

**FY 2022 Report on Monitoring
Golden-cheeked warblers (*Setophaga chrysoparia*) on
Travis County-managed Balcones Canyonlands Preserve Tracts**



Male golden-cheeked warbler

Photo: Courtesy of Tom Hausler

Travis County

Department of Transportation and Natural Resources

Natural Resources and Environmental Quality Division



October 1, 2021 September 30, 2022

Table of Contents

Introduction	1
Methods.....	3
Enumeration Surveys	3
Intensive Monitoring Plots and Nest Monitoring.....	4
GCWA Banding and Band Resighting.....	5
Results.....	6
Enumeration Surveys Results.....	6
<i>Chandler GCWA Enumeration Survey Results</i>	7
<i>Flying K GCWA Enumeration Survey Results</i>	8
<i>Hamilton Pool GCWA Enumeration Survey Results</i>	9
<i>Medway Enumeration Survey Results</i>	10
<i>Murfin GCWA Enumeration Survey Results</i>	11
<i>Ribelin/Sam Hamilton GCWA Enumeration Survey Results</i>	12
<i>Vireo Ridge/Nootsie GCWA Enumeration Survey Results</i>	13
<i>Vista Point GCWA Enumeration Survey Results</i>	14
Intensive Monitoring Plot and Nest Monitoring Results	15
GCWA Banding and Band Resighting Results.....	15
Acknowledgements.....	16
Literature Cited.....	17

List of Figures

Figure 1. GCWA Survey Area Overview on the Balcones Canyonlands Preserve, FY22, Travis County, Texas.....	2
Figure 2. GCWA observations and estimated territory delineations based on the Chandler enumeration survey from FY22, Travis County BCP, Texas.	7
Figure 3. GCWA observations and estimated territory delineations based on the Flying K enumeration survey from FY22, Travis County BCP, Texas.	8
Figure 4. GCWA observations and estimated territory delineations based on the Hamilton Pool Preserve enumeration survey from FY22, Travis County BCP, Texas.	9
Figure 5. GCWA observations and estimated territory delineations based on the Medway enumeration survey from FY22, Travis County BCP, Texas	10
Figure 6. GCWA observations and estimated territory delineations based on the Murfin enumeration survey from FY22, Travis County BCP, Texas.	11
Figure 7. GCWA observations and estimated territory delineations based on the Ribelin/Sam Hamilton enumeration survey from FY22, Travis County BCP, Texas	12

List of Tables

Table 1. GCWA Survey and Monitoring Effort Summary, FY22, Travis County BCP, Texas.....	1
Table 2. GCWA abundance and territory density estimates based on enumeration survey results from FY22, Travis County BCP, Texas.	6
Table 3. GCWA banding results from FY22, Travis County BCP, Texas.....	16

Introduction

As specified in the Balcones Canyonlands Conservation Plan (USFWS 1996; hereafter BCCP), the City of Austin and Travis County developed and implemented a Land Management Plan (LMP) to provide guidelines for managing the Balcones Canyonlands Preserve (BCP). The LMP Tier IIA-7 chapter (BCP 2007) describes the current management and monitoring goals for golden-cheeked warbler (*Setophaga chrysoparia*; hereafter GCWA) populations on the BCP. It states, “The GCWA population within the BCP will be monitored through a regional program to determine population size, territory density and trends, distribution, productivity, use of marginal habitat, and to determine the effects of habitat manipulation, urbanization, and recreation...” Guidelines are provided in the LMP for various levels of monitoring including presence/absence, territory mapping, pair detection and productivity.

In fiscal year 2022 (FY22), Travis County Natural Resources staff (Staff) and volunteers conducted various GCWA surveys and monitoring efforts on approximately 1,038 hectares (ha) of Travis County-managed BCP properties (Figure 1; Table 1). This report summarizes the results of the Travis County Natural Resources GCWA monitoring program in FY22.

Table 1. GCWA Survey and Monitoring Effort Summary, FY22, Travis County BCP, Texas.

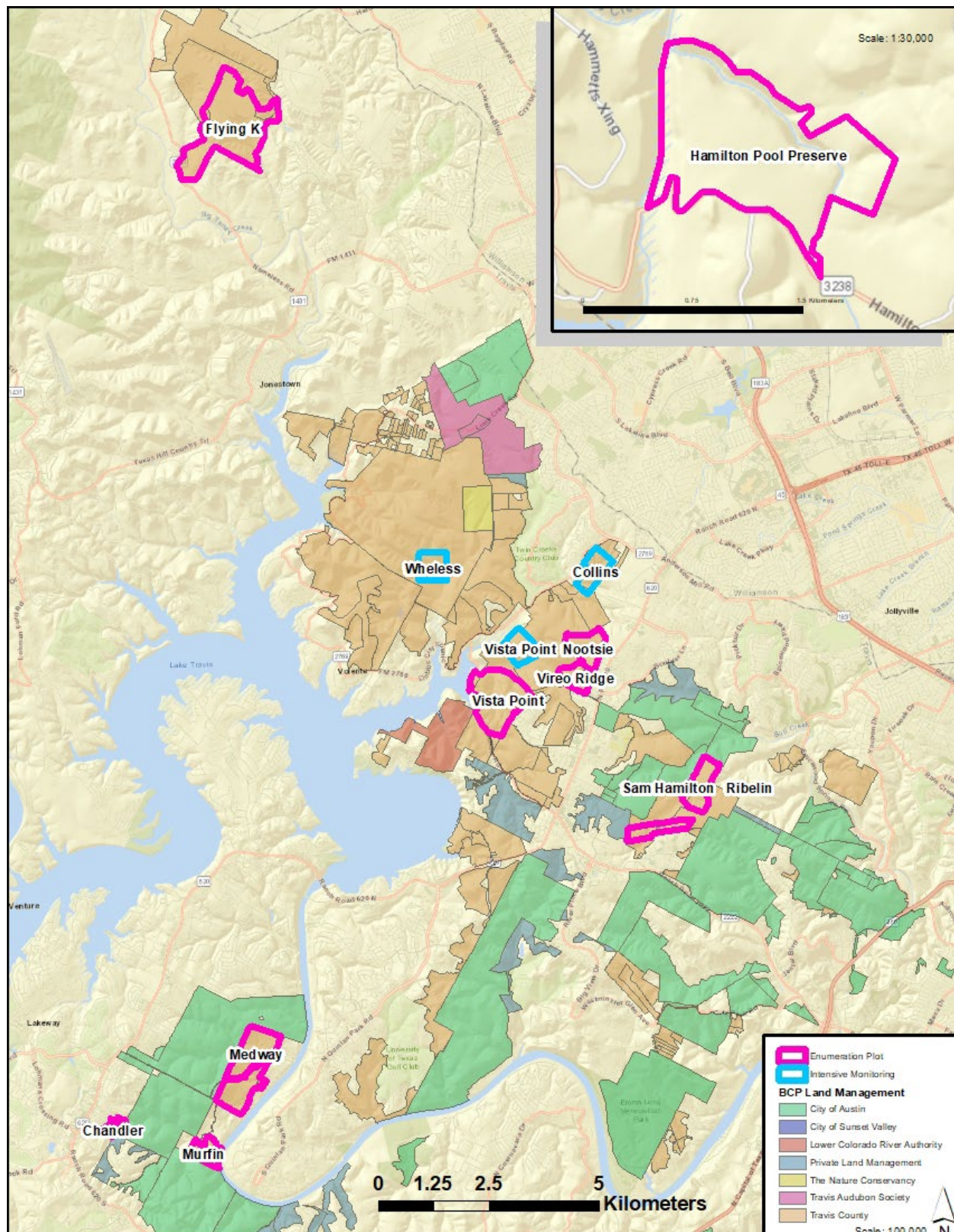
Survey Area ¹	Survey Type	Macrosite	Hectares Surveyed	Total Survey Hours
Chandler	Enumeration	South Lake Austin	12	10.25
Flying K	Enumeration	Lake Travis	263	192.50
Hamilton Pool Preserve	Enumeration	Pedernales River	95	30.25
Medway	Enumeration	South Lake Austin	140	53.75
Murfin	Enumeration	South Lake Austin	28	19.50
Ribelin/Sam Hamilton	Enumeration	Bull Creek	88	118.75
Vireo Ridge/Nootsie	Enumeration	Cypress Creek	82	71.00
Vista Point	Enumeration	Cypress Creek	133	130.75
Collins ^{2,3}	Intensive Monitoring	Cypress Creek	56	254.50
Vista Point ^{2,3}	Intensive Monitoring	Cypress Creek	70	166.50
Wheless ^{2,3}	Intensive Monitoring	Cypress Creek	70	75.25
Total			1,038	1,123.00

¹ Survey Areas may contain multiple BCP tracts

² The City of Austin staff analyzed these data, see *Appendix F* of the 2022 BCCP Annual Report for additional information

³ Area surveyed includes 100-meter survey buffer

Figure 1. GCWA Survey Area Overview on the Balcones Canyonlands Preserve, FY22, Travis County, Texas.



Methods

Enumeration Surveys

Enumeration surveys, or territory mapping, may provide an estimate of GCWA abundance, occupancy, distribution, and territory density in selected study areas (or plots). Enumeration surveys on Travis County-managed properties are typically carried out every five years or on an “as needed” basis should new or future potential disturbance activities occur on or adjacent to the BCP.

Enumeration plots are typically surveyed from 15 March to 25 May with a minimum of eight visits in each plot to ensure adequate plot coverage. Additional surveys may occur between 25 May - 15 June to determine late-season nesting or territorial behavior. Surveys may begin 30 minutes before sunrise, and typically proceed for three to six hours depending on survey area size. Surveys are canceled or postponed if weather conditions produce a steady rain or if wind inhibits surveyor’s ability to hear birds (approximately >12 miles/hour).

During each visit, surveyors attempted to audibly locate and follow male GCWAs and obtain several spatial and behavioral observations, while also recording male counter-singing to assist with the identification and delineation of male territory boundaries. GCWA locations are recorded using Garmin handheld global positioning units (GPS), ArcGIS Field Maps phone app (ESRI, Inc., Redlands, California), and/or on paper maps with an aerial imagery background using topographic lines and 100-meter Universal Transverse Mercator (UTM) grid. Data were recorded and analyzed in an ArcGIS 10.7 (ESRI, Inc., Redlands, California) geodatabase using a spatial reference of NAD 1983/UTM 14N. Data recorded for each GCWA observation included date, spatial coordinates, individual male observation ID, sex, song type, band information, counter-singing presence/directions, presence of a female/nests, and presence/number of fledglings.

Males are considered to have an established territory and are assigned a unique Territory ID post-hoc if any of the following occurred: 1) a male is observed on at least three occasions each separated by at least six days; 2) a male is with a female (appearing to be paired); 3) a male is observed attending a nest or feeding hatch-year fledglings.

After all field surveys are complete, territories are differentiated as either “Full”, “Edge” or “Off-plot”. A territory is designated as “Full” when the male is observed outside of

the designated survey plot on no more than one visit. An “Edge” territory is designated when a male is regularly observed inside the plot but is also observed outside on more than one visit. An “Off-Plot” territory is designated when a male is observed inside the plot on no more than one visit. “Off-plot” territories are not given a unique territory ID and are not included in further data analysis. A designation of “Unknown” is given, and no Territory ID is assigned to GCWA observations that do not meet the minimum requirements of a territory or when survey uncertainty cannot designate a Territory ID. After Territory IDs are assigned, Minimum convex polygons (MCP) are subsequently created using ArcGIS, around each set of unique Territory ID observations to delineate projected GCWA male territory outer boundaries.

Staff used Verner’s (1985) method to calculate GCWA territory density within survey plots, where “Full” territories were counted as 1.0 territory and “Edge” territories counted as 0.5 territories. Staff then divided the modified average of “Full” and “Edge” territories by the number of hectares in the survey plot to give an estimate of territory density (territories per hectares). Staff then calculated a GCWA abundance estimate by adding together the total number of “Full”, “Edge”, and other individual “Unknown” male observations within the survey plot. “Off-plot” males are not included in abundance calculations.

Observations of GCWA females and fledglings are recorded during enumeration surveys and assigned the Territory ID of an assumed associated male, post-hoc. If surveyors cannot determine if they are associated with a identified male territory, those females and fledglings are also designated as “Unknown”. GCWA female and fledgling observations are used to aid in male territory determinations and may also be used to assess mating pair status and nesting productivity; however, nesting productivity and mating behavior observations are not the focus of territory enumeration surveys and due to limitations inherent to territory mapping methods (i.e. differences in observer ability, observer bias, and mobility of the target species, etc.), results of all surveys should be interpreted as approximations.

Intensive Monitoring Plots and Nest Monitoring

In coordination with the City of Austin, Staff participates in a BCP-wide monitoring program of established intensive monitoring plots. These previously established “100-acre plots” are arranged across a spectrum of GCWA habitats based on canopy height. The objective of these plots is to document and estimate long-term GCWA trends using data collected from color-banded male GCWAs. The goal is to attempt to estimate return rates, dispersal, territory density/size, habitat use, territory age

structure, pairing success, breeding success, and nest survival. For a more detailed description of survey methods and results of the intensive monitoring program, see the City of Austin's *Appendix F* of the 2022 BCCP Annual Report.

The Collins intensive plot was established after Staff discovered a colony of invasive tawny crazy ants (*Nylanderia fulva*; hereafter TCA) on an adjacent property in 2017. TCAs are arboreal foragers and there are concerns of negative impacts to the GCWA prey-base. In response, Staff began a pilot study to examine the composition of the canopy arthropod community within affected and adjacent areas, along with an intensive monitoring plot for GCWAs within the Collins tract. Additional information on the on-going TCA project is detailed in *Appendix T4* of the 2022 BCCP Annual Report.

GCWA Banding and Band Resighting

In coordination with the City of Austin, Staff also assists with banding GCWAs on Travis County BCP intensive monitoring plots. GCWAs are manually captured using mist-nets set up in known non-banded male GCWA territories. Staff lure GCWAs to the mist-nets by playing audible recordings of other GCWAs' calls and songs. An imitation GCWA decoy may also be attached to nearby vegetation to assist in luring males into the net. Once a GCWA is captured, they are banded with a single silver aluminum USFWS band with a unique serial number and a up to three additional colored plastic bands, giving it a unique color band combination. Additional information collected while banding includes date of capture, sex, age, and spatial coordinates. The GCWA is captured, banded, and released as quickly as possible to minimize stress on the bird.

Previously established intensive plots, not intensively monitored in the current survey year, are treated as band resighting plots. Resight plots are also established in areas surrounding active intensive monitoring plots to identify additional GCWA dispersal and movement. These resight plots are systematically surveyed for returning color-banded GCWAs. This will continue until no banded GCWAs are observed within these plots for one full survey season. Resight plots are surveyed four times between 20 March and 15 April, with one additional survey between 15 May and 25 May to detect dispersing GCWAs. For a more detailed description of survey methods and results of the intensive monitoring program, banding, and band resighting effort, see the City of Austin's *Appendix F* of the 2022 BCCP Annual Report.

Results

Enumeration Surveys Results

In FY22, Staff and volunteers conducted GCWA enumeration surveys within seven survey plots on the Travis County-managed tracts of the BCP, covering approximately 491 ha and contributing approximately 626.75 hours of survey effort (Table 1). Estimated GCWA abundance, territories, and territory density based on enumeration survey results are presented in Table 2.

Table 2. GCWA abundance and territory density estimates based on enumeration survey results from FY22, Travis County BCP, Texas.

GCWA Enumeration Survey Area	Hectares (ha)	Estimated Abundance	No. of Full Territories	No. of Edge Territories	No. of Modified* Territories	Territory Density (Terr. per ha)
Bull Creek Macrosite						
Ribelin/Sam Hamilton	88	45	18	17	26.5	0.30
Cypress Creek Macrosite						
Vireo Ridge/Nootsie	82	26	9	8	13	0.16
Vista Point	133	46	40	3	41.5	0.31
Lake Travis Macrosite						
Flying K	263	42	34	7	37.5	0.14
Pedernales River Macrosite						
Hamilton Pool	95	7	6	0	6	0.06
South Lake Austin Macrosite						
Chandler	12	3	1	1	1.5	0.13
Medway	140	8	2	4	4	0.03
Murfin	28	2	1	1	1.5	0.05
All Survey Plots Combined	842	179	111	41	132	0.15

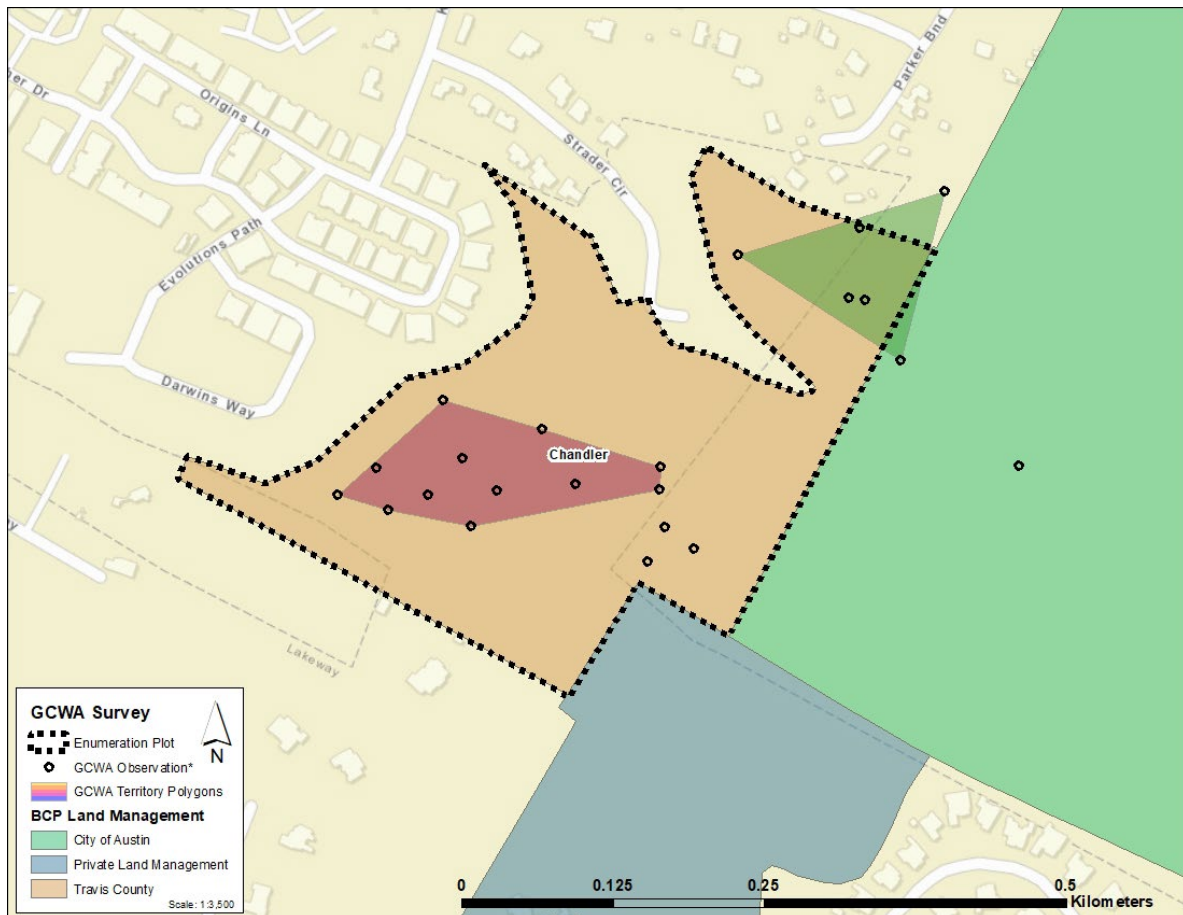
*Modified territories are the number of full territories plus one-half of the number of edge territories (Verner 1985).

Chandler GCWA Enumeration Survey Results

The Chandler GCWA enumeration survey plot included approximately 12 ha within the South Lake Austin macrosite. The Chandler survey plot is east of North Farm-to-Market (FM) 620 within the City of Lakeway, Texas.

Two GCWA territories (interior or edge) were delineated on the Chandler survey plot. The overall density of GCWAs for these survey plots were approximately 0.13 GCWA territories per ha. No female or fledging GCWAs were detected within survey plot. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 2.

Figure 2. GCWA observations and estimated territory delineations based on the Chandler enumeration survey from FY22, Travis County BCP, Texas.



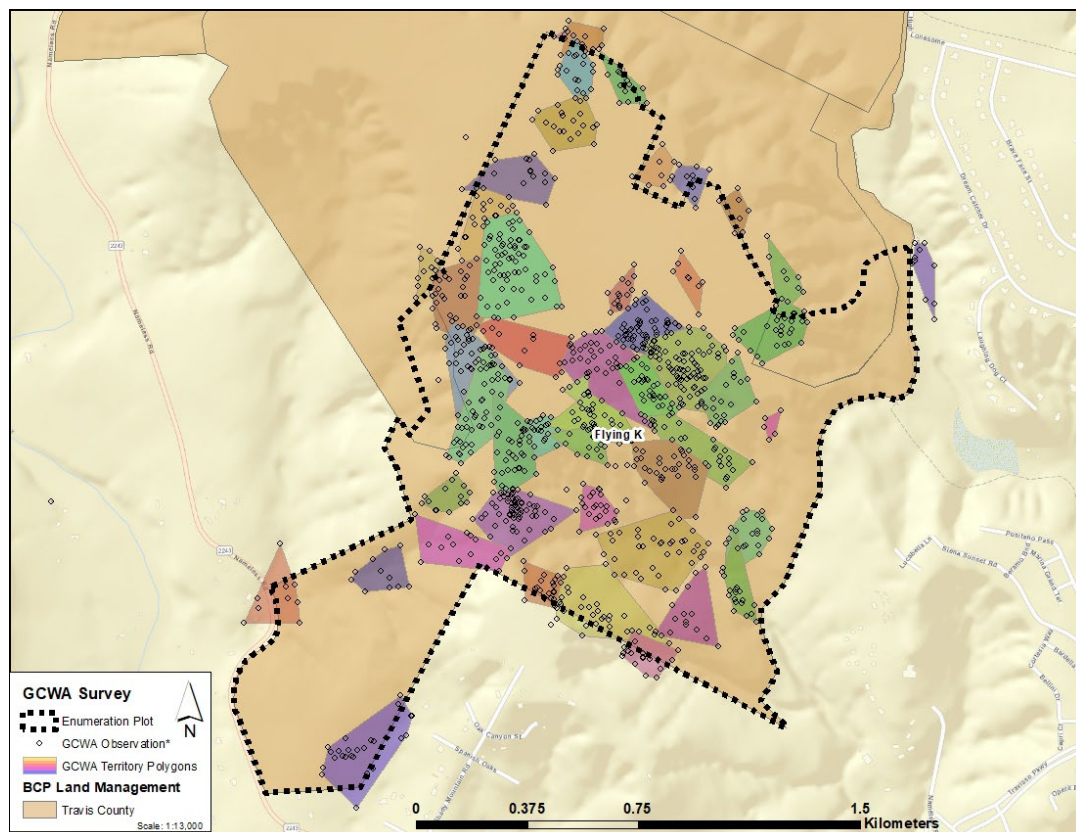
*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Flying K GCWA Enumeration Survey Results

The Flying K GCWA enumeration survey plot included a majority of the 251 hectare Flying K tract, as well as fringe portions of the Kotrla tract of the BCP, totaling approximately 263 ha within the Lake Travis macrosite. The Flying K tract was acquired by Travis County in December of 2021; therefore, this was the first year to be surveyed for GCWAs by Staff. The Flying K survey plot is located east of the Balcones Canyonlands National Wildlife Refuge and west of the City of Leander, Texas.

Forty-one GCWA territories (interior or edge) were delineated on the Flying K survey plot. The overall density of GCWAs for these survey plots were approximately 0.14 GCWA territories per ha. Female GCWAs were detected within 49% (n=20) of territories and GCWA fledglings were detected in 15% (n=6) of territories. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 3.

Figure 3. GCWA observations and estimated territory delineations based on the Flying K enumeration survey from FY22, Travis County BCP, Texas.



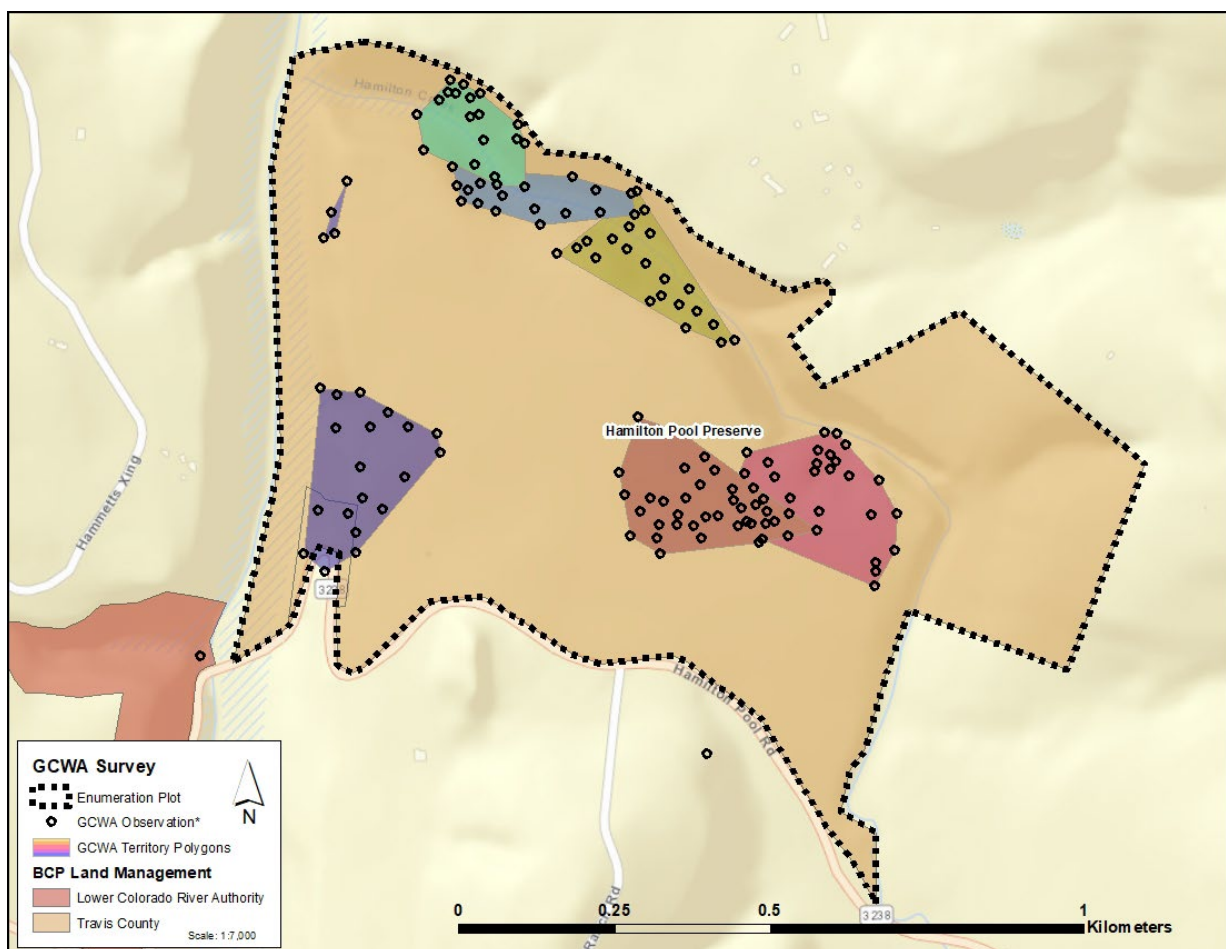
*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Hamilton Pool GCWA Enumeration Survey Results

The 95-ha Hamilton Pool GCWA enumeration survey plot includes the Martin tract and the Hamilton Pool Preserve, a Travis County Park that is included in the BCP. Hamilton Pool Preserve is located north of Hamilton Pool Road in southwest Travis County, within the Pedernales River macrosite.

Six GCWA territories (interior or edge) were delineated on the Hamilton Pool survey plot. The overall density of GCWAs for these survey plots were approximately 0.06 GCWA territories per ha. Female GCWAs were detected within 33% (n=2) of male territories and no GCWA fledglings were detected on this plot. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 4.

Figure 4. GCWA observations and estimated territory delineations based on the Hamilton Pool Preserve enumeration survey from FY22, Travis County BCP, Texas.



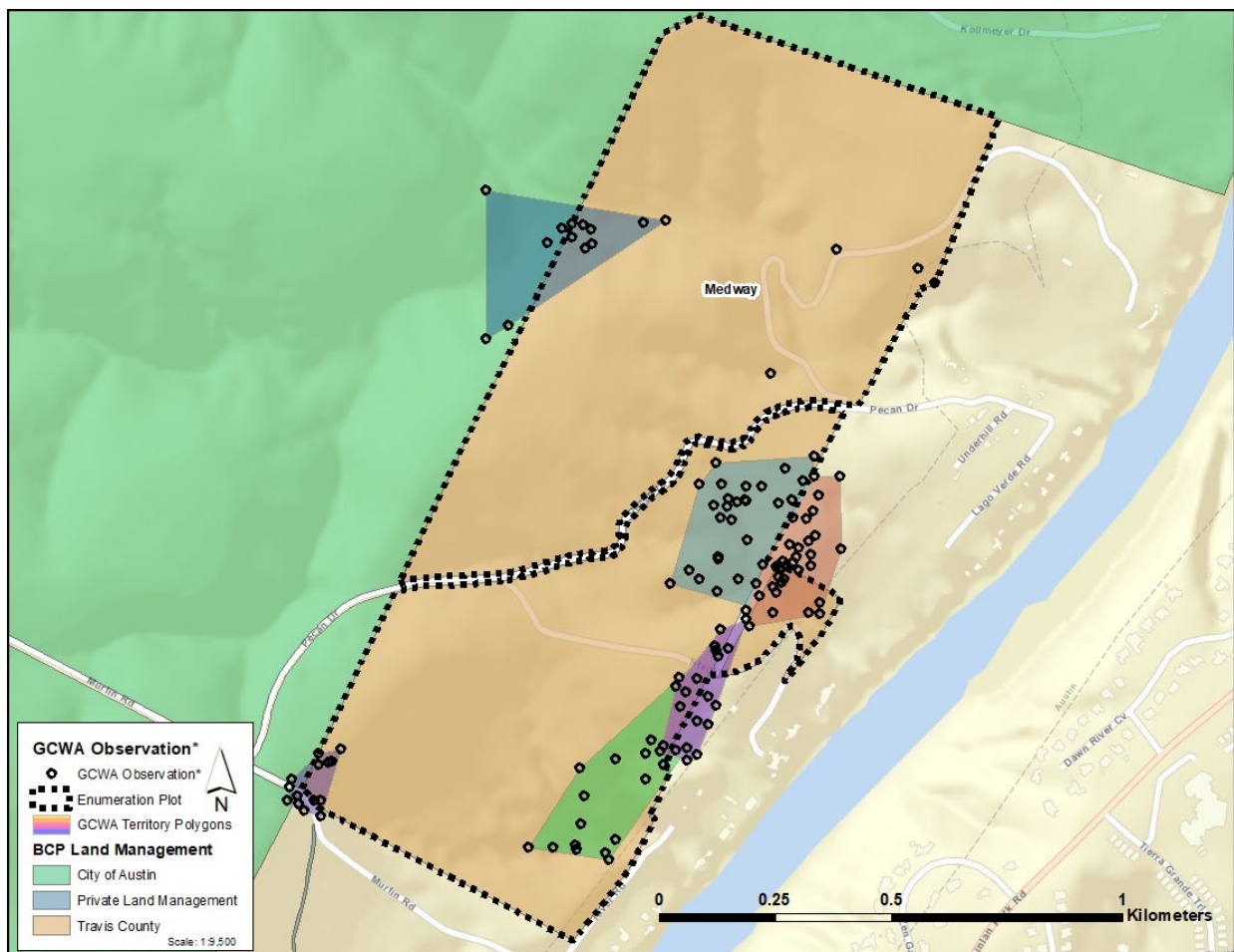
*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Medway Enumeration Survey Results

The Medway GCWA enumeration survey plot included the Medway tract of the BCP, totaling approximately 140 ha within the South Lake Austin macrosite. The Medway survey plot is located just east of the City of Lakeway, Texas.

Six GCWA territories (interior or edge) were delineated on the Medway survey plot. The overall density of GCWAs for these survey plots were approximately 0.03 GCWA territories per ha. Female GCWAs were detected within 17% (n=1) of territories and GCWA fledglings were detected in 17% (n=1) of territories. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 5.

Figure 5. GCWA observations and estimated territory delineations based on the Medway enumeration survey from FY22, Travis County BCP, Texas



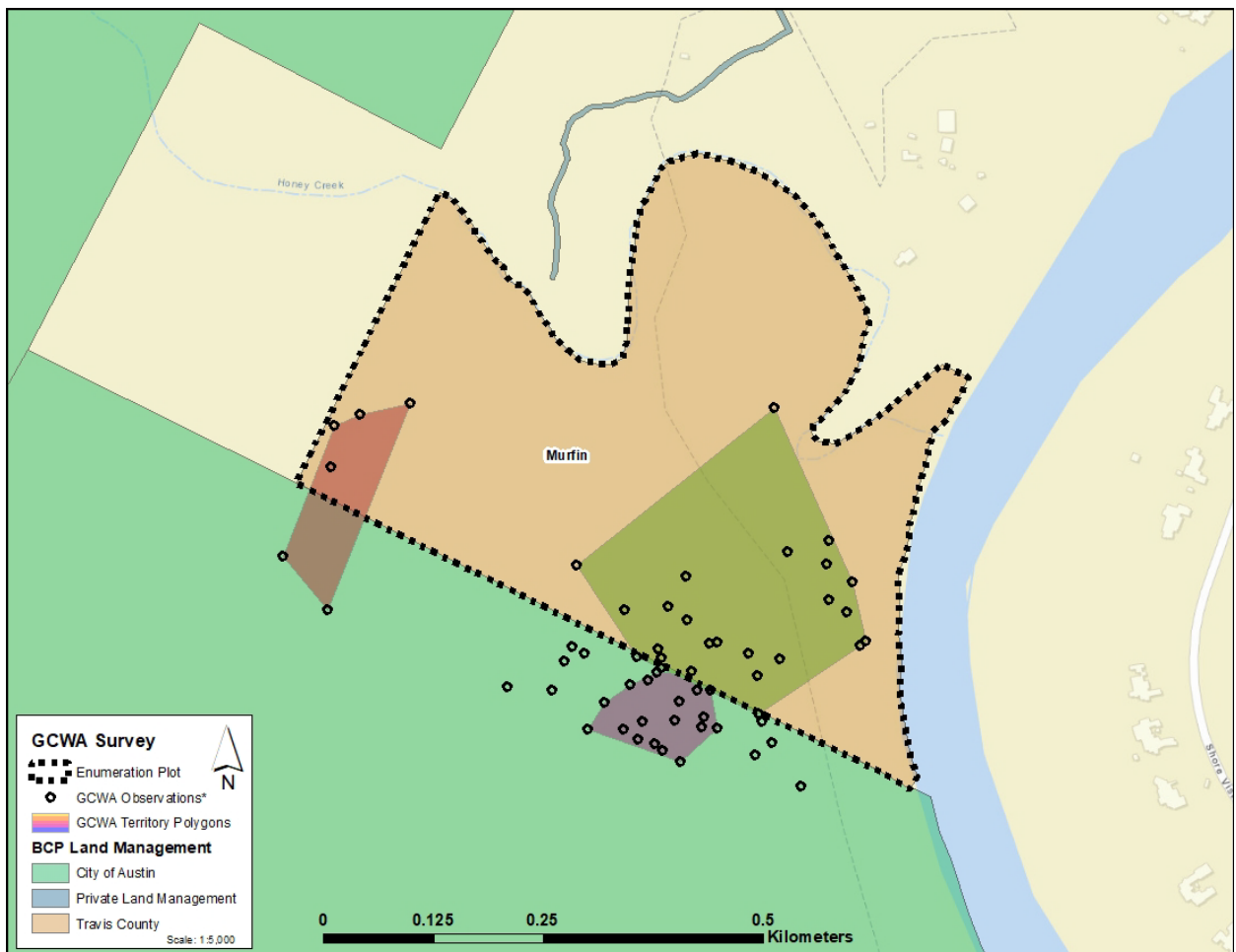
*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Murfin GCWA Enumeration Survey Results

The Murfin GCWA enumeration survey plot includes approximately 28 ha of the Murfin conservation easement. The Murfin survey plot is located just east of the City of Lakeway, Texas and its eastern boundary abuts Lake Austin.

Two GCWA territories (interior or edge) were delineated on the Murfin survey plot. The overall density of GCWAs for these survey plots were approximately 0.05 GCWA territories per ha. Female GCWAs were detected within 50% (n=1) of territories and no GCWA fledglings were detected during any plot survey. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 6.

Figure 6. GCWA observations and estimated territory delineations based on the Murfin enumeration survey from FY22, Travis County BCP, Texas.



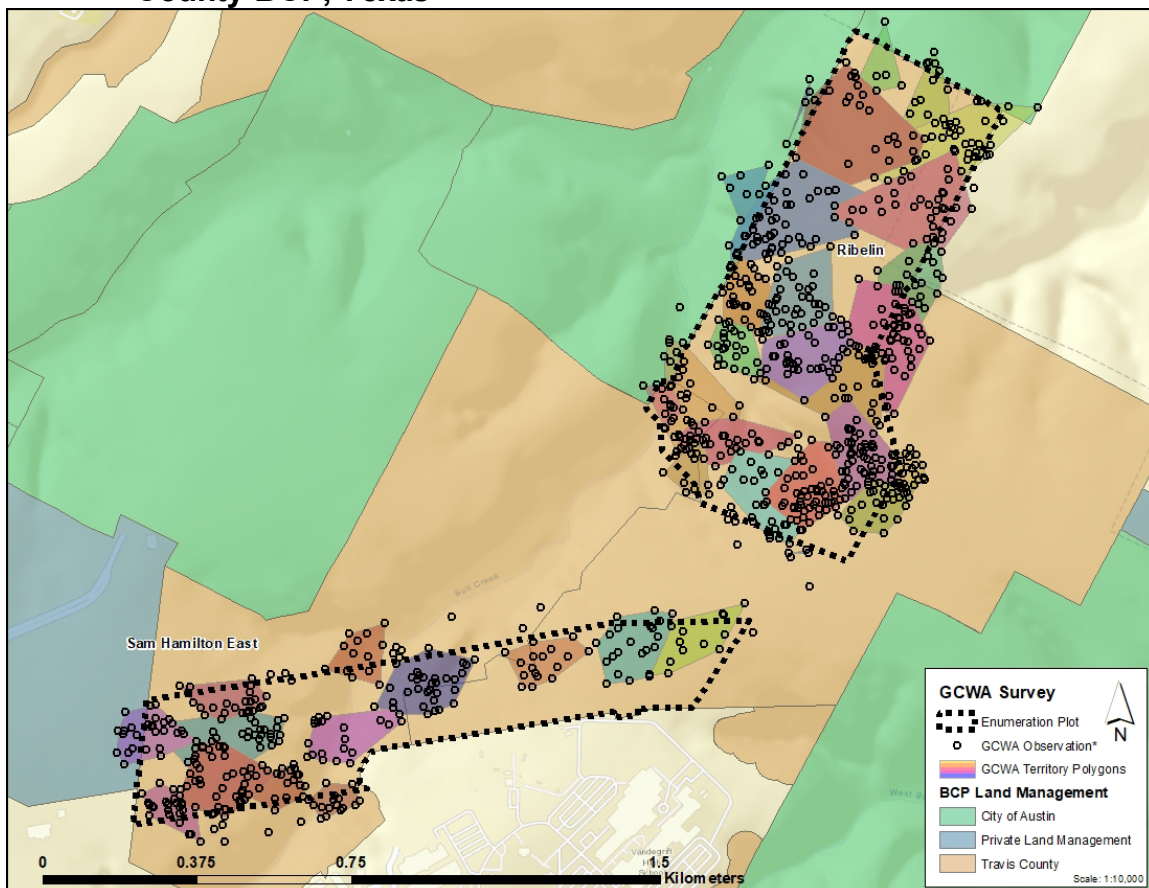
*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Ribelin/Sam Hamilton GCWA Enumeration Survey Results

The Ribelin/Sam Hamilton GCWA enumeration survey plot included approximately 54 ha of the northern portion of the Ribelin tract as well as approximately 34 ha buffering a transmission line corridor on the Sam Hamilton East and Ribelin tracts of the BCP, totaling approximately 88 ha within the Bull Creek macrosite. The Ribelin/Sam Hamilton survey plot is located east of the intersection of North FM 620 and FM 2222, just north of Vandergrift High School.

Thirty-five GCWA territories (interior or edge) were delineated on the Ribelin/Sam Hamilton survey plot. The overall density of GCWAs for these survey plots were approximately 0.30 GCWA territories per ha. Female GCWAs were detected within 54% (n=19) of territories and GCWA fledglings were detected in 9% (n=3) of territories. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 7.

Figure 7. GCWA observations and estimated territory delineations based on the Ribelin/Sam Hamilton enumeration survey from FY22, Travis County BCP, Texas



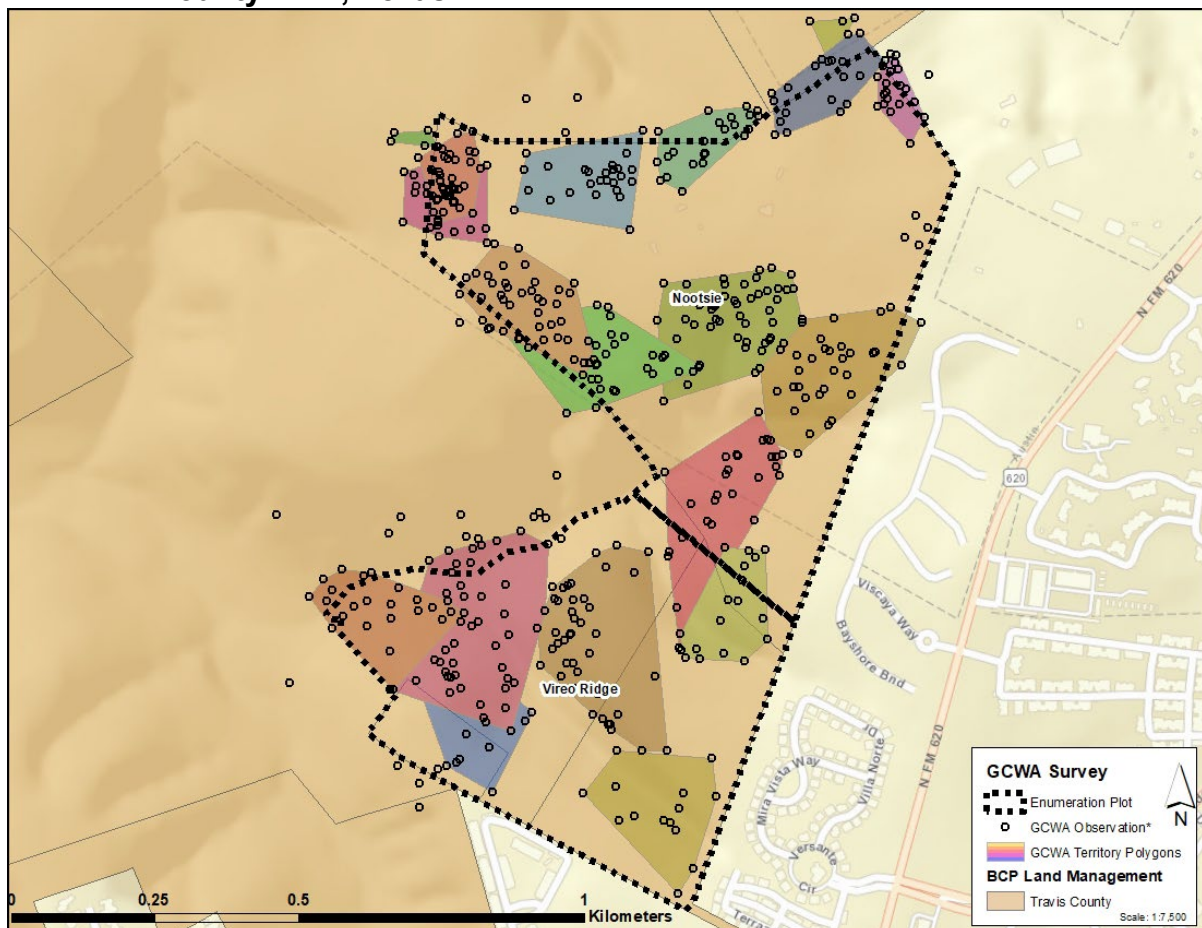
*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Vireo Ridge/Nootsie GCWA Enumeration Survey Results

The Vireo Ridge/Nootsie GCWA enumeration survey plot included the 49 ha Nootsie tract and approximately 33 ha of the eastern portions of the Vireo Ridge tract totaling approximately 82 ha within the Cypress Creek macrosite. The Vireo Ridge/Nootsie survey plot is within located west of North FM 620, on the northwest edge of the City of Austin, Texas.

Seventeen GCWA territories (interior or edge) were delineated on the Vireo Ridge/Nootsie survey plot. The overall density of GCWAs for these survey plots were approximately 0.16 GCWA territories per ha. Female GCWAs were detected within 41% (n=7) of territories and GCWA fledglings were detected in 6% (n=1) of territories. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 8.

Figure 8. GCWA observations and estimated territory delineations based on the Vireo Ridge/Nootsie enumeration survey from FY22, Travis County BCP, Texas



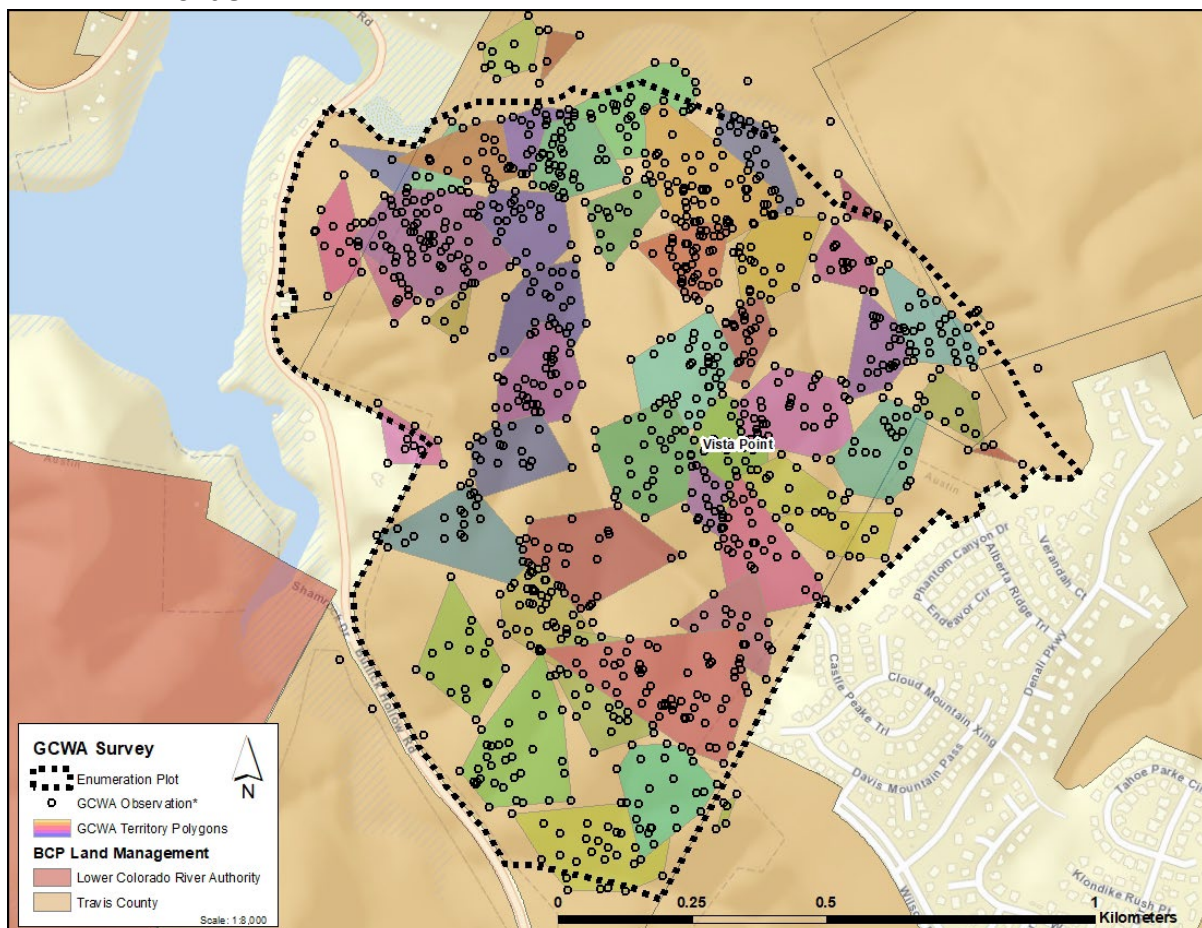
*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Vista Point GCWA Enumeration Survey Results

The Vista Point GCWA enumeration survey plot included approximately 121 ha of the Vista Point tract, as well as the adjacent 5 ha Montandon tract and 7 ha of the Grandhiew Hills tract, totaling approximately 133 ha within the Cypress Creek macrosite. The Vista Point survey plot is within located along the east side of Bullick Hollow Road.

Forty-three GCWA territories (interior or edge) were delineated on the Vista Point survey plot. The overall density of GCWAs for these survey plots were approximately 0.31 GCWA territories per ha. Female GCWAs were detected within 53% (n=23) of territories and GCWA fledglings were detected in 9% (n=4) of territories. GCWA observation locations and delineated territories from FY22 enumeration surveys are presented in Figure 9.

Figure 9. GCWA observations and estimated territory delineations based on the Vista Point enumeration survey from FY22, Travis County BCP, Texas



*GCWA Observations outside of designated survey boundaries are estimated locations, based on audible male detections.

Intensive Monitoring Plot and Nest Monitoring Results

In FY22, Staff conducted GCWA intensive plot monitoring at the Collins, Vista Point, and Wheless plots (Figure 1). Staff surveyed intensive monitoring plots weekly from 15 March 2022 to 25 May 2022. Additional weekly visits to the plots occurred between 25 May 2022 and 15 June 2022 to continue monitoring nesting activity, obtain hatch-year bird observations, and gain addition band resight information. Staff contributed approximately 254.50, 166.50, and 73.25 hours of survey time to the Collins, Vista Point, and Wheless intensive monitoring plots, respectively.

In FY22, Staff located 12 GCWA nests while conducting intensive plot surveys. Eight, three, and one nests on the Vista Point, Collins, and Wheless plot, respectively. Of the 12 nests, nine nests were observed in Ashe Juniper (*Juniperus ashei*), two in live oak (*Quercus fusiformis*), and one in a Texas Ash (*Fraxinus texensis*) tree. Of these 12 nests, seven (~58%) successfully fledged young, the remaining five nests (~42%) failed due to presumed depredation or weather. No nests were observed to have been parasitized by brown-headed cowbirds (*Molothrus ater*).

Travis County shared intensive plot monitoring and nest data collected in FY22 with the City of Austin staff for further analysis and publication. For a more detailed summary of the results and discussion of the intensive monitoring program and nest monitoring effort, see the City of Austin's *Appendix F* of the 2022 BCCP Annual Report.

GCWA Banding and Band Resighting Results

In FY22, Staff assisted the City of Austin with banding GCWAs on Travis County BCP intensive monitoring plots. Staff contributed approximately 30 hours to GCWA banding effort on the Collins, Vista Point, and Wheless plots, collectively. A summary of Staff FY22 banding efforts are shown in Table 3. In addition, City of Austin staff banded nine GCWAs (eight male; one female) on the Vista Point intensive plot. For a more detailed information on the City of Austin's banding efforts, see the City of Austin's *Appendix F* of the 2022 BCCP Annual Report.

Table 3. GCWA banding results from FY22, Travis County BCP, Texas.

Banding Area	Date Banded	Sex	Age*
Collins	4/7/2022	Male	SY
Collins	4/7/2022	Male	ASY
Collins	4/11/2022	Male	SY
Collins	4/11/2022	Male	SY
Collins	5/3/2022	Male	SY
Collins	5/3/2022	Male	SY
Wheless	4/21/2022	Male	ASY
Wheless	4/21/2022	Male	SY

* SY = Second Year; ASY = After Second Year; AHY = After Hatch Year

In FY22, volunteers assisted with band resighting efforts surrounding the Vista Point, Collins, and Hamilton SE (COA) intensive monitoring plots (Figure 1). Travis County shared banding and band resighting data collected in FY22 with the City of Austin staff for further analysis and publication. For a more detailed summary of the results and discussion of the band resighting effort, see the City of Austin's "Appendix ____" of the 2022 BCCP Annual Report.

Acknowledgements

Travis County would like to thank all of the BCP partners and Staff for their collaboration in the 2022 GCWA survey efforts. Special thanks go to our Travis County seasonal natural resource technicians Ky Parker, Jake Olson, and Nick Johns. Thank you also to our dedicated volunteers Megan Whitehouse, Jeffery Jackson, and other Hamilton Pool Preserve staff.

Literature Cited

- Balcones Canyonlands Preserve (BCP). 2007. Balcones Canyonlands Preserve land management plan, Tier IIA-7, golden-cheeked warbler management. City of Austin and Travis County, Austin, Texas.
- Verner, J. 1985. Assessment of counting techniques. *Current Ornithology*. 2:247-302.
- U.S. Fish and Wildlife Service (USFWS). 1996. Final environmental impact statement/habitat conservation plan for proposed issuance of a permit to allow incidental take of the golden-cheeked warbler, black-capped vireo, and six karst invertebrates in Travis County, Texas. Prepared by Regional Environmental Consultants (RECON) and U.S. Fish and Wildlife Service. Albuquerque, New Mexico.