City of Austin
2005 Golden-cheeked Warbler
Dendroica chrysoparia and Black-capped Vireo
Vireo atricapilla Monitoring Program

Balcones Canyonlands Preserve Annual Report
Fiscal Year 2004-05



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TABLE OF CONTENTS

I. GOLDEN-CHEEKED WARBLER MONITORING 4

INTRODUCTION 4
Background 4
Objectives 4
METHODS 5
Study Sites 5
Site Description 5
Region-wide Monitoring Program: 100-acre Study Plots 6
Enumerations 7
RESULTS AND DISCUSSION 7
100-acre Study Plots 7
Enumerations 10
Nest Parasitism 11

II. BLACK-CAPPED VIREO HABITAT RESTORATION 12

BACKGROUND 12
Balcones Canyonlands Conservation Plan 12
Current BCVI Habitat 12
BCVI HABITAT RESTORATION 12
HABITAT RESTORATION PROJECTS 13

III. BLACK-CAPPED VIREO MONITORING 14

INTRODUCTION 14
Background 14
Objectives 14
METHODS 14
Sites and Survey Effort 14
Data Collection and Analysis 15
RESULTS AND DISCUSSION 15
Nest parasitism and depredation on Cortaña 16
Other Tracts 16

IV. LITERATURE CITED 17

V. APPENDICES A – I 19

VI. FIGURES 30

LIST OF FIGURES

FIGURE 1. PRIME PLOT: 3M/ST.EDWARDS 31
FIGURE 2. PRIME PLOT: BARTON CREEK 32
FIGURE 3. PRIME PLOT: BOHLS 33
FIGURE 4. PRIME PLOT: EMMA LONG 34
FIGURE 5. PRIME PLOT: FOREST RIDGE 35
FIGURE 6. PRIME PLOT: IVANHOE 36
FIGURE 7. TRANSITIONAL PLOT: CANYON CREEK 37
FIGURE 8. TRANSITIONAL PLOT: DOUBLE J AND T 38
FIGURE 9. ENUMERATION: 3M/ST. EDWARDS/KRUGER/JESTER 39
FIGURE 10. ENUMERATION: BOHLS 40
FIGURE 11. ENUMERATION: COMMONS FORD PARK 41
FIGURE 12. ENUMERATION: CORTAÑA 42
FIGURE 13. ENUMERATION: DOUBLE J AND T (NORTH) 43
FIGURE 14. ENUMERATION: DOUBLE J AND T (SOUTH) 44
FIGURE 15. ENUMERATION: EMMA LONG PARK 45
FIGURE 16. ENUMERATION: FRANKLIN/WTP4/HANKS/LANIER 46
FIGURE 17. ENUMERATION: LIME CREEK/AUSTIN SIMON 47
FIGURE 18. ENUMERATION: PARKE WEST/LONG CANYON 48
FIGURE 19. ENUMERATION: REICHER RANCH 49
FIGURE 20. CORTAÑA 50

The City of Austin

2005 Golden-cheeked Warbler and Black-capped Vireo Monitoring Program

Balcones Canyonlands Preserve Annual Report

This report summarizes the results of the City of Austin's 2005 golden-cheeked warbler (*Dendroica chrysoparia*) and black-capped vireo (*Vireo atricapilla*) endangered species monitoring program. The 2005 field season was the eighth year of endangered species monitoring on the City of Austin's Balcones Canyonlands Preserve properties.

I. GOLDEN-CHEEKED WARBLER MONITORING

INTRODUCTION

Background

The golden-cheeked warbler (GCWA) is a Neotropical migrant passerine that breeds only in central Texas where suitable oak-juniper (*Quercus spp.-Juniperus Ashei*) habitat occurs (Ladd and Gass 1999). Due to accelerating loss of breeding habitat over the past several decades, this species was listed as federally endangered by the U.S. Fish and Wildlife Service in 1990 (USFWS 1990). The Balcones Canyonlands Preserve (BCP) was established in 1996 in part to mitigate for continuing loss of golden-cheeked warbler breeding habitat in western Travis County and to aid in the species' local recovery (BCP 1998). The Balcones Canyonlands Preserve is managed by a number of private and public entities, including the City of Austin. The City of Austin manages 13,035 acres of the BCP.

Objectives

Stated management goal of the Balcones Canyonlands Preserve for the golden-cheeked warbler is

> . . . to maintain and, if possible, increase the population of golden-cheeked warblers in the BCP. The focus of management should be to produce rates of occupancy, fecundity, and survivorship … that equal or exceed those recommended in the [USFWS 1996] *Golden-cheeked Warbler Population and Habitat Viability Assessment Report* (BCP 1998).

To facilitate species' survival and recovery, the golden-cheeked warbler population on the BCP and on the Balcones Canyonlands National Wildlife is monitored through a standardized, region-wide program. Population and productivity trends are tracked on a series of 100-acre plots located throughout the BCP and BCNWR. The City of Austin collects data on territory density, territory location, pairing success, breeding success, and productivity. The City of Austin also conducts territory enumerations over a large area of the BCP to ascertain distribution and to estimate overall territory numbers.

METHODS

Study Sites

In field season 2005, golden-cheeked warbler territories were mapped on six 100-acre "prime" study plots. Prime plots are defined as those with >75% excellent golden-cheeked warbler habitat, i.e. habitat with >70% canopy cover (BCP 1998). Prime plots were established on six different BCP tracts: Emma Long, Barton Creek, Ivanhoe, Forest Ridge, 3M/St. Edwards, and Bohls.

At least one plot is located in each Macrosite where the City of Austin owns BCP lands. Limited prime habitat in the South Lake Austin Macrosite required establishing the Bohls study plot in an area that does not fully meet the definition of prime plot, but contains <75% excellent habitat. The plot shape also differs from the other prime plots which are square.

Warbler territories were also mapped on two "transitional" plots: one on the Canyon Creek tract, and one on Double J and T. Transitional plots comprise habitat containing zero to a few warbler territories that may improve as warbler habitat within the next 30 years (BCP 1998). Additionally, enumerations were conducted on 18 city-managed Preserve tracts totaling 7,704 acres. (See Appendix A for a summary of acreages, surveyors and survey effort for each tract.)

Site Description

The topography and vegetation of the surveyed tracts are typical of the eastern edge of the Edwards Plateau. Steep, wooded canyons and riparian corridors dissect drier upland savannahs. Most streams are intermittent, though a few have a permanent water source, such as a perennial spring. The predominant vegetation association is oak-juniper.

It is thought that woodlands in western Travis County were logged in the late 1800s and early 1900s and are currently in various stages of recovery (Keddy-Hector 1996). 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. Current and past overbrowsing by white-tailed deer (*Odocoileus virginianus*) has reduced understory floral diversity and species abundance. A distinct browse line is visible on the majority of Preserve tracts. A paucity of certain deciduous woody species is evident throughout the Preserve.

In woodlands and forests, the canopy is dominated by 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 pavias pavias*), white shin oak (*Quercus sinuata* var. *breviloba*), Mexican buckeye (*Ungnadia speciosa*), Lindheimer silk-tassel (*Garrya Lindheimeri*) and elbow bush (*Forestiera pubescens*). Descriptions of individual prime plots

can be found in Abbruzzese and Koehler (2003), as well as in Tier III Land Management Plans for each property (BCP 1998).

Region-wide Monitoring Program: 100-acre Study Plots

Territory mapping was conducted on eight permanent 100-acre study plots. Each prime plot was monitored a total of 60 hours with ten visits during the breeding season. Prime plots are surveyed each year. Transitional plots are surveyed at least every other year and require only three to four visits during the breeding season. Canyon Creek was surveyed a total of 53 hours, and Double J and T a total of 29 hours. All permanent study plots were surveyed by staff biologists. The region-wide monitoring program and the data collection protocol is described in detail in the Balcones Canyonlands Preserve Land Managers Handbook, Chapter VIII: Monitoring of the Golden-cheeked Warbler (BCP 1998); the City of Austin Golden-cheeked Warbler and Black-capped Vireo Monitoring Program (Abbruzzese and Koehler 2003); and Appendix B of this document.

Analysis of Territory Density on Prime and Transitional Plots. Number of territories on 100-acre plots were calculated and presented in three ways: 1) as a low estimate (only full territories were counted); 2) as a high estimate (both full and edge territories were counted as 1.00); and 3) using Verner's (1995) method (each territory that straddles the boundary of the plot was counted as 0.5 territories). Verner's counting method avoids the upward bias inherent in the IBCC's (1970) methodology. Territory density is given as number of territories (using Verner's counting method) per 100 hectares. These calculations were also applied during the seven previous survey years for the 100-acre study plots.

Analysis of Pairing Status and Productivity on Prime Plots. Productivity and mated status were estimated only for "full" territories, i.e., those that fell entirely within plot boundaries. Males were determined to be paired if they were observed associating with a female, observed tending young, or a nest was located for that male. The pairing success rate is the number of males determined to have paired with a female divided by the number of full territories.

A territory was considered to have bred successfully if the male or female was observed tending one or more nestling or fledgling. The breeding success rate is the number of territories determined to have produced at least one young divided by the number of full territories. Productivity was calculated in two ways. First, the highest number of nestlings or fledglings observed for each brood were summed and divided by the number of pairs that successfully bred. Second, the total number of nestlings or fledglings produced per brood was divided by the total number of full territories. Pairing and productivity data were not collected on transitional plots.

Fecundity was derived by multiplying the total number of young produced for all full territories by 0.50 (based on studies indicating a 1:1 ratio of male and female offspring for this species (Anders 2000)) and then dividing by the number of full territories. This gives an estimate of the number of males produced per singing male.

Enumerations

Enumeration is a count of all singing males in a given area and provides data on distribution and an estimate of territory numbers. Enumerations required three to four visits per study area during good weather conditions (USFWS 1994). Incidental sightings of females and fledglings, parasitism, and predators were noted and mapped. Analysis of pairing and breeding success was not conducted.

Because enumeration survey effort varies between tracts and between years, results are not comparable. Surveyors attempted to sort out individual warblers to increase the accuracy of the count. However, significantly less time was spent on enumeration surveys per acre than on the 100-acre study plots. Therefore, all enumeration results are estimates only. Total survey effort in 2005 for enumerations was 385 hours (see Appendix A). Surveys were carried out by staff biologists and trained volunteers.

RESULTS AND DISCUSSION

100-acre Study Plots

Territory Densities and Locations. Table 1 presents data on territory numbers for six prime plots. Results are stated in three ways based on three different counting methods. The low estimate includes only territories within the boundaries of the plot. The high estimate counts territories within the plot as well as edge territories. The third method, based on Verner (1995), counts territories within the plot and counts each edge territory as a half territory. (See Methods section, above.)

In 2005, average golden-cheeked warbler territory density (based on Verner's (1995) counting method) for six prime study plots was 33.6 territories per 100 hectares (range 17.3-50.6) (Table 1). This territory density is slightly higher than in 2004 (33.4 territories/100ha). (See Appendix C for data from 1998-2004.) Consistent with 2004 surveys, Ivanhoe had the highest territory density, and Barton Creek had the lowest density, followed by the Bohls plot with the second lowest density. Figures 1-6 depict territory locations for prime plots. Territory maps depict territory locations relative to topography and to other territories and do not represent actual territorial boundaries.

Low territory density on the Bohls study plot may be influenced by both plot shape and limited prime habitat. Bohls is the only prime study plot that is not square in shape; its configuration has a higher edge to area ratio than the other five plots (see Figure 3). This increases the probability that on Bohls a given territory will straddle a plot boundary, and thus be counted as only half a territory. The other variable that may affect density data is the fact that Bohls is less than 75% prime habitat. All other prime plots comprise approximately 90─100% prime habitat. In comparing results between prime plots, variability in plot parameters should be considered.

Table 1. Golden-cheeked warbler territory number and territory density (per 100ha) for six 100-acre prime study plots on the City of Austin Balcones Canyonlands Preserve, Travis County, Texas, field season 2005. See Methods section for calculations.

Prime Plot Name	No. of Full Territories	No. of Full and Edge Territories	No. of Full Territories + (0.5 x Edge Territories)	Territory Density (100ha)
Barton Creek	4	10	7.0	17.3
Emma Long	14	22	18.0	44.5
Ivanhoe	15	26	20.5	50.6
St. Eds/3M	7	19	13.0	32.1
Forest Ridge	11	19	15.0	37.1
Bohls Hollow	6	10	8.0	19.8
Average			13.6	33.6

Pairing Success, Breeding Success, and Productivity. Average pairing rate for full territories on six prime study plots was 74%, with a 100% pairing occurring on Barton Creek (Table 2). This was followed by a pairing rate of 91% on Forest Ridge. Only 50% of males were found to have mates on Bohls. The average breeding success rate on the six prime plots was 47% (range 0-100%). Barton Creek had the highest breeding success, and Bohls had the lowest breeding success. No second broods were observed for any full territory. Although the pairing rate increased in 2005 from 66% in 2004, the breeding success rate remained the same as in 2004.

A total of 57 fledglings were observed in 27 broods, yielding an average productivity of 2.11 fledglings per successful pair and 1.00 fledglings per full territory. Fecundity was 0.50 male fledglings per singing male. Because young are very difficult to detect once they have fledged from the nest, productivity and fecundity measures represent minimum rates. Actual rates are likely to be higher. Reported fecundity rates from productivity studies conducted at Ft. Hood in 2000 and 2001 were 1.44 female young per SY (= second year) female in 2000 and 2001, and 1.56 female young per ASY (= after second year) female in 2000 and 1.74 female young per ASY female in 2001 (Anders 2000, 2001). These are the highest rates documented for golden-cheeked warbler fecundity (see Alldredge et al. 2002). Fecundity rates are assumed to be the same for male young per SY and ASY males.

In 2005, a two-year study was initiated on two tracts on the BCP: Emma Long and Forest Ridge. The study was designed, in part, to determine golden-cheeked warbler productivity by monitoring nests with video cameras (Reidy and Thompson). The study will be continued in field season 2006. Results should yield more reliable estimates of fecundity for the BCP warbler population.

Table 2. Golden-cheeked warbler pairing rate; breeding success rate; and productivity on six prime study plots on the City of Austin's Balcones Canyonlands Preserve, Travis County, Texas, field season 2005. Data is based on observations of full territories only. See methods for calculations.

Prime Plot Name	No. of Terr. w/ Female	Pairing Rate	No. of Terr. producing ≥1 young*	Breeding Success Rate	Product. / Successful Territory	Product. / Full Territory
Barton Creek	4	1.00	4	1.00	3.00	3.00
Emma Long	12	0.86	6	0.43	2.17	0.93
Ivanhoe	8	0.53	4	0.27	2.50	0.67
St. Eds/3M	5	0.71	5	0.71	1.60	1.14
Forest Ridge	10	0.91	8	0.73	1.75	1.27
Bohls Hollow	3	0.50	0	0.00	0.00	0.00
Average		0.74		0.47	2.11	1.00

* = Brood Number as no second broods were detected in 2005.

Transitional 100-acre Study Plots Average territory density for the two transitional study plots was 18.0 territories per 100 hectares, slightly higher than the prime plot with the lowest density (Barton Creek) (Table 3). Densities for both study plots increased dramatically over numbers from the last surveys conducted in 2003 (see Appendix E for survey data 1998-2003). Pairing rates for both plots are presented in Table 4. Breeding and productivity data for Canyon Creek were noted incidentally and are also presented in Table 4.

Table 3. Golden-cheeked warbler territory number and territory density (per 100ha) for two 100-acre transitional study plots on the City of Austin Balcones Canyonlands Preserve, Travis County, Texas, field season 2005. See Methods section for calculations.

Transitional Plot Name	No. of Full Territories	No. of Full and Edge Territories	No. of Full Territories + (0.5 x Edge Territories)	Territory Density (100ha)
Double J & T	6	7	6.5	16.1
Canyon Creek	3	13	8.0	19.8
Average			7.25	18.0

Table 4. Golden-cheeked warbler pairing rate for two 100-acre transitional study plots on the City of Austin Balcones Canyonlands Preserve, Travis County, Texas, field season 2005. Incidental breeding success and productivity data for Canyon Creek plot are included in brackets. Data based on observations of full territories only. See Methods section for calculations.

Transitional Plot Name	Pairing Rate	Breeding Success Rate	No. of 2nd broods/no. of young	Product. / Successful Territory	Product. / Full Territory
Double J & T	0.33				
Canyon Creek	1.00	[1.00	1/10	3.34	3.34]
Average	0.55				

Enumerations

A total of 249 singing golden-cheeked warbler males were recorded on 17 BCP tracts. Incidental observations include 68 females and 52 fledglings. Although the Vireo Preserve was surveyed for warblers, none were detected on the tract (as in previous years). Figures 9 through 19 depict the distribution of singing males and incidentally sighted females and fledglings.

Surveys conducted at Commons Ford Park detected only one male warbler defending a territory this year--a decrease from two in 2004. There were also no sightings of females or young this year. Noise pollution along the edge of the preserve from new residential

construction may have had a deleterious effect on pairing and breeding success in the park (E. Fair, pers. comm.).

Nest Parasitism

No incidents of nest parasitism of golden-cheeked warblers by brown-headed cowbirds (*Molothrus ater*) were reported on any surveys (see Appendix G for a summary of brown-headed cowbird management).

II. BLACK-CAPPED VIREO HABITAT RESTORATION

BACKGROUND

Balcones Canyonlands Conservation Plan

The BCCP Land Management Plan (BCP 1998) requires maintaining or creating 2000 acres of black-capped vireo habitat within the BCP. The BCCP Land Management Plan originally identified specific acreage as potential vireo habitat. Much of this acreage has, through natural succession, been replaced by oak-juniper woodland that is prime habitat for the golden-cheeked warbler. Additionally, a number of properties containing potential or occupied vireo habitat that were originally included within the proposed BCP boundaries have been lost to development in the intervening years.

Current BCVI Habitat

The Cortaña tract (1752 acres) in the North Lake Austin Macrosite is the only CoA BCP property currently occupied by black-capped vireos. In 1995, circa 57 acres of oak-juniper habitat were manipulated on upper Cortaña and the adjacent, privately managed, River Place Mitigation tract. Approximately 39 acres were manipulated on Cortaña and 18 acres on River Place. Both hand-clearing and hydro-axing methods were applied. In each year since 2000, three to five males have established territories in this area.

The Black-capped Vireo Preserve, although once home to 32 breeding pairs of vireos, is no longer occupied habitat. The last breeding pair was detected there in 1997.

BCVI HABITAT RESTORATION

The CoA BCP Program is committed to identifying and restoring habitat for the black-capped vireo on City-managed preserve land. A search for occupied or potential vireo habitat is conducted every year during enumeration surveys that cover a large portion of the CoA BCP (see Appendix A). GIS is also used to locate and analyze potential restoration sites. Specific site characteristics (e.g., soils, topography, geology), the distribution of golden-cheeked warblers, and the history of occupation by black-capped vireos are all considered in identifying restoration sites. Size of potential restoration area and proximity to urban development are also critical variables.

Because the acreage available for restoration within the boundaries of the BCP is limited, the CoA BCP Program has opted—in addition to restoring optimal habitat—to restore several sites that may yield only marginal vireo habitat.

Critical to all restoration efforts is the control of nest parasites. All occupied or potential vireo habitat that is estimated to become occupied in zero to two years is managed for the brown-headed cowbird (see Appendix G).

HABITAT RESTORATION PROJECTS

Bohls Ranch (450 acres), South Lake Austin Macrosite

- Approximately 30 acres of upland habitat was manipulated beginning in winter 2003-04. Tree shears were used to cut small and medium-sized Ashe junipers that were then mulched into moderately sized pieces (three feet to six inches long) using a small Seppe. This was followed by topping selected live oaks and shin oaks at knee height with chainsaws in order to force lateral re-growth.
- Eighteen acres of additional habitat was restored in September 2005. Selected junipers and other woody vegetation were cleared using a small Seppe to create islands of desirable woody vegetation. Cleared vegetation was mulched into moderately sized pieces. Topping of selected oaks is scheduled for winter 2005-06.

Cortaña (1752 acres), North Lake Austin Macrosite

Upper Cortaña

- In October 2005, nine acres of previously restored habitat on upper Cortañaa were manipulated to maintain an open, patchy landscape; this area had become invaded by dense stands of small Ashe juniper since 1995. Adjacent to this, an additional nine acres of previously un-restored habitat were manipulated. A Seppe was used in both areas to clear and mulch selected woody individuals. This was followed by topping of selected oaks to encourage re-sprouting at the base.

Middle Cortaña

- In winter 2003-04, small and medium-sized Ashe junipers were cut with tree shears on a 30-acre patch at middle Cortaña. In winter 2004-05, felled junipers were mulched into moderately sized pieces with a Seppe. This was followed by topping at knee height of selected live oaks using chainsaws.
- Shin oak acorn planting (harvested from the Kruger tract) on middle Cortaña was completed in October 2005. Circa 450 acorns were randomly planted on the upper slope of the restoration area. Acorns were planted individually in groups of three. Each group was marked with a numbered flag for future monitoring.
- Shin oak acorn planting also took place just north of the middle Cortaña restoration area. In 2005, a small fire burned an 8.5-acre patch of south-facing slope. One hundred fifty acorns were planted and will be monitored to assess the impact of disturbance on the vegetation.

Future Projects

- Seventy-five acres of potentially excellent black-capped vireo habitat have been identified on the Lime Creek tract. Work is scheduled to begin there following field season 2006.
- Several additional tracts have been identified for possible future restoration efforts. These include portions of Double J and T Ranch, Cortaña, and Reicher Ranch.

III. BLACK-CAPPED VIREO MONITORING

INTRODUCTION

Background

The black-capped vireo (*Vireo atricapilla*) is an endangered, Neotropical migrant that breeds only in portions of central Texas, southern Oklahoma, and Coahuila, Mexico (Grzybowski 1995). This species was listed by the USFWS in 1987. Major threats to species' survival are habitat loss, habitat fragmentation, and parasitism by brown-headed cowbirds (*Molothus ater*).

The Balcones Canyonlands Preserve was established in 1996 to mitigate for loss of BCVI habitat in western Travis County due to suburban sprawl and to aid BCVI recovery. The black-capped vireo has been documented on several City of Austin-managed BCP tracts. The best-studied vireo colony occurred at the Black-capped Vireo Research Area. The colony declined steadily from a high of 32 pairs in 1987 to just one pair in 1997 (Steed 1988; Abbruzzese 1998). In 2004, a male BCVI was observed briefly at the Vireo Research area; however, its breeding status could not be confirmed.

A small breeding colony of vireos (three to five territories) have occupied habitat on the Cortaña tract every year since 2000. A part of this colony occupies the adjacent River Place Mitigation tract to the east. Other records for vireos on the CoA BCP for the past decade include sightings on Forest Ridge and Parke West; however, breeding status could not be confirmed.

Objectives

The Balcones Canyonlands Conservation Plan requires setting aside a total of 2,000 acres of potential black-capped vireo habitat in western Travis County within the BCP (1998). The vireo management plan calls for protection and enhancement of the black-capped vireo population on the Preserve. In conjunction with the Balcones Canyonlands National Wildlife Refuge, the BCP should support a viable breeding population, as outlined in the BCVI Recovery Plan (USFWS 1991).

To monitor population trends of black-capped vireos on the City of Austin BCP, black-capped vireo are surveyed every year. In addition, nest searches are conducted to monitor cowbird parasitism. Productivity data are also gathered. Because parasitism by brown-headed cowbirds is a major threat to species' survival, control of cowbirds in vireo habitat is a priority. A hybrid cowbird trap has been maintained during the breeding season on Cortaña since 2000 (see Appendix G).

METHODS

Sites and Survey Effort

In field season 2005, black-capped vireos were surveyed on the northernmost portion (ca. 39 acres) of the Cortaña tract. Observations of vireos on the adjacent River Place Mitigation

tract were also mapped during these surveys. Additionally, all vireos detected during any endangered species survey during the field season were recorded and mapped. An attempt was made to determine their breeding status. The Black-capped Vireo Research Area (214 acres) was surveyed by a staff biologist for a total of 10 survey hours, approximately once per month from April through June.

On Cortaña, data were collected on territory number, territory location, pairing success, breeding success, parasitism, and productivity. Staff biologists used territory mapping (IBBC 1970; Bibbey 1995) to determine territory number and locations. Nest searching was initiated to monitor for cowbird parasitism, but avoided if vireos appeared agitated or changed their behavior in response to biologist's presence. Staff biologists conducted surveys from 7 April to 21 July for a total of 49 survey hours. A final, three-hour presence/absence survey was conducted on 22 September.

In 2004 a black-capped vireo foraging study was initiated on Cortaña and continued during field season 2005 (Houston and Baccus). Observations on pairing and productivity made by the researcher during the study were included in the BCP's monitoring data.

Data Collection and Analysis

All locations of males, females, fledglings and nests were recorded on Digital Aerial Imagery (2003) at a scale of 1:2000. Nests were regularly checked to monitor brood number and fate and to check for cowbird eggs. If parasitized, the egg was removed from the nest. Pairing status and number of young produced per pair were determined for each territory. Pairing success, breeding success and productivity were calculated for all territories using the same criteria and formulas as for golden-cheeked warblers (see Methods, Part I). Playback tapes of vireo song and shrads were used occasionally to elicit responses.

RESULTS AND DISCUSSION

Three male black-capped vireos were observed defending territories on the restored portion of the Cortaña tract and neighboring River Place Mitigation tract, the same number detected on these tracts in 2004. Figure 20 depicts territory locations. Two of the males defended the same areas in 2005 as in 2004 on Cortaña. A third territory location from 2004 was absent of vireos this year. Instead, a third male occupied an area on the western side of the River Place Mitigation tract.

Based on plumage characteristics (as described in Pyle 1997), all three males were ASY birds. All males were observed associating with females (pairing success = 100%), and all pairs nested at least once, producing at least one young (breeding success = 100%).

Productivity for 2005 was 3.0 young produced per territory. For all territories combined, five of nine nestlings were confirmed to have fledged. For territory #1, two nests were located on Cortaña. For the first nest attempt, the female was noted brooding into the nestling stage (see Appendix H and I). However, the number of eggs could not be determined as the female would not flush from the nest during repeated nest checks. We assume that this pair produced

at least one egg that survived to the nestling stage. The nest was found empty before the young were old enough to fledge and was presumed to have been depredated.

The second nest attempt for territory #1 was found during the nestling stage. Four nestlings were three days old. A check on the anticipated fledging date yielded an empty nest with no feather sheathings. However, the parents aggressively defended a large area around the nest. No fledglings could be confirmed on this day. Subsequently, the male was seen on three separate days feeding or tending at least one fledgling.

No nests were located for the other two territories. However, both were observed with fledglings (see Appendix I). Territory #2 was not detected with any fledglings until 1 July, at which time the female was observed tending at least one fledgling. Territory #3 produced at least four fledglings that were observed on three separate occasions. No other broods were detected for this pair.

As part of restoration efforts on Cortaña in winter 2004-05, small junipers were cleared in an area roughly two acres in size. In 2004, this area represented a small portion of one breeding territory. In 2005, no territory was re-established in this area. The absence of a territorial male in this area in 2005 may have been impacted by these vegetational changes, causing a male to avoid the area entirely. Although this cannot be confirmed, caution is warranted in deciding where to manipulate habitat for restoration. Vireos may be sensitive to small modifications in habitat components and may shun these areas on return to their breeding grounds. Avoiding habitat manipulation in currently occupied habitat may be the most prudent course of action for the BCP.

Nest parasitism and depredation on Cortaña

Zero nests were found parasitized and no cowbirds were reported in the area during surveys. No black-capped vireos or other avian species were observed tending cowbird fledglings. Five cowbird females and one cowbird fledgling were caught in the cowbird trap during the field season (see Appendix G).

The fate of black-capped vireo nests was not directly observed. Potential predators include a number of species of snakes (one Great Plains rat snake was found in the cowbird trap), as well as ringtails, raccoons, western scrub jays, American crows, and red imported fire ants. In 2004, common grackles and northern mockingbirds were seen harassing black-capped vireos near their nests on several occasions. This was not observed in 2005.

Other Tracts

Two male black-capped vireos (at least one of which was SY) were detected on 21 June on the Ivanhoe tract (J. Ingram, pers. comm.). They were reported to have counter-sang briefly. Two subsequent visits yielded no evidence of their presence. No female or fledglings were observed. Vireos were not observed at any time on the Black-capped Vireo Research Area this year.

IV. LITERATURE CITED

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V. APPENDICES A – I

Appendix A

Summary of BCP tracts surveyed for GCWA by the City of Austin, field season 2005, Travis County, Texas. Tract acreage, surveyor(s) and total survey effort given in hours is shown.

Tract	Acres Surveyed	Surveyor(s)	Survey Hours
100-acre prime plots			
3M/St. Edwards	100	P. Ramirez	60
Barton Creek	100	B. Reiner	60
Bohls	100	J. Chenoweth	60
Emma Long	100	H. Becker	60
Forest Ridge	100	H. Becker	60
Ivanhoe	100	M. Sanders	60
100-acre transitional plots			
Canyon Creek	100	B. Reiner	53
Double J and T	100	J. Chenoweth	29
Enumerations			
3M/St. Edwards/Kruger	360	P. Ramirez	16
Bohls	450	J. Chenoweth	18
Commons Ford	115	E. Fair	4
Cortaña (middle)	50	P. Ramirez	6
Double J and T	1729	C. Davis, J. Chenoweth	29
Emma Long Park	950	S. Haywood H. Becker	60
Franklin	151	M. Sanders	28
Hanks	88	M. Sanders	21
Jester	294	M. Sanders	24
Lanier	133	L. O'Donnell, J. O'Donnell	10
Lime Creek	494	B. Reiner	38
Long Canyon/Park West	918	P. Ramirez	34
Reicher Ranch	820	S. Haywood J. Chenoweth	58
Vireo Preserve	214	L. O'Donnell	7
WTP4	138	M. Sanders	32
Totals	**7704**		**827**

Appendix B

100-acre Study Plot Protocol

I. Protocol from Management Handbook, Chapter VII: Golden-cheeked Warbler Management:

Plot selection: random as possible, based on habitat rather than warbler density

Plot shape: square as possible

Plot characteristics:

Prime sites: minimum 75-80% excellent warbler habitat w/ >70% canopy cover.

Transitional sites: currently has zero to a few warbler territories and has potential to develop into excellent habitat in next 30 years

II. Standardization of methods:

Season for territory mapping: March 25-May 25 (after this, observations should not be used for territory data, only productivity); **productivity data** can still be gathered after May 25

Start time: ½ hour after sunrise

Weather: rough guidelines: temp>55°; wind<15mph; none to light precipitation

Visits during season:

Prime sites: 10x

Transitional: 3x: Transitional sites only need to be surveyed every other year. Productivity data not gathered.

Hours per visit: Six hours per visit

Mapping methods: territory mapping roughly following IBCC (1970) guidelines (except calculation of edge territories); breeding territories are differentiated using observations of bird behavior, location, counter-singing, and sequential movements rather than using "clusters" (see Bibbey et al 1992)

Playback tapes: No playback tapes

Data Analysis:

- ***territory density***: # of territories per 100 acres
- ***calculation of edge territories****:* each territory that straddles the plot boundary counts as a half territory (0.5 territories) (see Verner 1995)
- ***territory size***: NOT doing territory size estimates based on research by Anders (2000).
- ***productivity measures (see Anders 2000)***: these will only be calculated for full territories ONLY:

1) ***pairing success***: Pairing success of male warblers determined by observing one or more of the following conditions: a territorial male associating with a female; the nest of a territorial male; and/or a male tending ≥1 fledgling. Pairing success rate = number of territories determined to have pairing success / total number of full territories

2) ***breeding success***: Breeding success rate = number of territories that successfully fledged at least one young / total number of full territories

3) ***estimated brood size***: average brood size per successful pair (based on "breeding success"

4) ***productivity*** = sum of the highest number of fledglings recorded at any one time for each full territory / total number of full territories

Citations

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Appendix C

A summary of golden-cheeked warbler territory number and territory density (per 100 HA) for six 100-acre prime study plots on the City of Austin's BCP, Travis County, Texas, field seasons 1998--2005. See Methods section for calculations.

Prime Plot Name	Survey Year	No. of Full Territories	No. of Full and Edge Territories	No. of Full Territories + 50% of edge Territories	No. of Territories per 100HA
Barton Creek	1998	2	8	5.0	12.5
	1999	6	12	9.0	22.5
	2000	5	9	7.0	17.5
	2001	3	7	5.0	12.5
	2002	2	8	5.0	12.5
	2003	2	9	5.5	13.8
	2004	3	10	6.5	16.1
	2005	4	10	7.5	17.3
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	20.0	50.0
	2003	14	19	16.5	41.3
	2004	11	22	16.5	40.8
	2005	14	22	18.5	44.5
Ivanhoe	1998	7	13	10.0	25.0
	1999	8	17	12.5	31.3
	2000	7	19	13.0	32.5
	2001	2	14	8.0	20.0
	2002	9	22	15.5	38.8
	2003	13	30	21.5	53.8
	2004	12	30	21.0	51.9
	2005	15	26	20.5	50.6
St. Edwards/ 3 M	1998	6	12	9.0	22.5
	1999	7	15	11.0	27.5
	2000	7	17	12.0	30.0
	2001	3	8	6.0	15.0
	2002	9	16	12.5	31.3
	2003	8	16	12.5	31.3
	2004	6	17	11.5	28.4
	2005	7	19	13.5	32.1
Forest Ridge	1998	7	14	10.5	26.3
	1999	11	17	14.0	35.0
	2000	7	14	10.5	26.3
	2001	8	14	11.0	27.5
	2002	11	15	13.0	32.5
	2003	9	16	12.5	31.3
	2004	13	22	17.5	43.2
	2005	11	19	15.0	37.1
Bohls Hollow	1998	3	6	4.0	10.0
	1999	1	4	4.0	10.0
	2000	1	5	3.0	7.5
	2001	4	8	6.0	15.0
	2002	4	7	5.5	13.8
	2003	4	9	6.5	16.3
	2004	5	11	8.0	19.8
	2005	6	10	8.0	19.8

		TOTAL			AVERAGE
All Prime Plots	1998	31	64	47.0	19.6
	1999	40	77	60.0	25.0
	2000	39	85	62.0	25.9
	2001	35	74	54.5	22.7
	2002	53	88	70.5	29.4
	2003	50	99	74.0	34.1
	2004	50	112	81.0	33.4
	2005	57	106	81.5	33.6

Appendix D

A summary of golden-cheeked warbler territories with females, number of fledgling groups and productivity for six 100-acre prime study plots on the City of Austin BCP, Travis County, Texas, field seasons 1998--2005. See Methods section for calculations.

Prime Plot Name	Survey Year	Females Observed (inferred)*	No. of Fledgling Groups**	No. of Fledglings per Successful Pair***	No. of Fledglings per Territory****
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
	2003	2(2)	2	1.5	1.5
	2004	3	2	1.50	1.00
	2005	4	4	3.00	3.00
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
	2003	9(10)	7	2.4	1.21
	2004	9	5	2.60	1.18
	2005	12	6	2.17	0.93
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
	2003	8(9)	9	2.7	1.8
	2004	7	4	3.00	1.00
	2005	8	4	2.50	0.67
St. Edwards / 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
	2003	2(3)	2	1.5	.43
	2004	4	3	2.00	1.00
	2005	5	5	1.60	1.14
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
	2003	6(7)	6	2.3	1.6
	2004	7	7	3.00	1.62
	2005	10	8	1.75	1.27
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
	2003	3(3)	0	0	0
	2004	3	-- +	-- +	-- +
	2005	3	0	0.00	0.00
		TOTAL		**AVERAGE**	
All Prime Plots	1998	15(19)	15	1.97	0.97
	1999	18(28)	25	1.95	1.30
	2000	17(19)	12	1.97	0.68
	2001	21(25)	18	2.13	1.30
	2002	31(34)	20	2.38	1.30
	2003	30(34)	26	1.74	1.09
	2004	33	21	2.62	1.22
	2005	40	27	2.11	1.00

* = Number of territories with females; for 2004 and 2005 data, females observed and inferred are combined.
** = Number of territories producing ≥ 1 young.
*** = Productivity per successful territory.
**** = Productivity per full territory.
+ Data not collected.

Appendix E

A summary of golden-cheeked warbler territory number and territory density (per 100 HA) for two 100-acre transitional study plots on the City of Austin BCP, Travis County, Texas, field seasons 1998--2005. See Methods section for calculations.

Transitional Plot Name	Survey Year	No. of Full Territories	No. of Full and Edge Territories	No. of Full Territories + 50% of edge Territories	No. of Territories per 100HA
Canyon Creek	1998	0	8	4.0	10.0
	1999	2	7	4.5	11.3
	2000	0	8	4.0	10.0
	2001	3	12	7.5	18.8
	2003	0	7	3.5	8.8
	2005	3	13	8.0	19.8
Double J & T	1998	0	1	0.5	1.3
	1999	0	1	0.5	1.3
	2000	0	1	0.5	1.3
	2001	2	4	3.0	7.5
	2003	3	4	3.5	8.8
	2005	6	7	6.5	16.1
		TOTAL			**AVERAGE**
All Transitional Plots	1998	0	9	4.5	5.7
	1999	2	8	5.0	6.3
	2000	0	9	4.5	5.7
	2001	5	16	10.5	13.2
	2003	3	11	7.0	8.8
	2005	9	20	14.5	18.0

Appendix F

A summary of golden-cheeked warbler territories with females, number of fledgling groups and productivity for six 100-acre prime study plots on the City of Austin Balcones Canyonlands Preserve, Travis County, Texas, field seasons 1998--2005. See Methods section for calculations.

Prime Plot Name	Survey Year	Females Observed*	No. of Fledgling Groups**	No. of Fledglings per Successful Pair***	No. of Fledglings per Territory****
Canyon Creek	1998	0	0	0.0	0.6
	1999	2	1	2.0	1.0
	2000	1	0	0.0	0.0
	2001	0	0	0.0	0.0
	2005	3	3	3.34	3.34
Double J & T	1998	0	0	0	0
	1999	0	0	0	0
	2000	0	0	0	0
	2001	0	0	0	0
	2005	2	-- +	-- +	-- +
		TOTAL		**AVERAGE**	
All Transitional Plots	1998	0	0	0.0	0.3
	1999	2	1	2.0	0.5
	2000	0	0	0.0	0.0
	2001	0	0	0.0	0.0
	2005	5			

* = Number of territories with females.
** = Number of territories producing ≥ 1 young.
*** = Productivity per successful territory.
**** = Productivity per full territory.
\+ Data not collected

Appendix G

2005 Brown-headed Cowbird Management

The brown-headed cowbird (*Molothrus ater*) management program was expanded in field season 2005 from one to three traps in operation. As in 2004, a wooden hybrid trap was operated in 2005 on the Cortaña tract in occupied black-capped vireo habitat. A second trap was placed on Emma Long Park and a third trap on Reicher Ranch. The two new trap locations were chosen based on incidental observations of high cowbird abundance in these areas in 2004. Both new traps were placed in or near occupied golden-cheeked warbler habitat. All traps in operation were wooden hybrid traps built according to specifications recommended by TPWD (http://www.tpwd.state.tx.us/conserve/pdf/cowbirds.pdf).

Prior to 2005, the City focused its limited trapping resources on occupied vireo habitat (the Cortaña colony). With the expansion of available resources this past year, we were able to expand our efforts to control of cowbirds in golden-cheeked warbler habitat as well. Parasitism of golden-cheeked warblers on the BCP has been documented by both the City of Austin and Travis County biologists (Abbruzzese and Koehler 2000, 2001, 2002, 2003; Becker and Koehler 2004; Travis County NR 1999, 2000, 2001, 2002, 2003).

In 2005, two traps were operated by trained volunteers who were supervised by program biologists. The cowbird trap maintenance volunteer program is a new initiative that was organized during the winter of 2004-05. Our hope is that cowbird trapping can be greatly expanded over the years if a corps of trained volunteers is in place. The 2005 volunteer program turned out to be very successful, and we are planning on its expansion for field season 2006. In addition, three new traps are being built in winter 2005-06 and targeted for operation in field season 2006. Trap results for field season 2005 are given below.

Trap Location	Habitat	Days in Operation	Total BHCO Trapped	Females Trapped	Fledglings Trapped	Trap Rate (=females caught per trap day)
Reicher Ranch	GCWA	3/23/05 - 6/08/05	23	7	0	0.09
Emma Long	GCWA	3/01/05 - 6/07/05	14	2	0	0.02
Cortaña	BCVI	2/28/05 - 7/14/05*	10	5	1	0.04
Average						**0.05**

* Closed for 16 days at the end of March for re-stocking.

Appendix H

Summary of nest attempts for one black-capped vireo pair on the Cortaña tract, field season 2005.

Territory	Nest attempt	Substrate	Date of check	Observer	Nest Stage*	Behavior of parents	Nest Contents	Nest Fate**
#1	1	*Quercus sinuata*	4/14/05	HB	B	both male and female present	0	
			4/19/05	HB	R	female present	0	
			4/25/05	HB	I	female brooding	? (female would not flush)	
			5/09/05	HB	N (based on female brooding and date)	female brooding	? (female would not flush)	
			5/13/05	HB	E	no activity in nest area	0	D
	2	*Rhus lan-ceolata*	6/7/05	DH	N	male feeding nestlings	4 nestlings, age not reported	
			6/8/05	HB	N	male nearby, shradding	4 nestlings, 4 days old	
			6/16/05	HB	E	parents defending area near nest	0	F

* Nest Stages: B=Building; R=Rest Day; L=Laying; I=Incubating; N=Nestling; E=Empty
** Nest Fate: D=Depredated; F=Fledged

Appendix I

Summary of observations of black-capped vireo fledglings for three territories on the Cortaña tract, field season 2005.

Territory	Date of observation	Observer	Number of Fledglings	Behavior of parents
#1	7/01/05	DH	1	Male feeding
	7/05/05	HB	1	Male feeding
	7/21/05	HB	1	Male tending
#2	7/01/05	DH	1	Female tending
#3	5/17/05	HB	2 (1 day old)	Male and female feeding
	5/26/05	HB	2	Male feeding
	6/15/05	PR	3	Fledglings following male
	6/16/05	HB	3	Male and female tending

VI. FIGURES

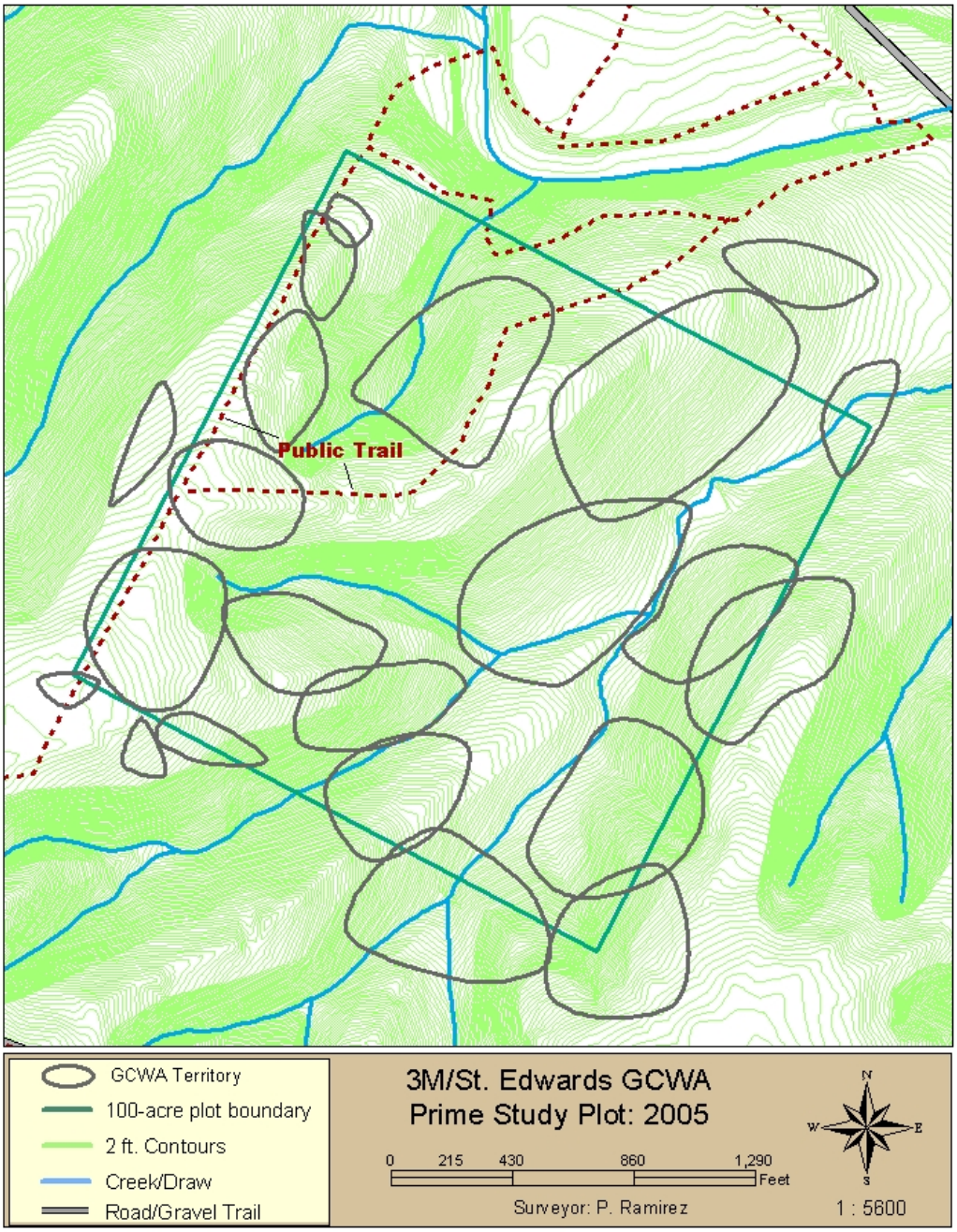


Figure 1. Locations of golden-cheeked warbler territories at 3M/St. Edwards 100-acre prime study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

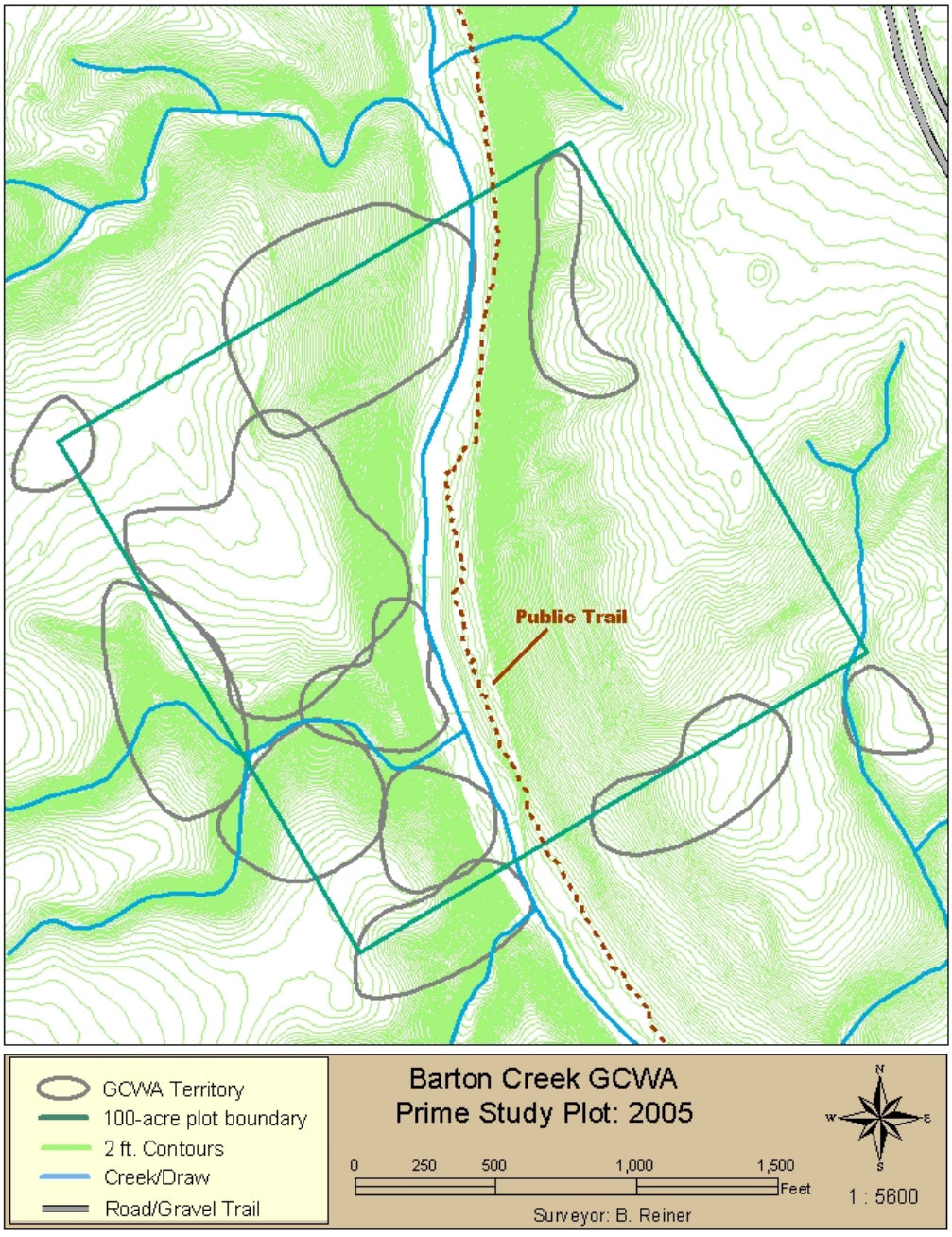


Figure 2. Locations of golden-cheeked warbler territories at Barton Creek 100-acre prime study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

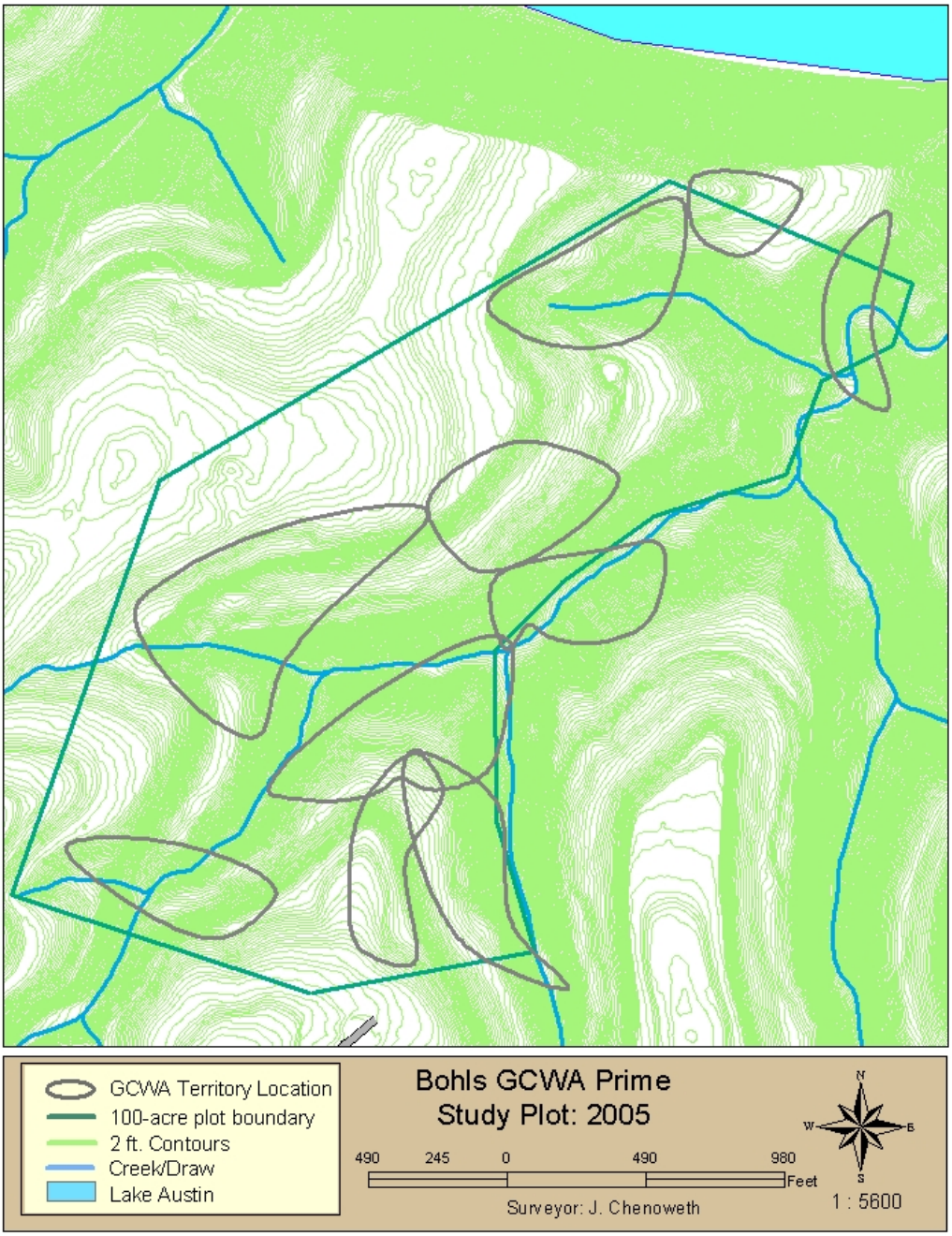


Figure 3. Locations of golden-cheeked warbler territories at Bohls 100-acre prime study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

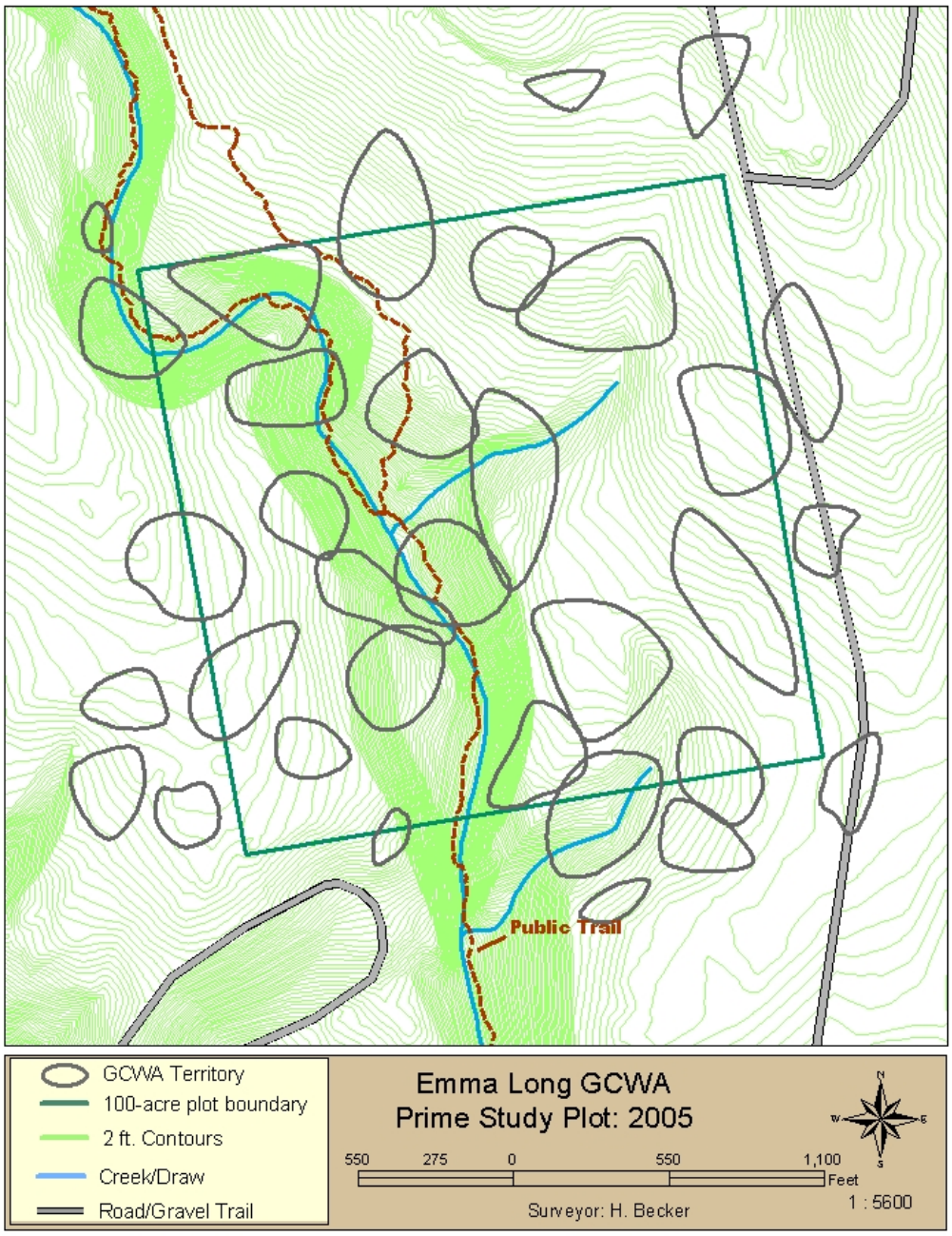


Figure 4. Locations of golden-cheeked warbler territories at Emma Long 100-acre prime study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

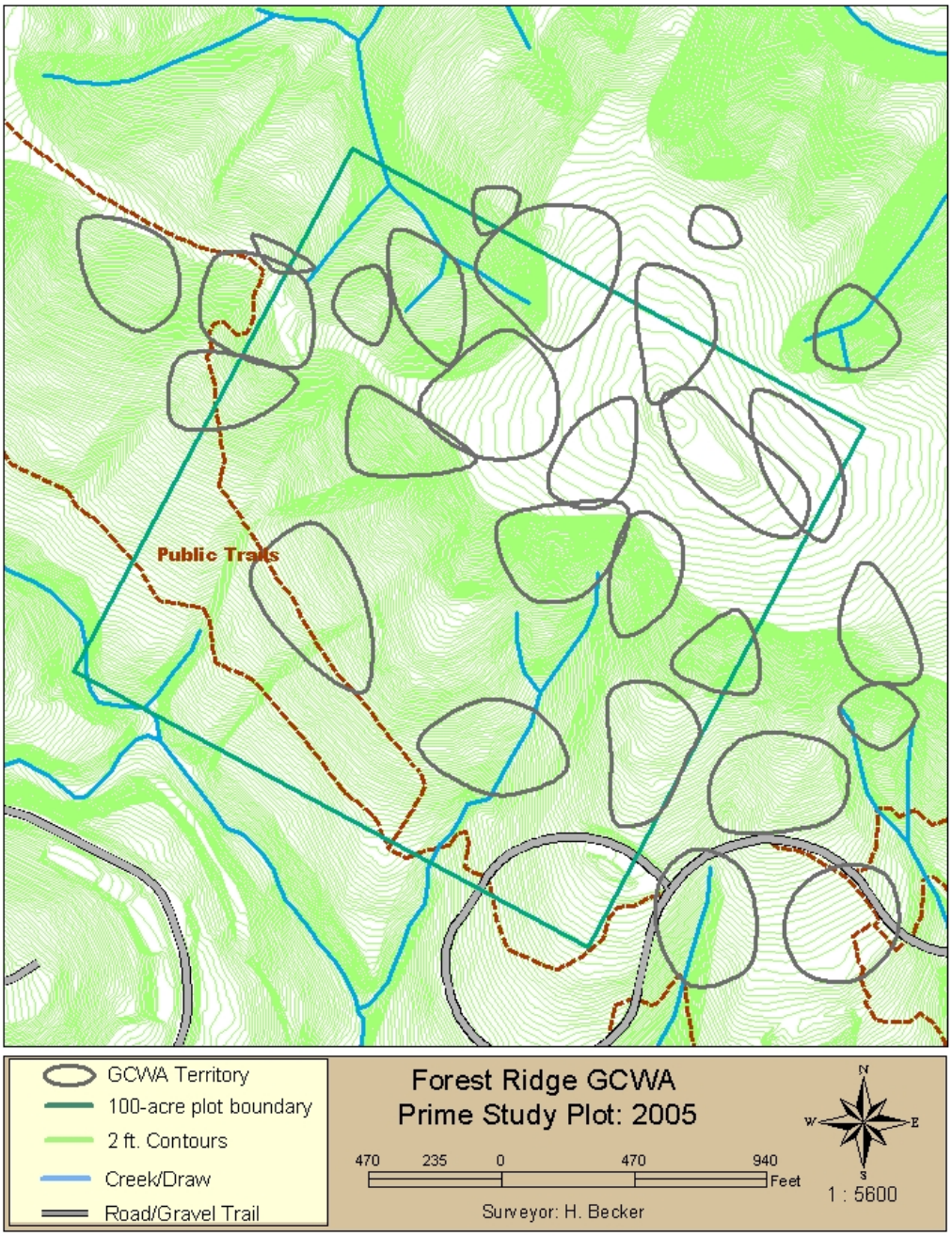


Figure 5. Locations of golden-cheeked warbler territories at Forest Ridge 100-acre prime study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

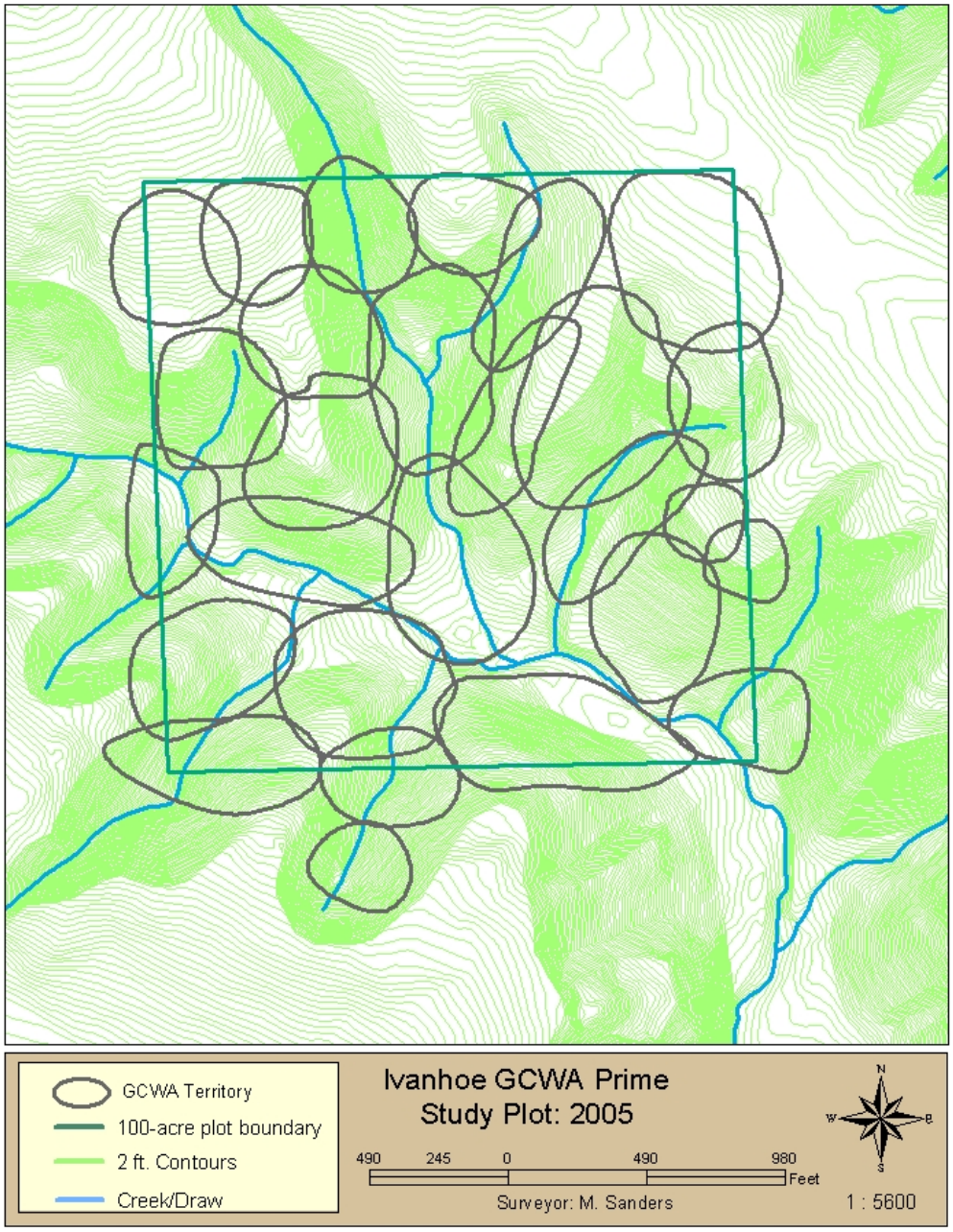


Figure 6. Locations of golden-cheeked warbler territories at Ivanhoe 100-acre prime study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

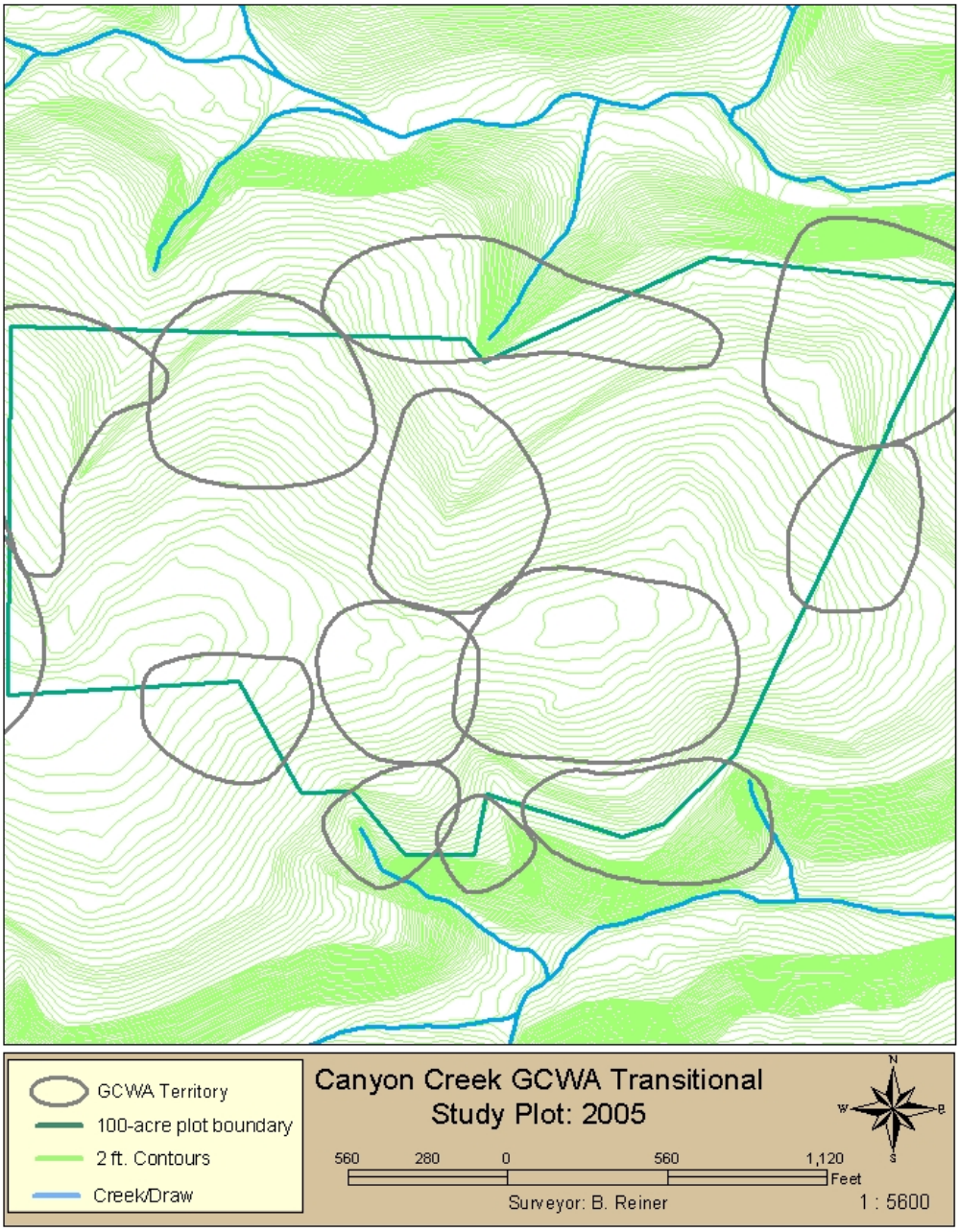


Figure 7. Locations of golden-cheeked warbler territories on the Canyon Creek 100-acre transitional study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

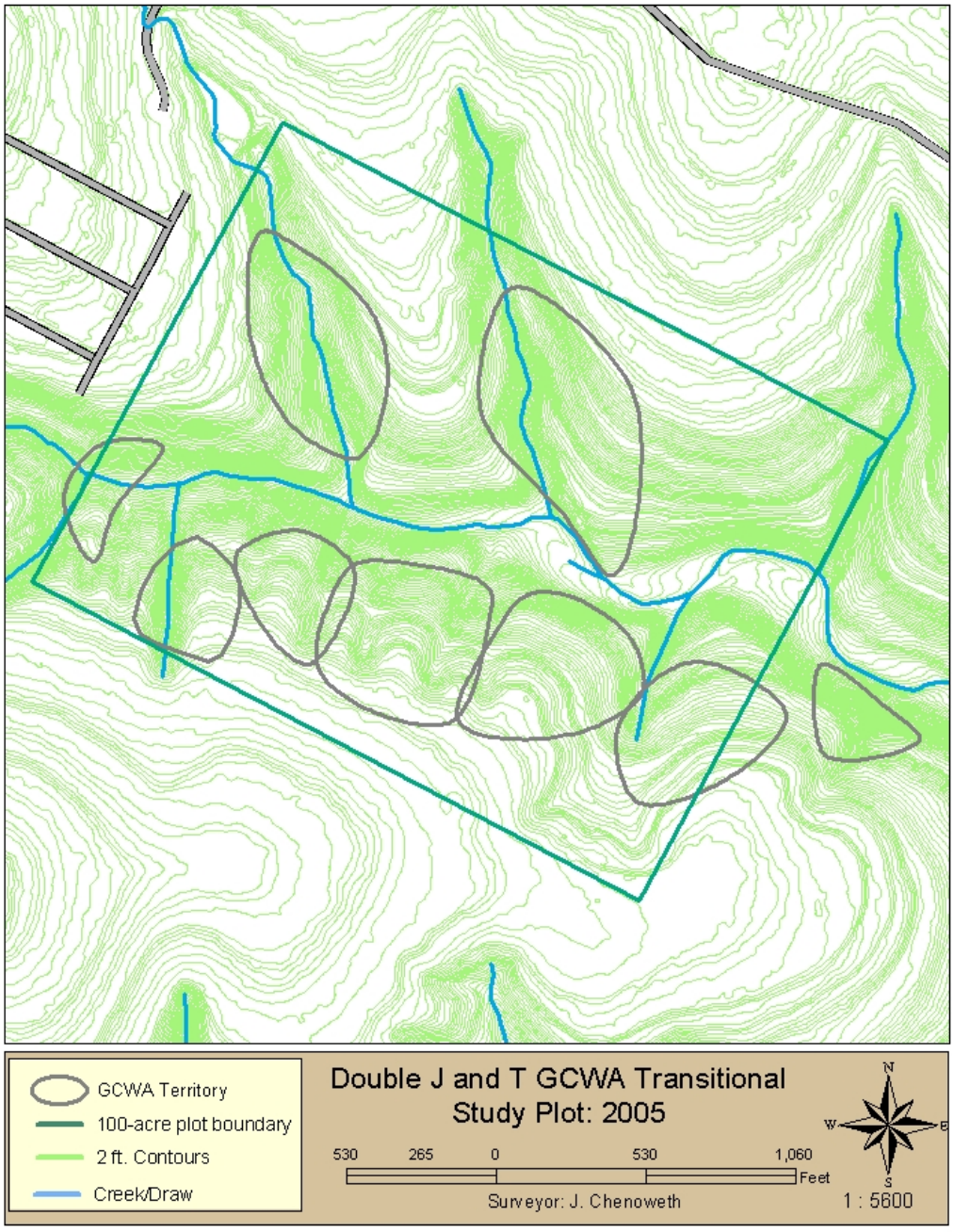


Figure 8. Locations of golden-cheeked warbler territories on the Double J and T 100-acre transitional study plot, field season 2005. Polygons enclose observations of individual territorial warblers and are not meant to represent actual territory boundaries.

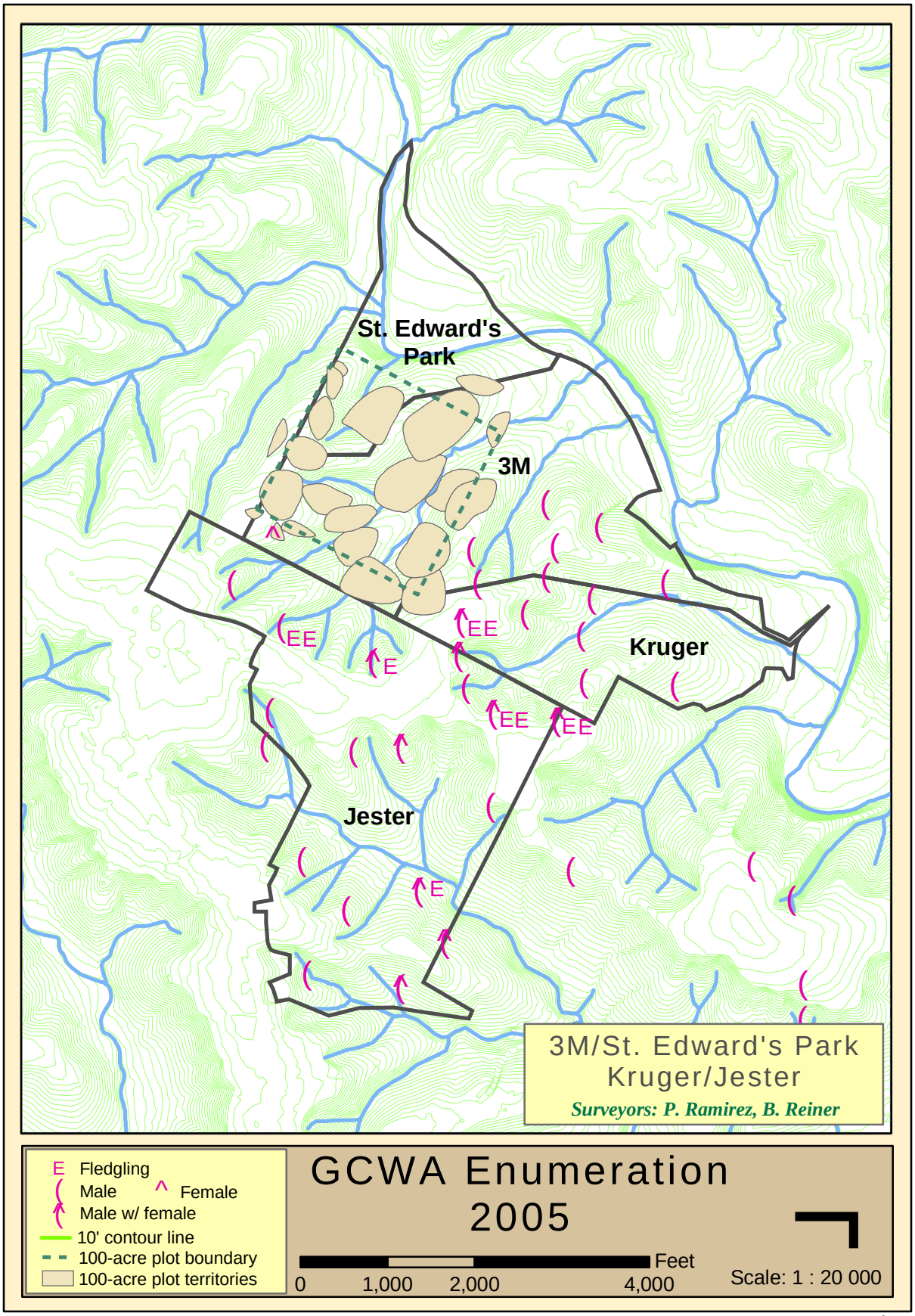
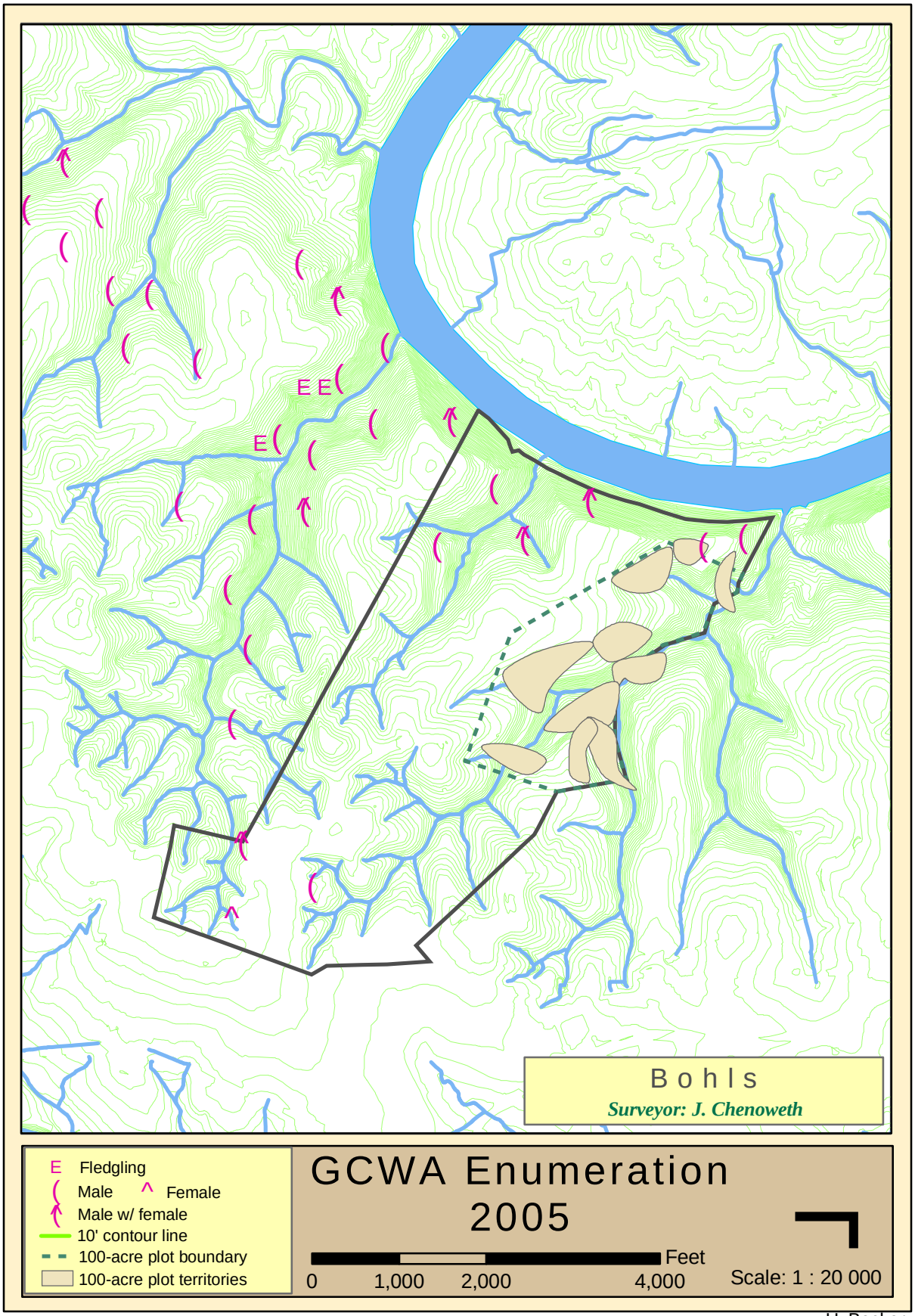


Figure 9

P. Ramirez



H. Becker

Figure 10

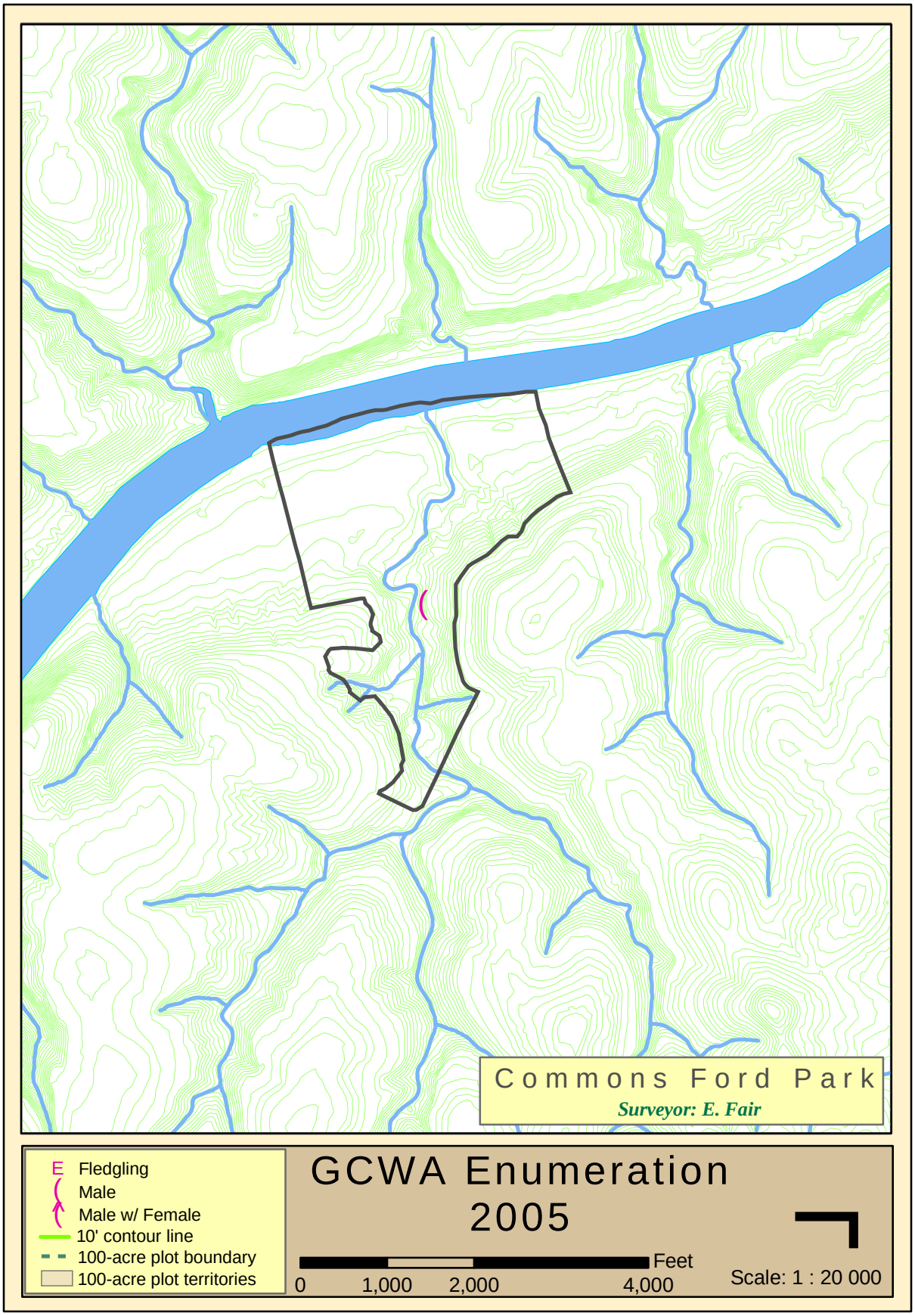


Figure 11

H. Becker

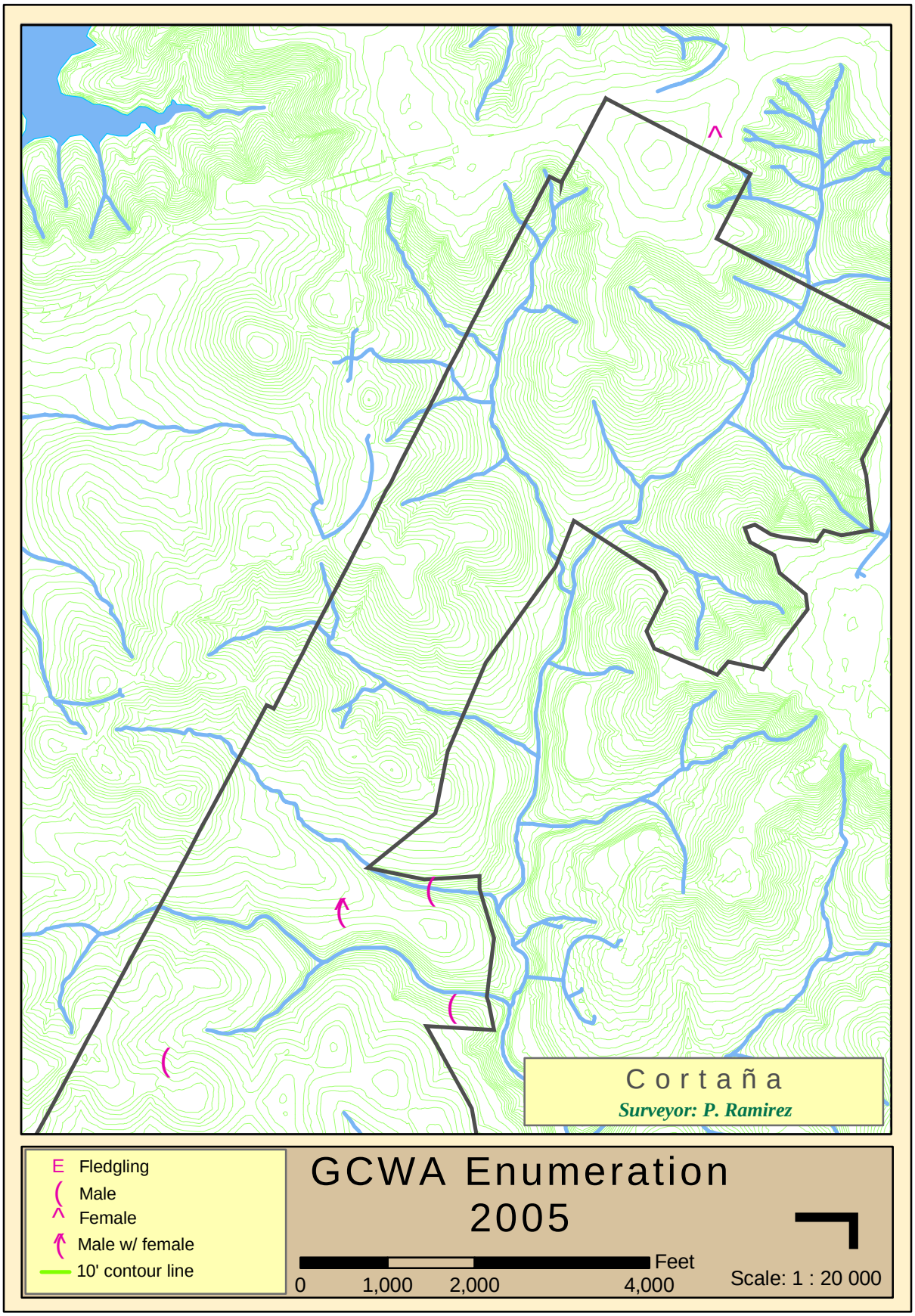
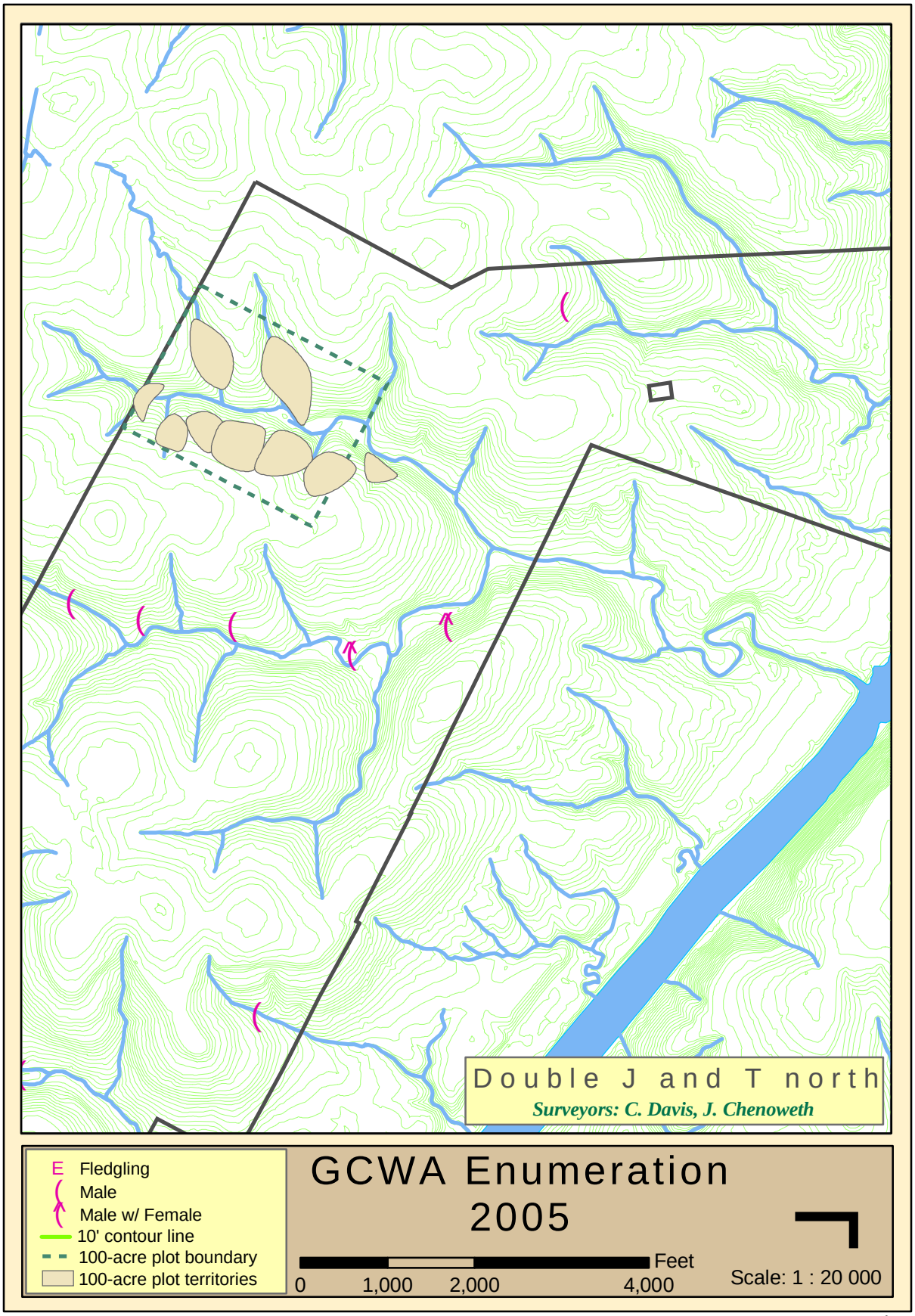


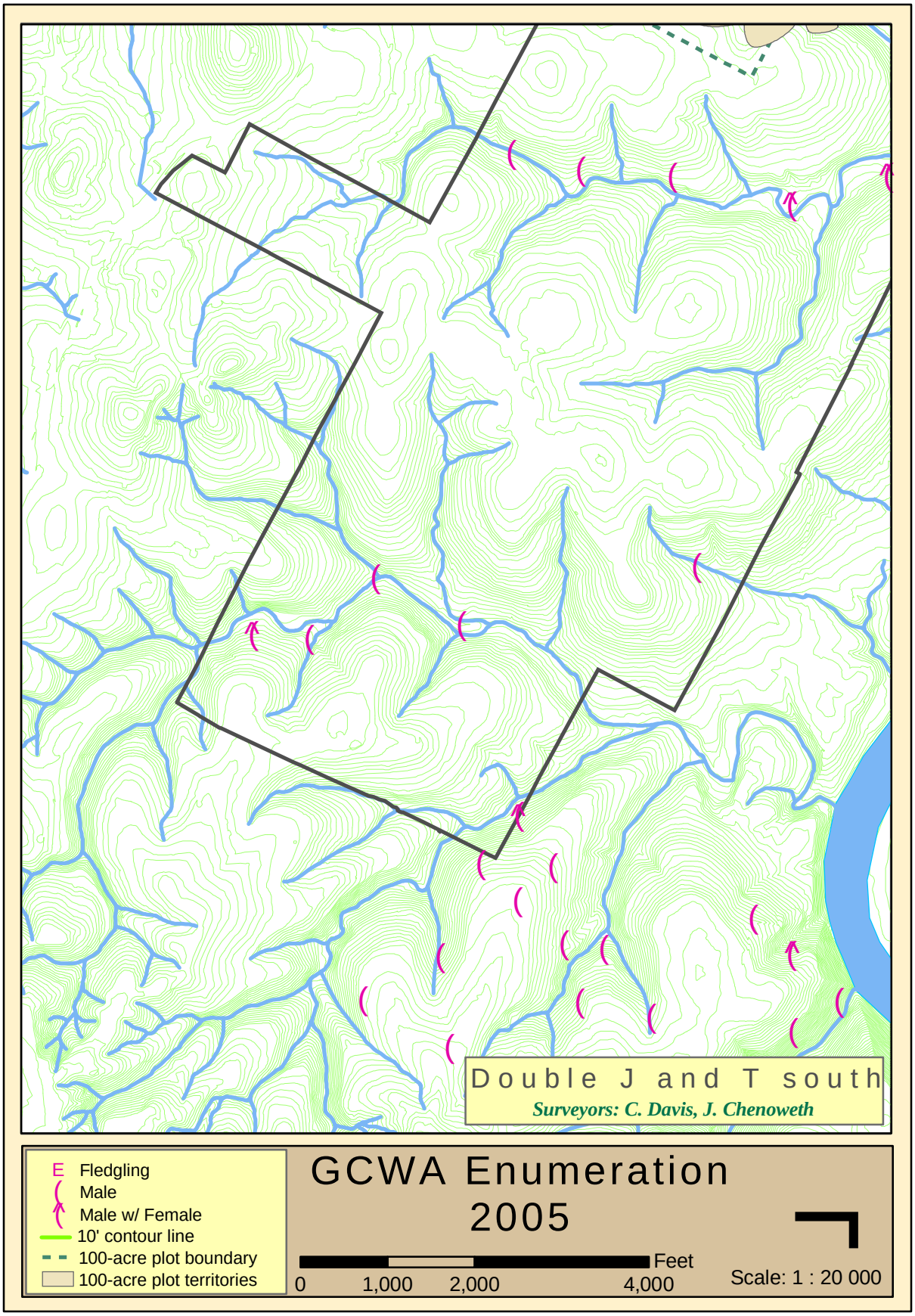
Figure 12

P. Ramirez



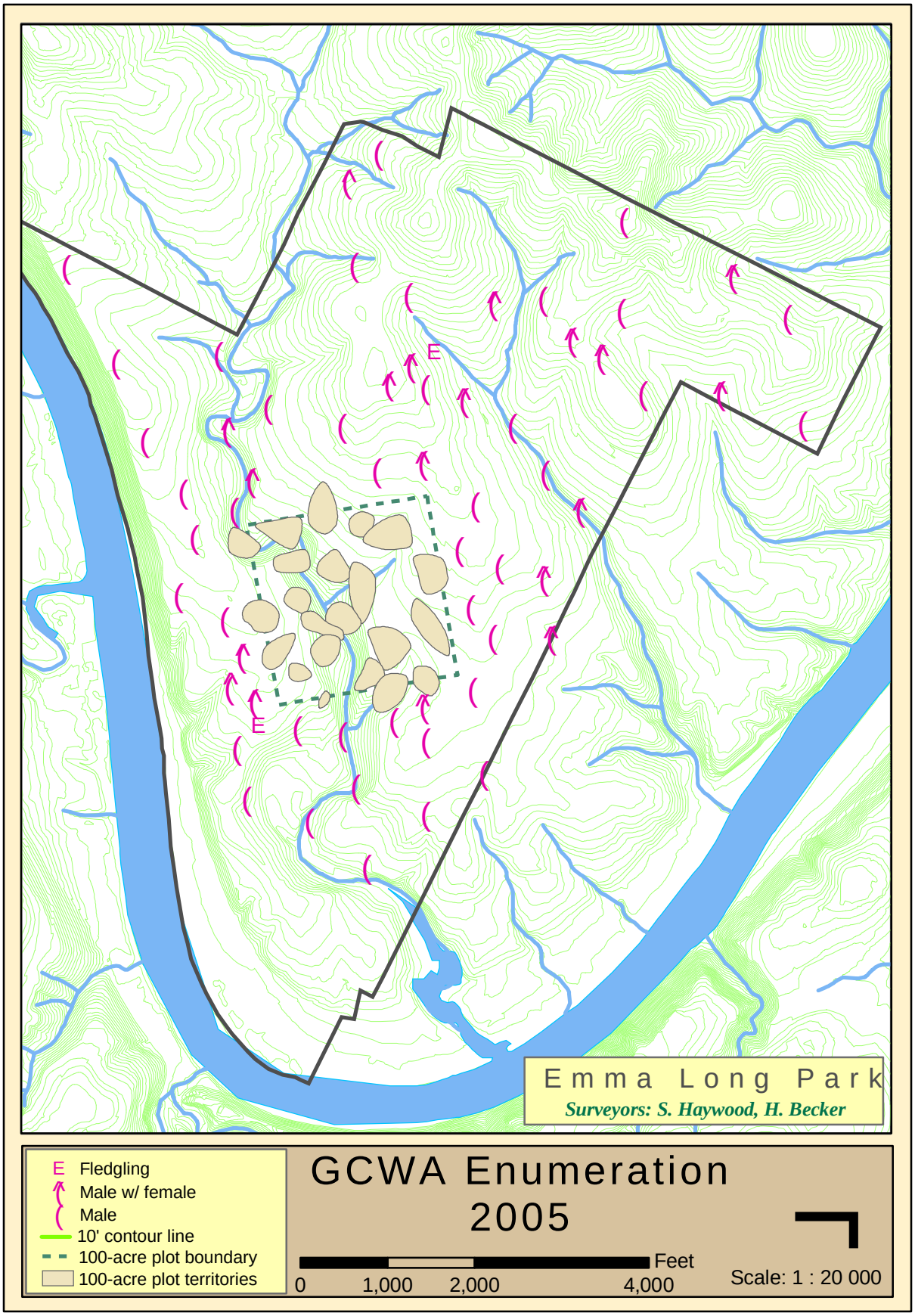
H. Becker

Figure 13



H. Becker

Figure 14



H. Becker

Figure 15

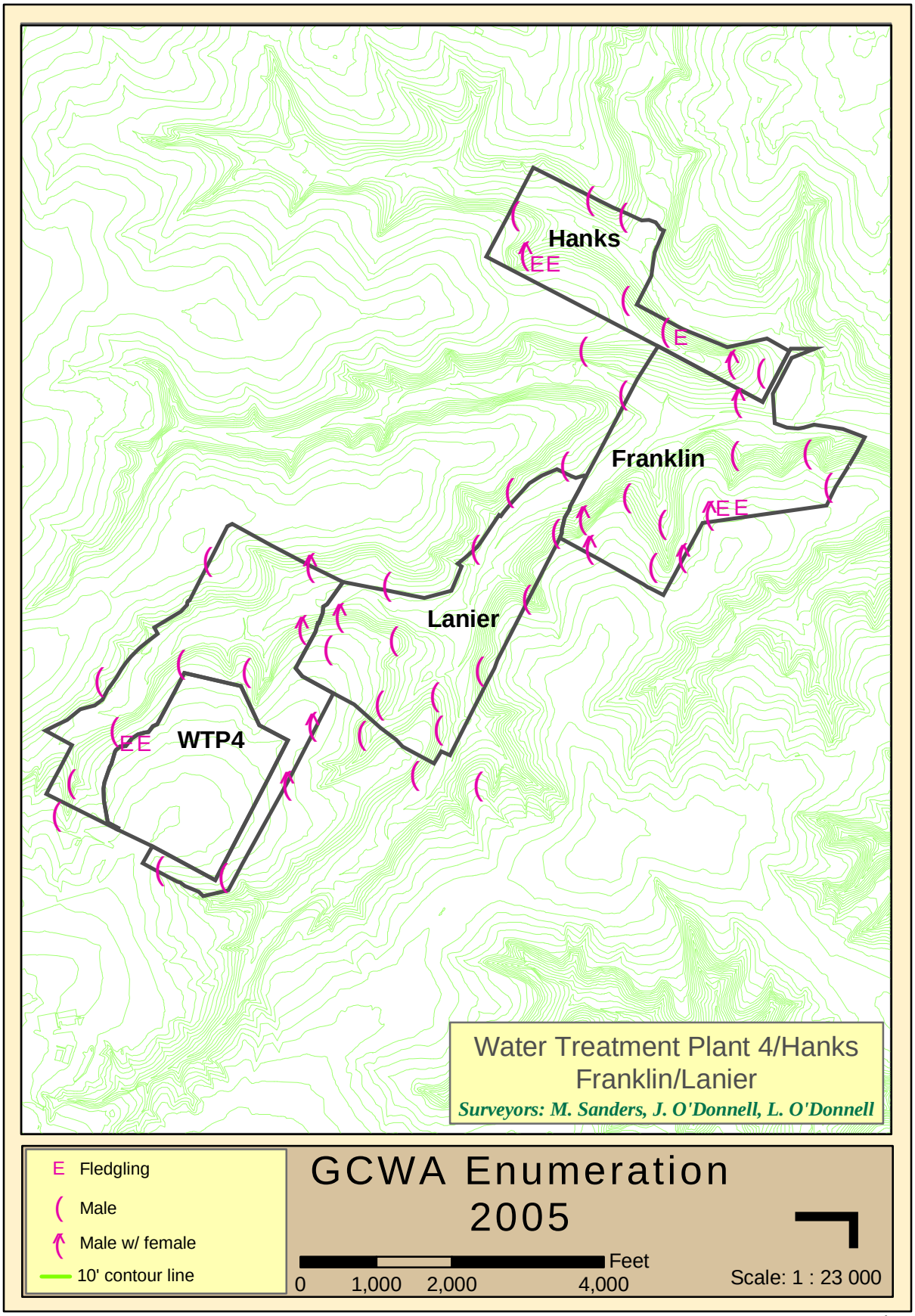


Figure 16

P. Ramirez

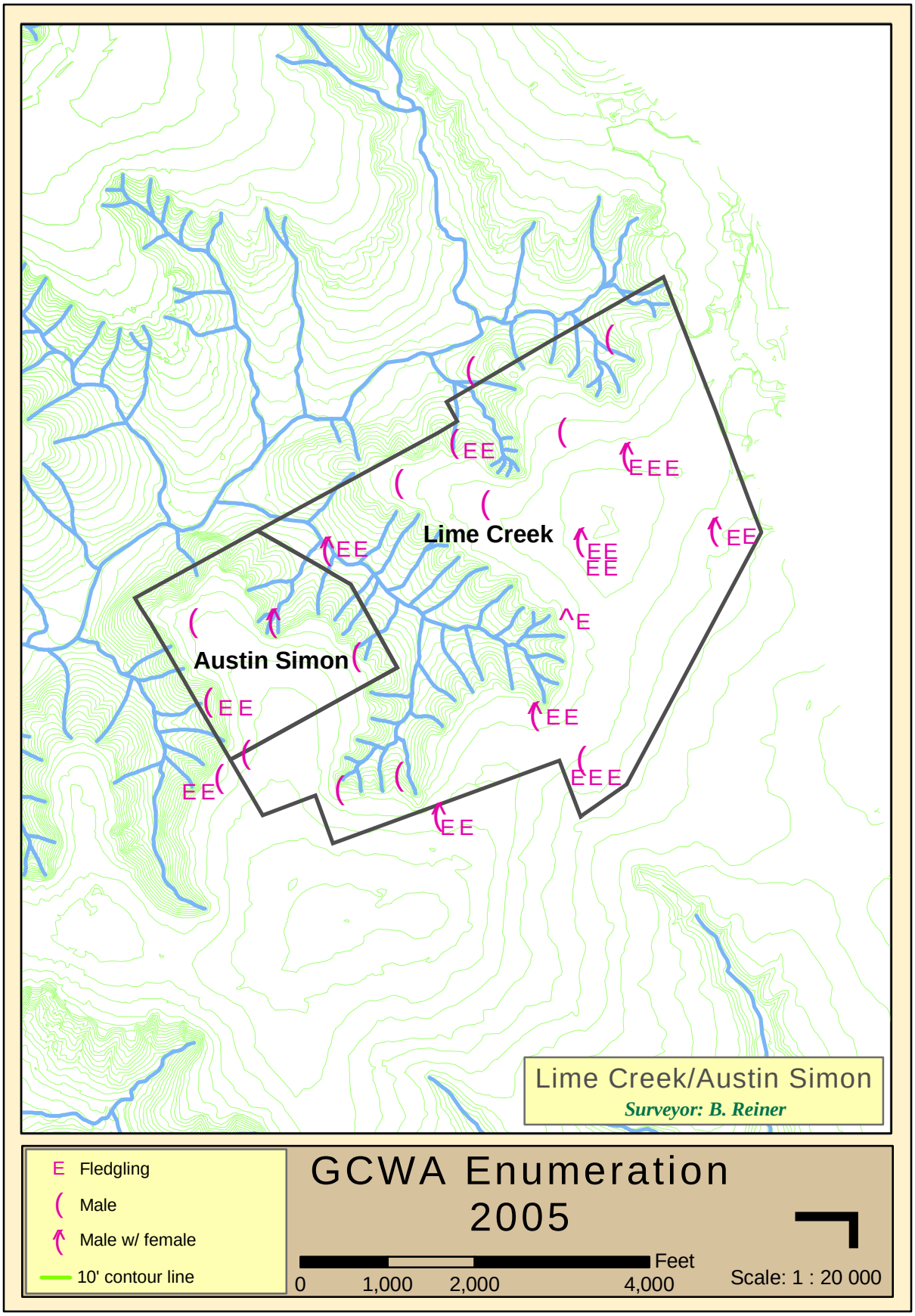


Figure 17

P. Ramirez

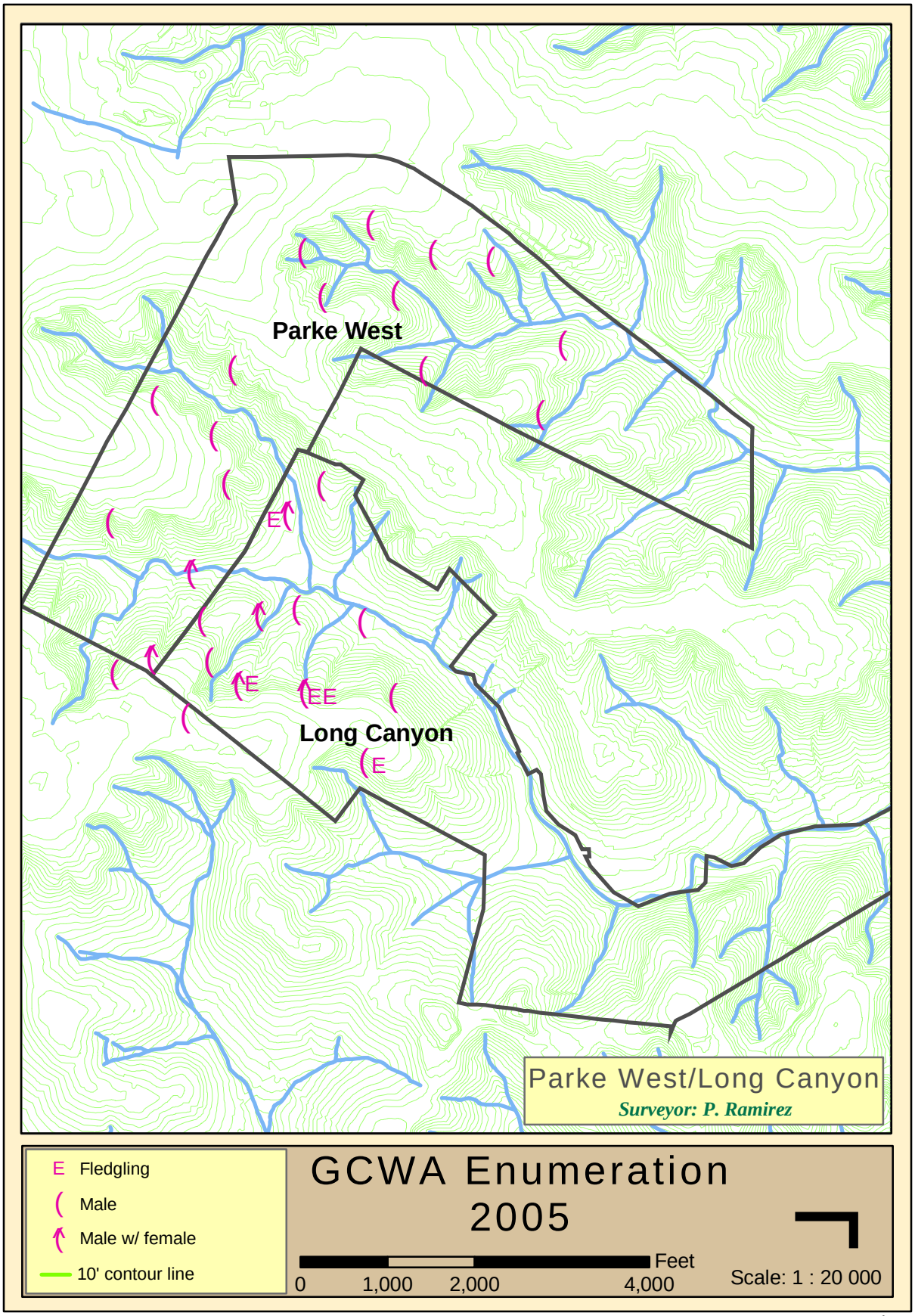


Figure 18

P. Ramirez

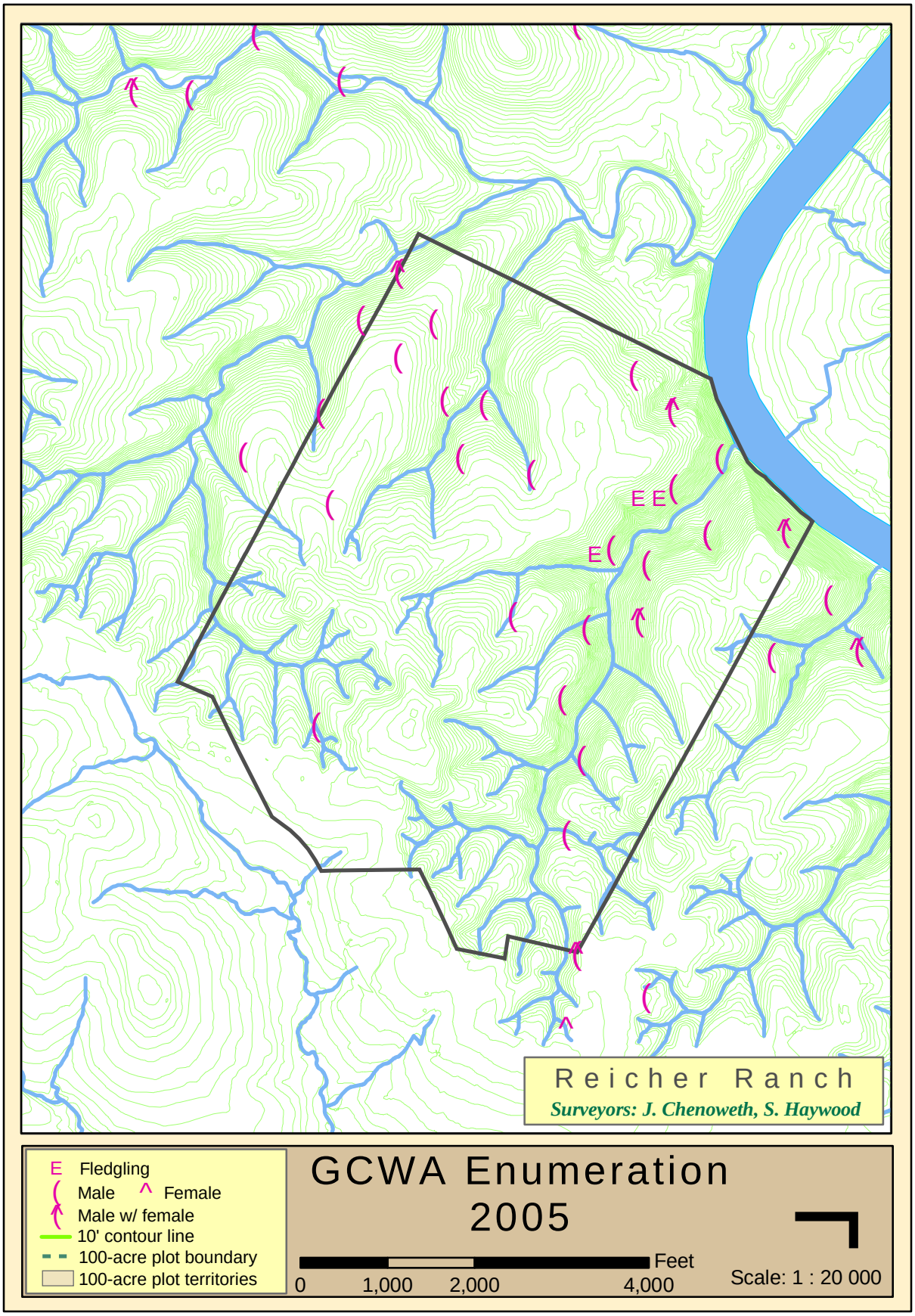


Figure 19

H. Becker

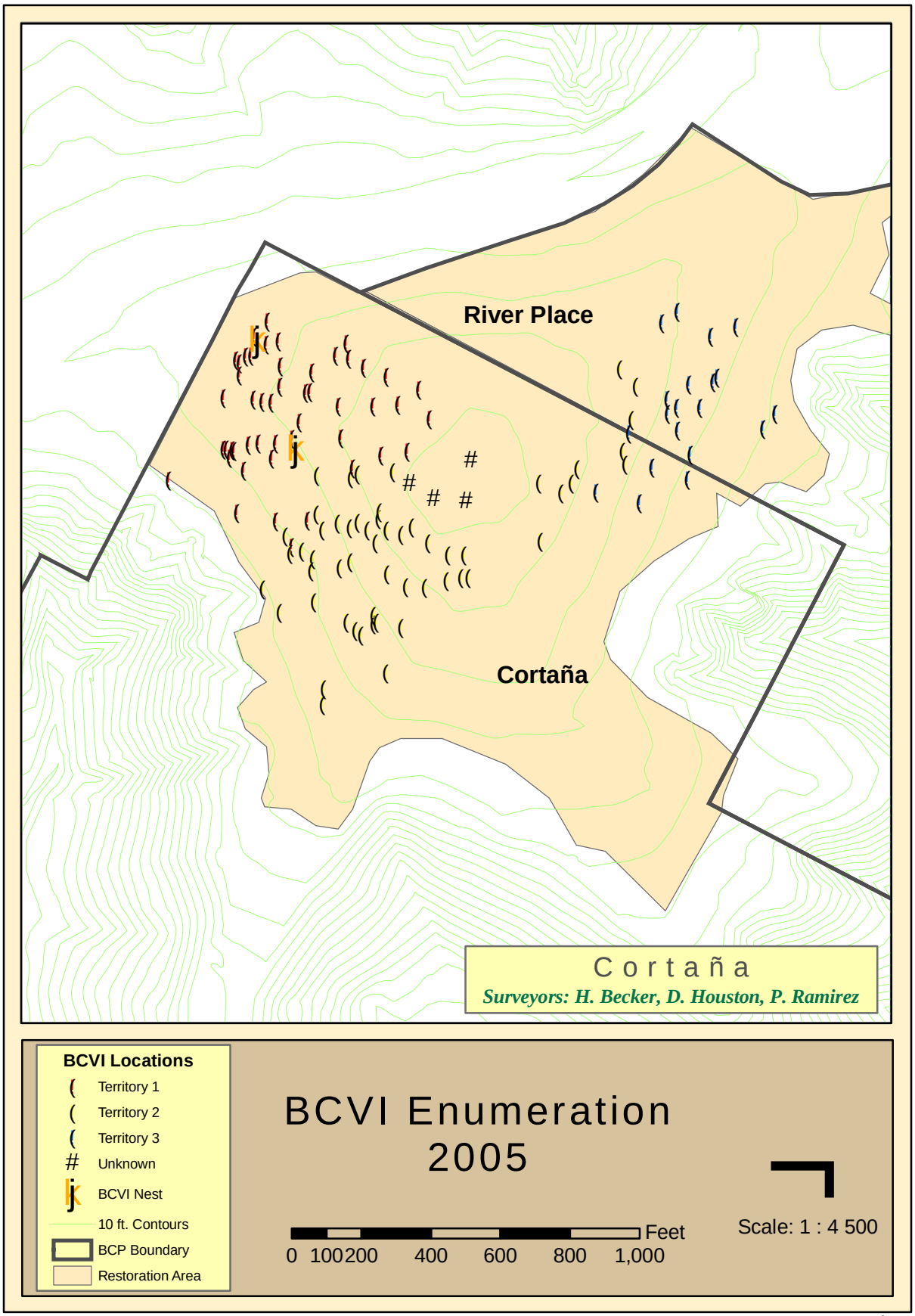


Figure 20

P. Ramirez