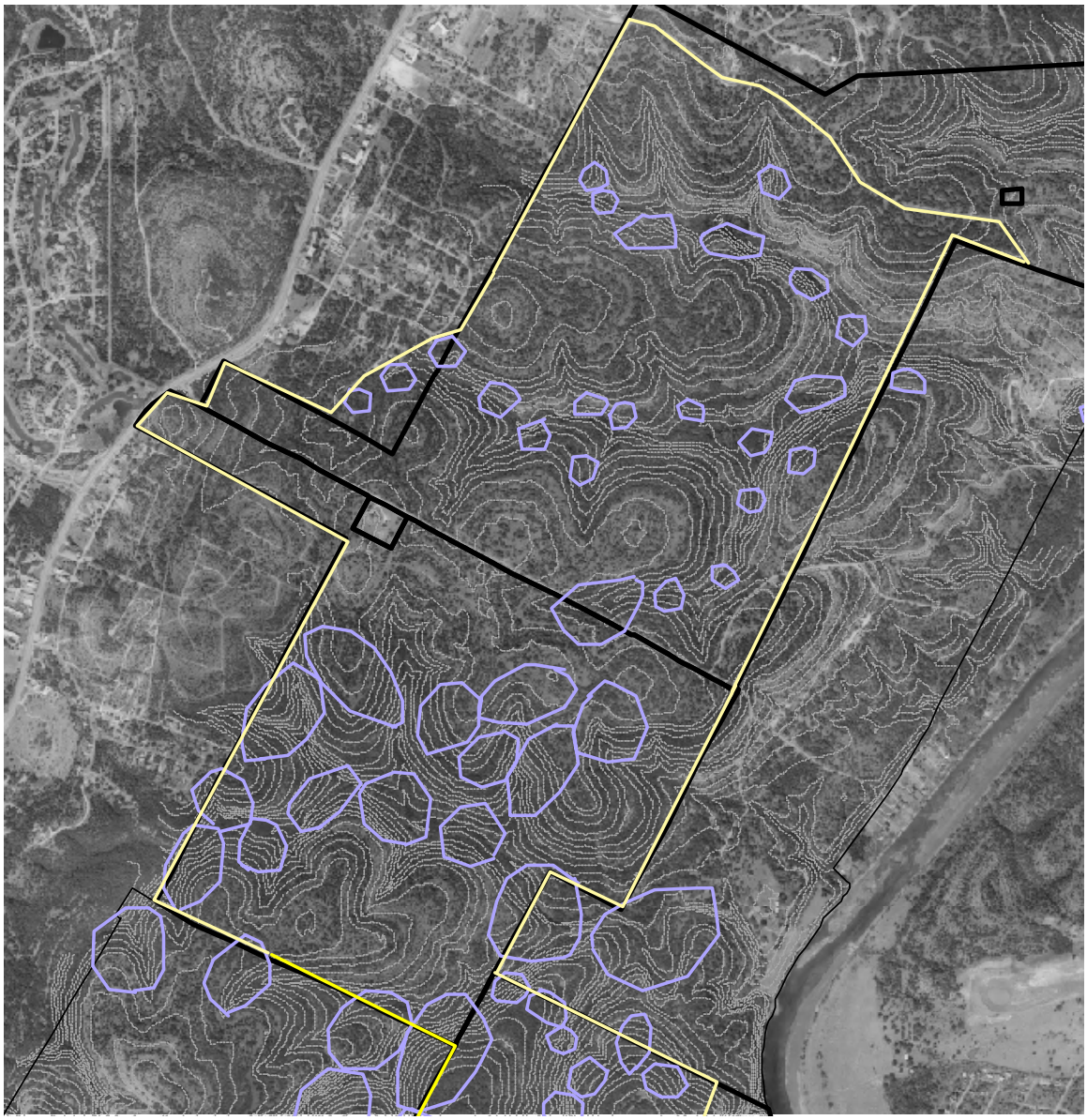
- Property Boundary
- GCW Fledglings
- GCW Females
- GCW Territory Boundary
- Survey Area

N
W E
S

Scale

2000 0 2000 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: M. Sanders



2002 Golden-Cheeked Warbler Surveys
Double J and T Enumeration

Figure 11

Legend

- Property Boundary
- GCW Territory Boundary
- GCW Fledglings
- Survey Area
- GCW Females

N
W E
S

Scale

900 0 900 1800 Feet

Base Map: USGS 7.5' Bee Cave, Tex.
Observers: C. Davis, Jackie Davis



2002 Golden-Cheeked Warbler Surveys
Bull Creek Enumeration

Figure 12

Legend

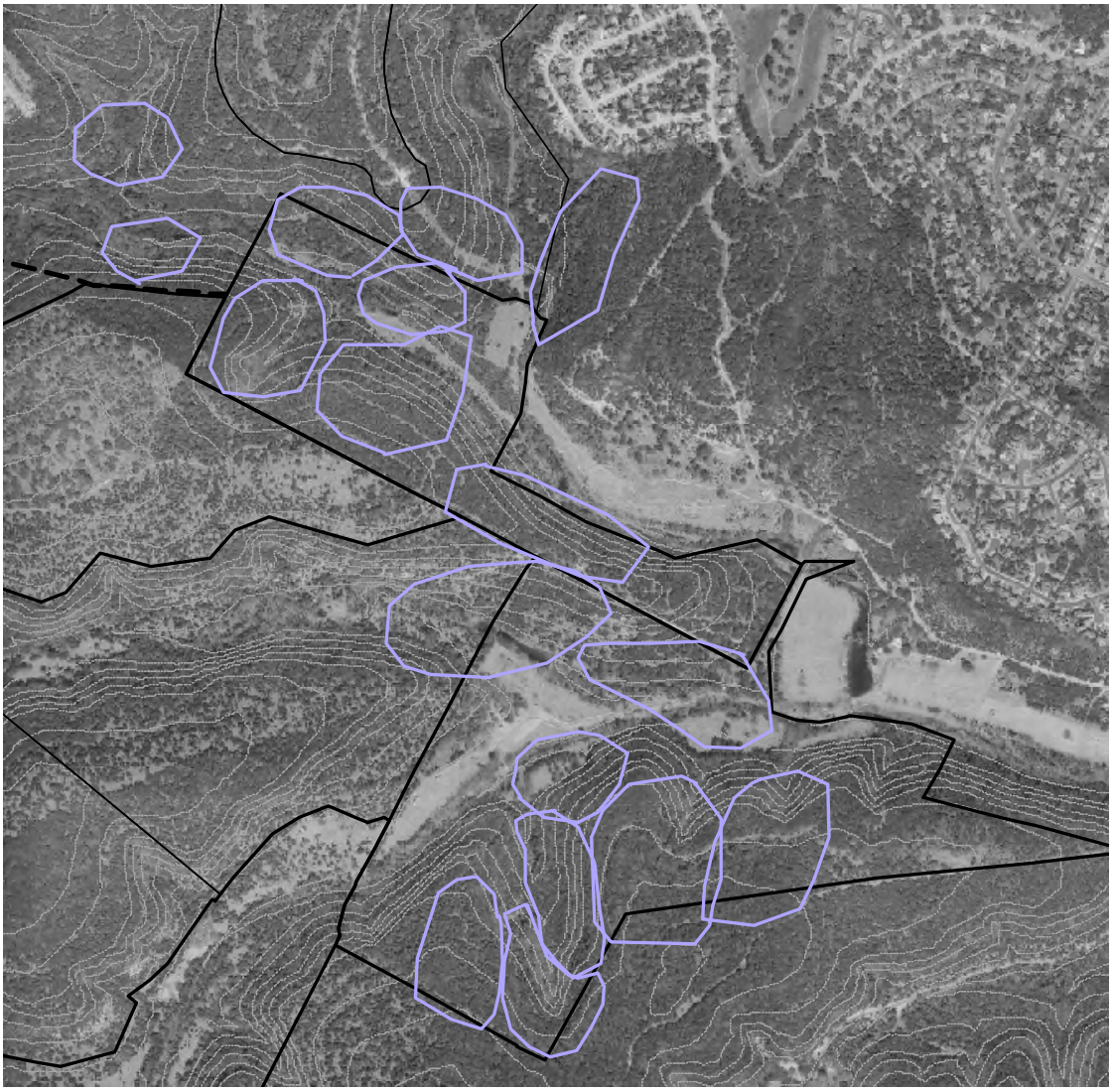
- Property Boundary
- GCW Fledglings
- GCW Females
- GCW Territory Boundary
- Survey Area

N
W E
S

Scale

0 4000 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: J. Davis, M. Lytle



2002 Golden-Cheeked Warbler Surveys
Franklin/Hanks Tracts

Figure 10

Legend

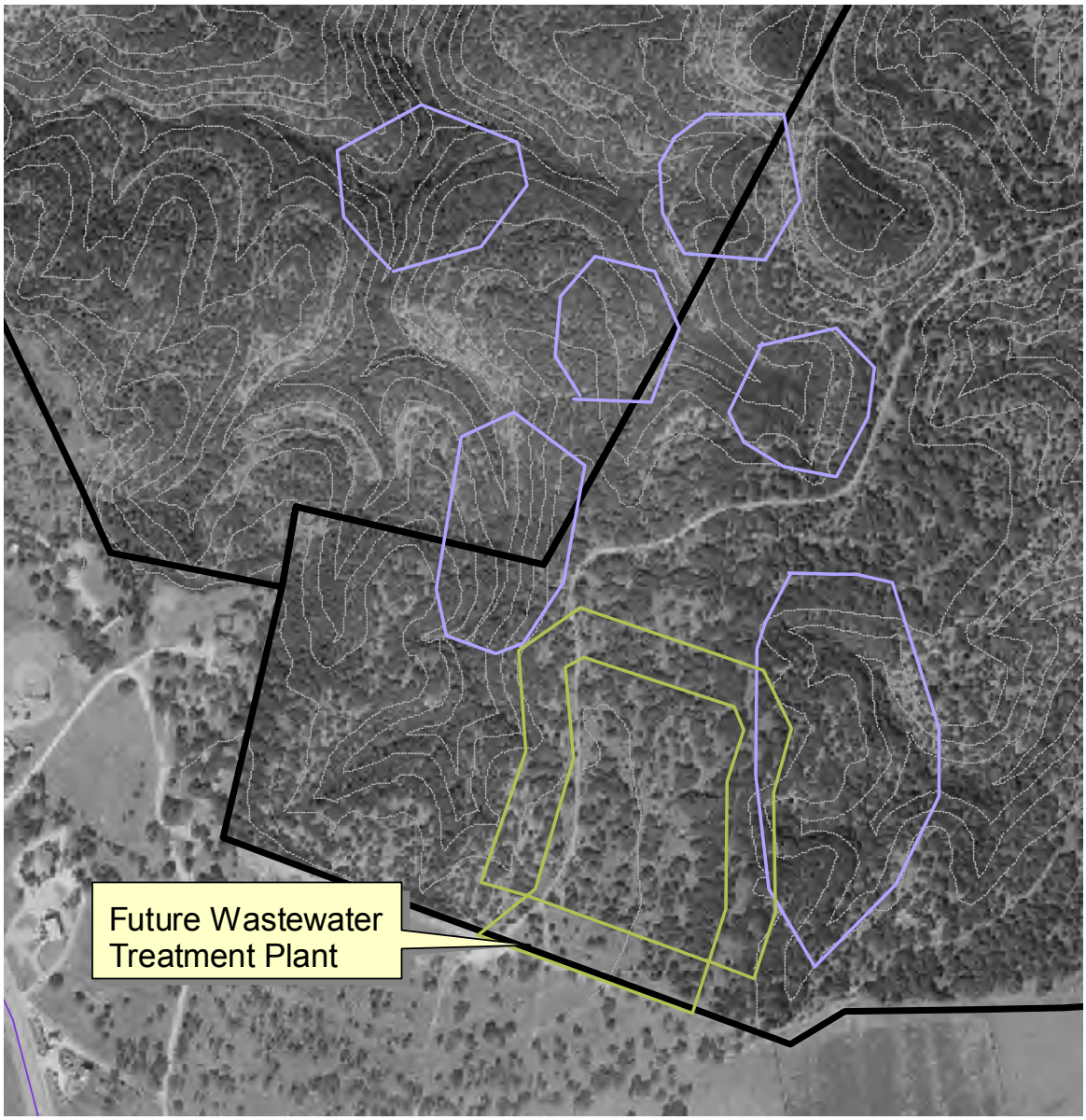
- Property Boundary
- GCW Fledglings
- GCW Females
- GCW Territory Boundary
- Survey Area

N W E S

Scale

2000 0 2000 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: M. Sanders



2002 Golden-Cheeked Warbler Surveys
Bohls Enumeration

Figure 14

Legend

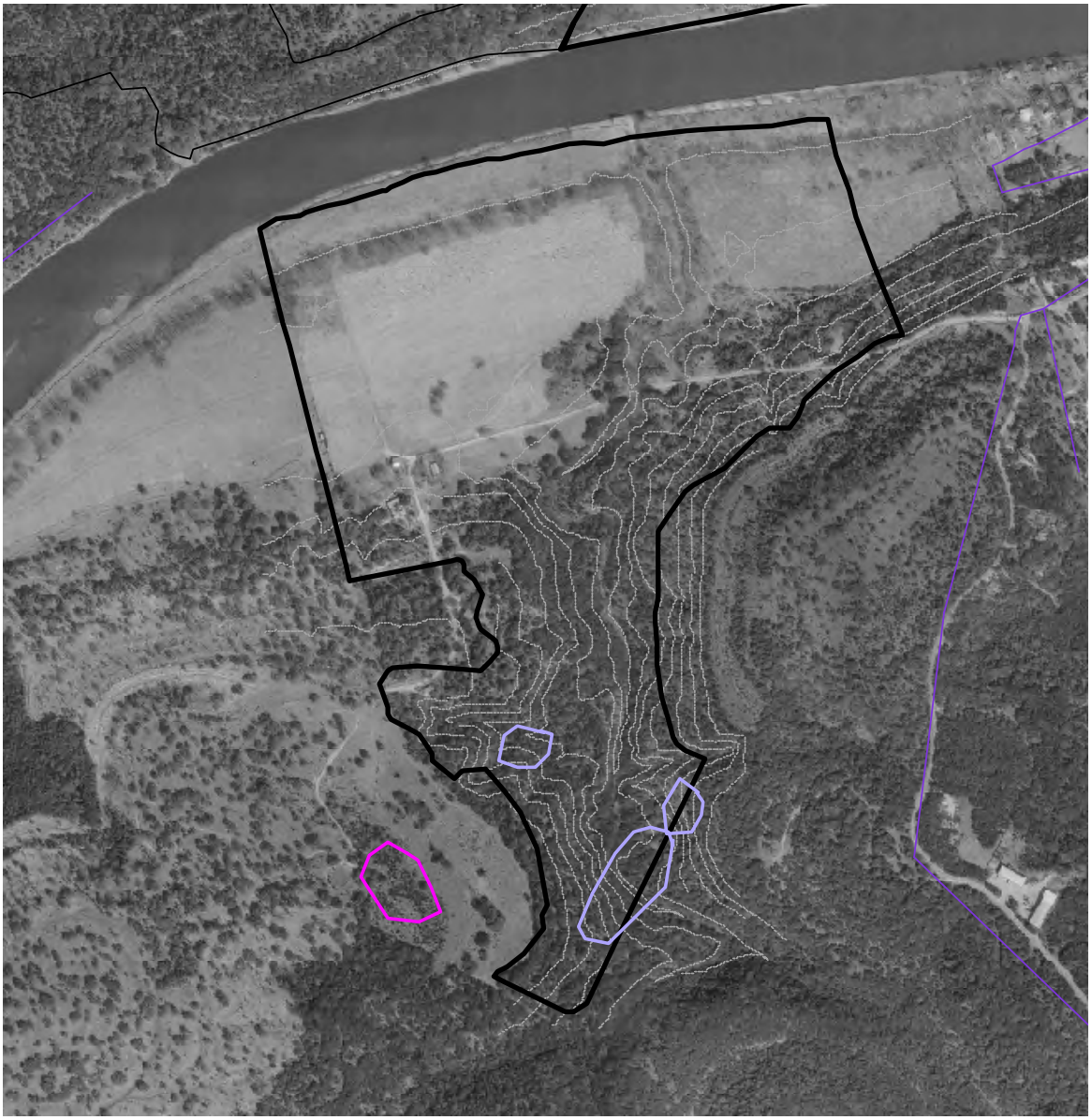
- Property Boundary
- GCW Fledglings
- GCW Females
- GCW Territory Boundary
- Plot Boundary

N
W E
S

Scale

300 0 300 600 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: Carlo Abbruzzese



2002 Endangered Bird Surveys
Commons Ford Ranch

Figure 15

Legend

- Property Boundary
- GCW Fledglings (Ñ)
- GCW Females ($)
- GCW Territory Boundary
- BCV Territory Boundary

N W E S

Scale

300 0 300 600 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observer: Carlo Abbruzzese



2002 Black-capped Vireo Surveys
Cortana Tract

Figure 16

Legend

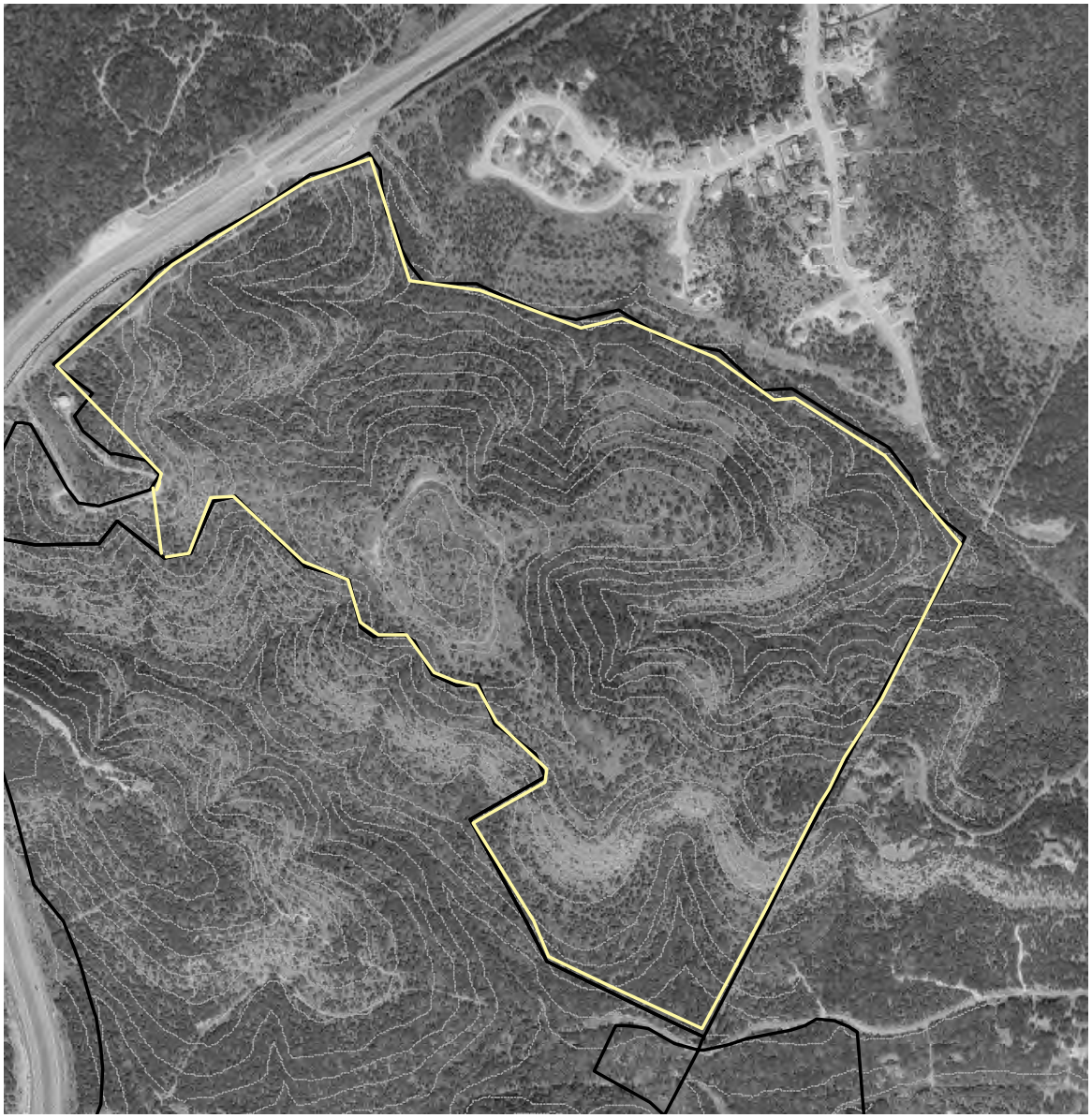
- Property Boundary
- BCV Fledglings
- BCV Territory Boundary
- BCV Females
- BCV Nest

N
W E
S

Scale

200 0 200 400 Feet

Base Map: USGS 7.5' Jollyville, Tex.
Observers: C.Abbruzzese,



2002 Black-capped Vireo Surveys
Black-capped Vireo Research Area

Figure 17

Legend

Property Boundary Survey Area

N
W E
S

Scale

400 0 400 800 Feet

Base Map: USGS 7.5' Austin West Tex.
Observers: A. Sugeno, C. Abbruzzese