City of Austin 2013
Black-capped Vireo *(Vireo atricapilla)*
Monitoring Program

Balcones Canyonlands Preserve Annual Report



Black-capped Vireo fledgling, 10 July 2013, Kent Butler Ecological Reserve
© Jonny Scalise, City of Austin staff

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

TABLE OF CONTENTS

INTRODUCTION 1
Background 1
Objectives 2
METHODS 2
Sites and Survey Effort 2
Data Collection and Analysis 3
RESULTS AND DISCUSSION 3
Territory Mapping and Reproductive Success on the Forest Ridge Tract 3
Return of Vireos to the Kent Butler Ecological Reserve 5
Territory Mapping on the Cortaña Study Site 6
Parasitism and Interaction with Predators 6
Golden-cheeked Warblers in Black-capped Vireo Habitat 6
BLACK-CAPPED VIREO HABITAT MANAGEMENT 6
Maintenance of Recently Occupied Habitat – Cortaña 7
Restoring and Creating Habitat – Wild Basin/Vireo Preserve 7
Habitat Creation – Bohls 8
Monitoring Effects of Habitat Management Efforts 9
Identifying Other Potential Management Sites 9
LITERATURE CITED 10

FIGURES

FIGURE A. Locations of 2009 Black-capped Vireo Habitat Improvement, Kent Butler Ecological Reserve
FIGURE B. Locations of Black-capped Vireos on Kent Butler Ecological Reserve, 2013
FIGURE C. Photos of Black-capped Vireo Habitat Restoration/Creation Projects at Wild Basin/Vireo Preserve, 2013

City of Austin
2013 Black-capped Vireo Monitoring Program
Balcones Canyonlands Preserve Annual Report

This report summarizes the results of the City of Austin's 2013 black-capped vireo (*Vireo atricapilla*) endangered species monitoring program. The 2013 field season was the sixteenth year of endangered species monitoring on the City of Austin's Balcones Canyonlands Preserve tracts.

Collaborative efforts to create and restore habitat continue for the black-capped vireo. The City of Austin is partnering with Travis County, St. Edwards University, Wild Basin, and volunteers to restore, create, and monitor vireo habitat on the Wild Basin/Vireo Preserve, including degraded areas that are currently not habitat for either the vireo or the golden-cheeked warbler. Since Wild Basin/Vireo Preserve supports many of the habitat types observed throughout the BCP, lessons learned at this site should be applicable to other areas within the BCP.

INTRODUCTION

Background

The black-capped vireo (vireo) is an endangered, neotropical migrant that breeds in portions of Oklahoma, Texas, and Mexico (Grzybowski 1995). The U.S. Fish and Wildlife Service listed this species as endangered in 1987 (USFWS 1987). Major threats to the vireo's survival include habitat loss, habitat fragmentation, over-grazing/browsing, natural vegetation succession, and parasitism by brown-headed cowbirds. Rapid westward expansion of development from the city of Austin led to the creation of the Balcones Canyonlands Conservation Plan (a Habitat Conservation Plan) and issuance of a 10(a)(1)(B) permit in1996 by the U.S. Fish and Wildlife Service to the City of Austin and Travis County to mitigate for the incidental "take" of habitat loss due to development and to facilitate the local recovery of the vireo and seven other endangered species (USFWS 1996). The permit requires a minimum of 12,300 hectares of endangered species habitat in western Travis County be set aside as a preserve (the BCP) for these species. The BCP is owned and managed by a number of public and private entities, including the City of Austin, Travis County, Lower Colorado River Authority, The Nature Conservancy, Travis Audubon Society, and St. Edwards University/Wild Basin.

The vireo has been documented on several BCP tracts that are managed by the City of Austin. The largest known colony in Travis County formerly existed at the Wild Basin/Vireo Preserve. A 1961 wildfire created several hundred hectares of vireo habitat in this area. The vireo colony likely peaked sometime in the 1970s, but declined steadily from 32 territories (22 breeding pairs) in 1987 to one territory in 1997 (Grzybowski 1989, Steed 1988, DLS Associates 1989, 1990, Abbruzzese 1998), and intermittent sightings of single males in 2004 (Becker and Koehler 2004), 2011 (City of Austin 2011), and 2012 (City of Austin et al. 2012). A small breeding colony of vireos (three to five territories) had occupied habitat on the Cortaña tract every year since 2000. A part of this colony spilled onto the adjacent River Place mitigation tract to the northeast. However, the number of territories in that colony

dwindled to only one in 2011; no vireos established territories there in 2012. Two to three vireo territories have been established on the Forest Ridge tract each year since 2009. On the Kent Butler Ecological Reserve (formerly known as the Ivanhoe tract), vireos nested along electric transmission line corridors in 2008 and 2009, but none established a territory in 2010, 2011, or 2012. Other records for vireos on the City of Austin's BCP tracts for the past decade include intermittent sightings of males on the Commons Ford, Parke West, and Sam Hamilton West tracts.

Objectives

The Balcones Canyonlands Conservation Plan (USFWS 1996) states that "baseline monitoring will be gathered in accordance with the Land Management Plan Guidelines and approved land management plans, and should concentrate on determining basic population levels on preserve lands, key population parameters, and other ecological parameters that may affect the target species." The Tier IIA-8 land management plan (BCP 2007) identifies "distribution, abundance, productivity, and recruitment" as key population parameters to monitor. The City of Austin's vireo monitoring program continues to focus on estimating abundance, the extent of territories, pairing, nesting, and productivity for all vireos detected each year.

Because of the threat posed by brown-headed cowbirds, monitoring for direct and indirect signs of cowbird parasitism during field surveys is a high priority, and BCP staff is committed to intensive management of cowbirds at or near all vireo colonies. With the absence of vireos on the Cortaña tract in 2012, and the lack of evidence of cowbird parasitism at the Forest Ridge colony, active trapping of cowbirds was discontinued on City of Austin properties in 2013.

Because of the early successional nature of vireo habitat, the land management plan (BCP 2007) emphasizes vegetation management and monitoring. Vireos occupy shrublands of mixed deciduous and evergreen species with irregular height and distribution. Open spaces between clumps of woody vegetation are also important, so optimal vireo habitat appears as a mosaic of grassy or rocky spaces and clumps of shrubs. Shrubs that have a skirt of vegetative cover extending down to the ground are especially important to conceal nests. Because this early successional stage of habitat must continually be manipulated to remain viable, restoration projects in conjunction with habitat monitoring are frequently undertaken on various City of Austin tracts (see Black-capped Vireo Habitat Management).

METHODS

Sites and Survey Effort

To monitor population trends, surveys for vireos are conducted every year. The vireo monitoring program closely follows the golden-cheeked warbler (warbler) monitoring protocols (see Methods in City of Austin et al. 2013). However, the smaller population size and more transitory nature of the vireo requires more flexibility in the location, size, and extent of the survey areas, as opposed to the permanent study plots with fixed size that have been established for the warbler.

During the 2013 field season, staff again conducted spot-mapping of vireos on a 15.8-hectare section of the Cortaña tract. Combined with a 7.3-hectare section of the adjacent River Place mitigation tract, this

parcel makes up the 23-hectare vireo habitat study area that was originally restored in 1996. Vireos were also mapped on, and adjacent to, the Forest Ridge warbler intensive study plot. Because much of the habitat on the Forest Ridge study plot is more typically associated with warblers, the exact size of the vireo habitat on Forest Ridge is undetermined. Vireos detected during other endangered species surveys were also recorded and mapped, and attempts were made to determine their breeding status.

Survey effort on the established Cortaña colony is roughly equivalent, hectare-for-hectare, to the level of effort on the warbler intensive study plots. From the Cortaña colony, City of Austin staff biologists collected the following data: number of territories, territory location, pairing success, breeding success, parasitism, and productivity. Staff biologists used standard territory mapping (IBCC 1970, Bibby 1992) methods, conducting surveys from April 11 to June 11, 2013, for a total of 29.0 hours.

The Forest Ridge intensive study plot was surveyed once or twice each week in conjunction with the warbler monitoring program from March 15 through June 15. Once vireos were detected on April 1, staff collected data on the number of vireo territories, territory locations, pairing success, breeding success, parasitism, and productivity, continuing surveys through August 22. Because vireos and warblers both occurred at this site, the exact number of hours devoted to monitoring the vireo is difficult to ascertain.

Data Collection and Analysis

Vireo observations were recorded with Garmin global positioning units (GPS), which have an accuracy ranging from 3 to 9 meters. Other sightings were recorded on topographic maps at a scale of 1:2,400 or 1:3,600, using a 100-meter UTM grid. Pairing status, breeding success, and number of fledglings produced per pair were determined for each territory. For methodology and calculations, see City of Austin et al. 2013. No playback tapes of vireo songs or calls were used during this season's monitoring.

RESULTS AND DISCUSSION

In 2013, staff found vireos holding territories on only two City-owned BCP tracts: Forest Ridge and the Kent Butler Ecological Reserve.

Territory Mapping and Reproductive Success on the Forest Ridge Tract

Three territorial male vireos were observed on and adjacent to the Forest Ridge intensive warbler study plot in 2013. A male was first heard, but not seen, on April 1. The first vireo actually seen, a week later, was a five-year-old male, OR/SI:BL/GR, banded as a second-year male in 2009 on Forest Ridge by William Simper, Travis County BCP. The second male, unbanded, was first observed on April 23. Both males held territories along the upper part of south-facing slopes near the summit of the main ridge, on either side of a ravine. OR/SI:BL/GR claimed the center of the plot, and the unbanded male's territory straddled the plot boundary to the southeast.

A third male, also unbanded, appeared on June 10, along the ridge to the northwest of the banded male's territory and outside the western boundary of the study plot. He was observed to be building a nest (see photo, next page) on that date, but no female was ever seen in that territory. This western unbanded male

was last observed on July 12. The eastern unbanded male was last observed on July 19, and OR/SI:BL/GR on August 22.



Black-capped Vireo Nests in Texas Mountain-Laurel, Forest Ridge, © Jonny Scalise
(nest on left is "bachelor pad" built by apparently unmated male)

The two male vireos with territories on the study plot were both mated. Unbanded female vireos were first observed with these males on April 23. On that same date, BCP staff found a nest in the territory of OR/SI:BL/GR that appeared to be nearly complete. No chicks fledged from this territory, though two other nests found within the territory (photo of one of these, above) may have been indicative of multiple attempts by this pair.

A nest containing four chicks was found in the territory of the eastern unbanded male on June 28; the unbanded male and female both "shradded" the observer. An inspection in early July found the nest empty except for one dead nestling. On July 15, in this same vicinity, a fledgling was defended by a female, and on July 19 two fledglings were observed with the unbanded male. An "older-looking" fledgling was being tended by a female in the territory of OR/SI:BL/GR on August 22, but was likely the offspring of the unbanded male.

Pairing success for the three territories at Forest Ridge was 67 percent, and breeding success was 33 percent. With two fledglings confirmed, and likely a third fledgling present in the difficult-to-penetrate vegetation, productivity was 0.67 to 1.0 fledglings per territory, and 2.0 to 3.0 for the one successful territory.

Return of Vireos to the Kent Butler Ecological Reserve

In 2008, BCP staff found a pair of vireos had established a territory on the Kent Butler tract. They had chosen an area bisected by four electric transmission lines. Utility crews had kept vegetation trimmed below its normal height in some places along these lines, where tree limbs might cause damage to the infrastructure; they also maintained roads for vehicular access. The trimming encouraged a shrubby growth that was apparently suitable for this pair of vireos, which successfully fledged at least one chick.

Since utility corridor maintenance would always prevent the vegetation in the corridors under these lines from becoming optimal warbler habitat, BCP staff proposed to the Lower Colorado River Authority (LCRA) and Austin Energy (AE), who owned the lines, a new approach. In a few places where maintenance had kept vegetation at suboptimal structure for warblers, but the trees were too tall for good vireo habitat, the vegetation would be cut to the ground. Highest priority was given to areas where stump-sprouting shrubby species were already established.

The utilities agreed, and in February 2009, an LCRA crew removed the above-ground trunks of woody vegetation in three areas (Figure A). No vegetation was altered where the vireo family had been seen in 2008 (City of Austin, 2009).

In spring 2009, a different male vireo (a second-year bird, subsequently banded DG/YE:BK/SI by William Simper of Travis County BCP staff) established a territory and attracted a mate to the same general area that had been occupied in 2008. The pair nested (see location in Figure A), but the nestlings died before fledging, possibly victims of hypothermia after a June thunderstorm. No vireos established a territory on the Kent Butler tract for the next three years.

On April 28, 2013, BCP staff found an unbanded male vireo defending a territory that included the area occupied in 2008 and 2009, but also incorporating parts of two of the habitat improvement areas (Figure B). When this bird remained on territory, City BCP staff invited William Simper to attempt to catch and band him. The attempt, on May 31, failed, possibly because the male vireo was busily courting a female. That female was apparently building a nest, discovered with four eggs on June 11. On June 22, the female was on the nest, but the male was seen with food in bill. By July 5, the nest was no longer active, but no fledglings could be confirmed. On July 10, the first fledgling was sighted (photo on title page). On July 17, the male was tending two fledglings in one area of the territory, and the female tending a third about 150 meters away.

On June 3, a second male vireo was singing at one end of the eastern habitat improvement area (Figure B), roughly 400 meters east of the first male's territory. The second male had two yellow bands on the left leg. It was almost certainly the individual that had recently been banded YE/YE:MV/SI by W. Simper on the adjacent Ribelin tract (and which had apparently abandoned that territory). A vireo was heard in this same area on June 4 and 7, but was not seen again.

Territory Mapping on the Cortaña Study Site

Staff observed a probable female vireo at Cortaña on May 1, but, for the second consecutive year, no vireo established a territory.

Parasitism and Interaction with Predators

No brown-headed cowbirds were observed during vireo surveys on either the Forest Ridge tract or the Kent Butler Ecological Reserve. No vireos were observed tending cowbird fledglings.

BCP staff and volunteers had managed cowbirds at the Cortaña colony every year since vireos were first observed there in 2000. However, since no vireo established a territory at this site in 2012 or 2013, trapping was discontinued.

City staff observed neither interactions between vireos and potential predators, nor any harassment of vireos by other species. Western Scrub-Jays were observed near vireos at Forest Ridge.

Golden-cheeked Warblers in Black-capped Vireo Habitat

In some areas, vireo habitat may progress to warbler habitat through natural succession. Likewise, natural or anthropogenic disturbance patterns may convert warbler habitat to the early successional stage preferred by the vireo. These habitat types often overlap. During 2013 within the City of Austin BCP, territorial warblers and vireos were observed in the same or neighboring areas on the Forest Ridge and Kent Butler tracts.

Warblers were incidentally mapped during vireo surveys around the 15.8-hectare vireo habitat area on the Cortaña tract. Male warblers were usually detected singing near the perimeter of the vireo habitat area; the canyons surrounding the upland study site are excellent warbler habitat. On April 11, a warbler nest was discovered in an Ashe juniper at the rim of the canyon on the west side of the Cortaña shinnery This warbler nest successfully fledged four young, observed on May 12.

On the Forest Ridge tract, the vireo territories were intermingled with warbler territories within prime warbler habitat on and near the intensive study plot. The Forest Ridge study plot supports a dense understory of vegetation that is used by both species.

BLACK-CAPPED VIREO HABITAT MANAGEMENT

The Balcones Canyonlands Conservation Plan (USFWS 1996) requires maintaining or creating 810 hectares (2,000 acres) of vireo habitat within the BCP, and the land management plan (BCP 2007) provides additional, general guidelines to help achieve this goal. The Balcones Canyonlands Conservation Plan recommends focusing potential vireo management areas in portions of the BCP that are not currently occupied by the warbler. Consistent with these recommendations, BCP staff is implementing adaptive management to create vireo habitat in areas within the BCP that are not currently suitable for either the vireo or the warbler. Since vireos occupy an earlier successional stage, actively managing to create vireo habitat may be a more realistic option in some areas than trying to restore

mature, closed canopy woodlands. This would also protect existing warbler habitat from conversion or fragmentation to create vireo habitat. Focal areas for vireo habitat management on City of Austin BCP lands currently include the Cortaña tract, Wild Basin/Vireo Preserve, the Bohls tract, and infrastructure corridors (Kent Butler Ecological Reserve). BCP staff is also evaluating areas with significant tree mortality from the 2011 drought for potential as future vireo habitat.

Maintenance of Recently Occupied Habitat – Cortaña

The Cortaña tract (709 hectares) in the North Lake Austin Macrosite has been under active management for over 15 years. In 1996, about 23 hectares of juniper-oak woodlands on the northern Cortaña tract and the adjacent, privately managed, River Place mitigation tract were cut back to establish a shrubby successional stage favorable to vireos. Approximately 15.8 hectares were treated on Cortaña and 7.3 hectares on River Place. Both hand-clearing and hydro-axing methods were applied. In each year from 2000 to 2011, one to five males had established territories in this area. No vireo established a territory on the Cortaña tract during the past two years.

During winter 2009-10, City of Austin staff created fire lanes in anticipation of a prescribed burn to enhance habitat on approximately 4.5 hectares of the Cortaña tract. However, burn bans and staffing limitations may make mechanical treatments more feasible than prescribed burns for future habitat revitalization.

Restoring and Creating Habitat – Wild Basin/Vireo Preserve

The Vireo Preserve and adjacent Wild Basin tract supported at least 32 vireo territories during the mid-1980s, making this the largest concentration of vireos known in Travis County. This area was once part of a larger ranch that was in the process of being cleared of brush in preparation for a cattle ranch and subsequently burned in April 1961 (Austin American-Statesman 1961, Respess 1987, Westlakehills undated). The wildfire was reportedly ignited by a cigarette tossed from a car along St. Stephens School Road, which started a grass fire. A strong cold front and the large piles of brush scattered throughout the ranch further fueled the fire, which burned for three days and spread over about 1,620 hectares. Although shrubs and many trees burned, pockets of mature Ashe juniper woodlands survived. The brush clearing followed by the 1961 wildfire converted what was formerly a closed-canopy Ashe juniper-oak woodland (preferred habitat of the warbler) to mostly open shrub land (preferred habitat of the vireo). Analysis of a decadal series of aerial photos of this area shows habitat succession progressing steadily since the 1961 fire (City of Austin et al. 2012). Assuming vireo habitat in western Travis County has a life-span of 20 to 30 years following intense manipulation, and warbler habitat takes at least 50 years to recover (BAT 1990), a decline of the vireo colony as the habitat matured toward a taller, more closed-canopy woodland would be expected during the 1980s-1990s. Complicating this issue, however, is the simultaneous increase in urbanization (including the building of Loop 360 and surrounding subdivisions) that occurred during this same time period. The last vireo observed nesting on the Wild Basin/Vireo Preserve (a 10-year-old male banded as an SY in 1987) was in 1996, 35 years after the 1961 fire.

The Wild Basin/Vireo Preserve collectively supports over 100 hectares of former vireo habitat (13% of the 810-hectare requirement). Habitat restoration efforts to date have included a prescribed burn on about 2.8 hectares (February 16, 2010), perimeter fencing (fall 2010), and mechanical manipulation of about 20 hectares (fall 2010 and 2011). The primary focus of these habitat restoration efforts has been to encourage resprouting of mature evergreen sumac and other broad-leaved species, protect regenerating plants from browse by white-tailed deer, create a more open habitat with a diverse height structure on the uplands, and protect the diversity of habitat types across Wild Basin/Vireo Preserve, including warbler habitat. Due to the 2011 drought and subsequent burn ban, City of Austin staff revised plans for 7.5 hectares of woody vegetation that had been cut with a tree shear in preparation for a prescribed burn. During the fall of 2011, the majority of the slash was mulched to assist with other habitat restoration efforts within the BCP. More details on these restoration efforts are presented in City of Austin (2010 and 2011).

Since Wild Basin/Vireo Preserve supports many of the habitat types observed throughout the BCP, is easily accessible, and offers the opportunity to partner with Travis County and St. Edwards University, it is an ideal site to experiment with habitat creation and restoration techniques. Lessons learned at this site should be applicable to other areas within the BCP. We are continuing adaptive management efforts to restore areas degraded by past land use (Bray 1904) by rebuilding soils, controlling erosion, and increasing diversity, with the goal of creating and enhancing endangered species habitat. Adaptive management includes using locally and commercially available materials (mulch, mulch socks, biochar, mycorrhizal fungi, soil amendments, native seed and plants) to help rebuild soils and promote regeneration of woody plants. Mulch is a common by-product of juniper-oak forest clearing and thus readily available for habitat restoration projects. Allowing mulch to age and "compost" contributes additional nutrients and micro-organisms. Biochar is a low temperature charcoal produced from the biomass of wood and leafy plant materials; it is a commercially produced soil amendment that increases plant growth yields by contributing carbon and increasing mycorrhizal fungi activity. Other soil amendments used to date include organic fertilizers, composts, and/or mycorrhizal fungi inoculants. Photographs showing examples of 2013 habitat restoration projects are presented in Figure C.

In conjunction with the habitat restoration work, St. Edwards University has been conducting three research projects: abundance, distribution, and diversity of ants in recently manipulated and non-manipulated areas; vegetation transects to monitor changes over time; and soil metagenomics to determine how microbial populations (bacteria, fungi) change in response to soil amendments. The University of Texas at Austin is also conducting a study to assess populations of native and imported fire ants within open areas on the BCP, including the Vireo Preserve.

Habitat Creation – Bohls

In an effort to create vireo habitat, City staff coordinated a combination of mechanical cutting followed by a prescribed burn on about 12 hectares of the Bohls tract. The mechanical clearing took place during the winter of 2003-04, in September 2005, and in February 2007, and the prescribed burn in February 2007. City of Austin staff continues to monitor habitat succession on this site, which has not yet been

occupied by vireos. Additional work is planned to expand the vireo habitat management area near the established shinnery, including either a prescribed burn or mechanical treatment.

Monitoring Effects of Habitat Management Efforts

Staff has established photo points and vegetation transects on the Bohls and Vireo Preserve tracts, and two locations on the Cortaña tract, in order to track changes to the habitat over time. Monitoring of these sites takes place before and after habitat manipulation events, and otherwise when feasible. BCP staff also collected data on species diversity, abundance, and cover for the mulch sock project at the Wild Basin/Vireo Preserve in February and August 2013.

Identifying Other Potential Management Sites

Travis County and City of Austin BCP staff are continuing work on a comprehensive plan to identify existing and potential sites for vireo habitat management. A GIS database has been developed to assess site characteristics and to locate suitable sites to restore or create vireo habitat. Data layers include geology, soils, topography, historic vireo sightings, and warbler observations. Travis County staff has been conducting spatial analyses to quantify warbler and vireo habitat using landcover maps and territory data. These analyses are being used to identify both priority warbler and vireo management areas. Other variables that are being considered in identifying sites for vireo management include size of the potential restoration area, history of occupation by vireos, proximity to the nearest vireo colony, proximity to urban development, and feasibility of management.

LITERATURE CITED

Abbruzzese, C. 1998. 1998 golden-cheeked warbler and black-capped vireo monitoring program, Balcones Canyonlands Preserve. City of Austin Parks and Recreation Department, Natural Resources Division. Austin, Texas.

Austin American-Statesman. 1961. Newspaper articles reporting Westlake fire, April 14-18. Austin, Texas.

Balcones Canyonlands Preserve. 2007. Land management plan, Tier IIA-8, black-capped vireo management. City of Austin and Travis County, Austin, Texas.

Biological Advisory Team. 1990. Comprehensive report of the Biological Advisory Team. Austin, Texas.

Becker, H. and D. Koehler. 2004. City of Austin 2004 golden-cheeked warbler *Dendroica chrysoparia* and black-capped vireo *Vireo atricapilla* monitoring program: Balcones Canyonlands Preserve annual report FY2003-04. City of Austin Water, Utility Wildland Conservation Division, Balcones Canyonlands Preserve program. Austin, Texas.

Bibby, C. J., N.D. Burges, and D.A. Hill. 1992. Bird Census Techniques. Academic Press. San Diego, California. 257pp.

Bray, W. 1904. The timber of the Edwards Plateau of Texas: its relation to climate, water supply, and soil. U.S. Department of Agriculture, Bureau of Forestry – Bulletin No. 49. Government Printing Office, Washington.

City of Austin. 2009. City of Austin 2009 golden-cheeked warbler *(Dendroica chrysoparia)* and black-capped vireo *(Vireo atricapilla)* monitoring program: Balcones Canyonlands Preserve annual report FY 2008-09. City of Austin Water Utility Wildland Conservation Division. Balcones Canyonlands Preserve. Austin, Texas.

——. 2010. City of Austin 2010 golden-cheeked warbler *(Dendroica chrysoparia)* and black-capped vireo *(Vireo atricapilla)* monitoring program: Balcones Canyonlands Preserve annual report FY 2009-10. City of Austin Water Utility Wildland Conservation Division. Balcones Canyonlands Preserve. Austin, Texas.

——. 2011. City of Austin 2011 golden-cheeked warbler *(Setophaga chrysoparia)* and black-capped vireo *(Vireo atricapilla)* monitoring program: Balcones Canyonlands Preserve annual report FY 2010-11. City of Austin Water Utility Wildland Conservation Division. Balcones Canyonlands Preserve. Austin, Texas.

——. 2012. City of Austin 2012 black-capped vireo (Vireo atricapilla) monitoring program: Balcones Canyonlands Preserve annual report FY 2011-12. City of Austin Water Utility Wildland Conservation Division. Balcones Canyonlands Preserve. Austin, Texas.

City of Austin, Travis County, and U.S. Forest Service. 2013. 2013 annual report: golden-cheeked warbler *(Setophaga chrysoparia)* monitoring program, Balcones Canyonlands Preserve. Prepared by City of Austin Water Utility Wildland Conservation Division, Travis County Department of Transportation and Natural Resources, U.S. Forest Service Northern Research Station, Department of Fisheries & Wildlife Sciences, University of Missouri. Balcones Canyonlands Preserve, Austin, Texas.

DLS Associates. 1969. Black-capped vireo monitoring program, Travis County, Texas and vicinity, 1989. Final report submitted to The Nature Conservancy of Texas, Inc. and the Executive Committee of the Balcones Canyonlands Habitat Conservation Plan. Austin, Texas.

DLS Associates. 1990. Black-capped vireo monitoring program, Travis County, Texas, 1990. Final report submitted to The Nature Conservancy of Texas, Inc. and the Executive Committee of the Balcones Canyonlands Habitat Conservation Plan Austin, Texas.

Grzybowski, J.A. 1989. Interim report: black-capped vireo investigations: population and nesting ecology. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

——. 1995. Black-capped vireo (Vireo atricapillus). *In* The Birds of North America, No. 181 (A. Poole and F. Gill, eds). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D. C.

International Bird Census Committee. 1970. An international standard for a mapping method in bird census work. Audubon Field Notes 24(6):722-726.

Respess, K. 1987. Notes toward a vegetational history of Wild Basin. Wild Basin, Austin, Texas.

Steed, D.. 1988. Black-capped vireo in Travis County, Texas. Technical Brief. July 1987. Revised 1988. DLS Associates. Austin, Texas.

U.S. Fish and Wildlife Service. 1987. Endangered and threatened wildlife and plants; determination of the black-capped vireo to be an endangered species. Federal Register 52(193):37420-37423.

——. 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.

Westlakehills. Undated. Fire history of the Westbank. Website article: http://www.westlakehills.org/FireSafety/documents/Fire%20History%20of%20the%20Westbank.pdf

V. FIGURES

Figure A: Locations of 2009 Black-capped Vireo Habitat Improvement, Kent Butler Ecological Reserve
(2009 aerial photography)

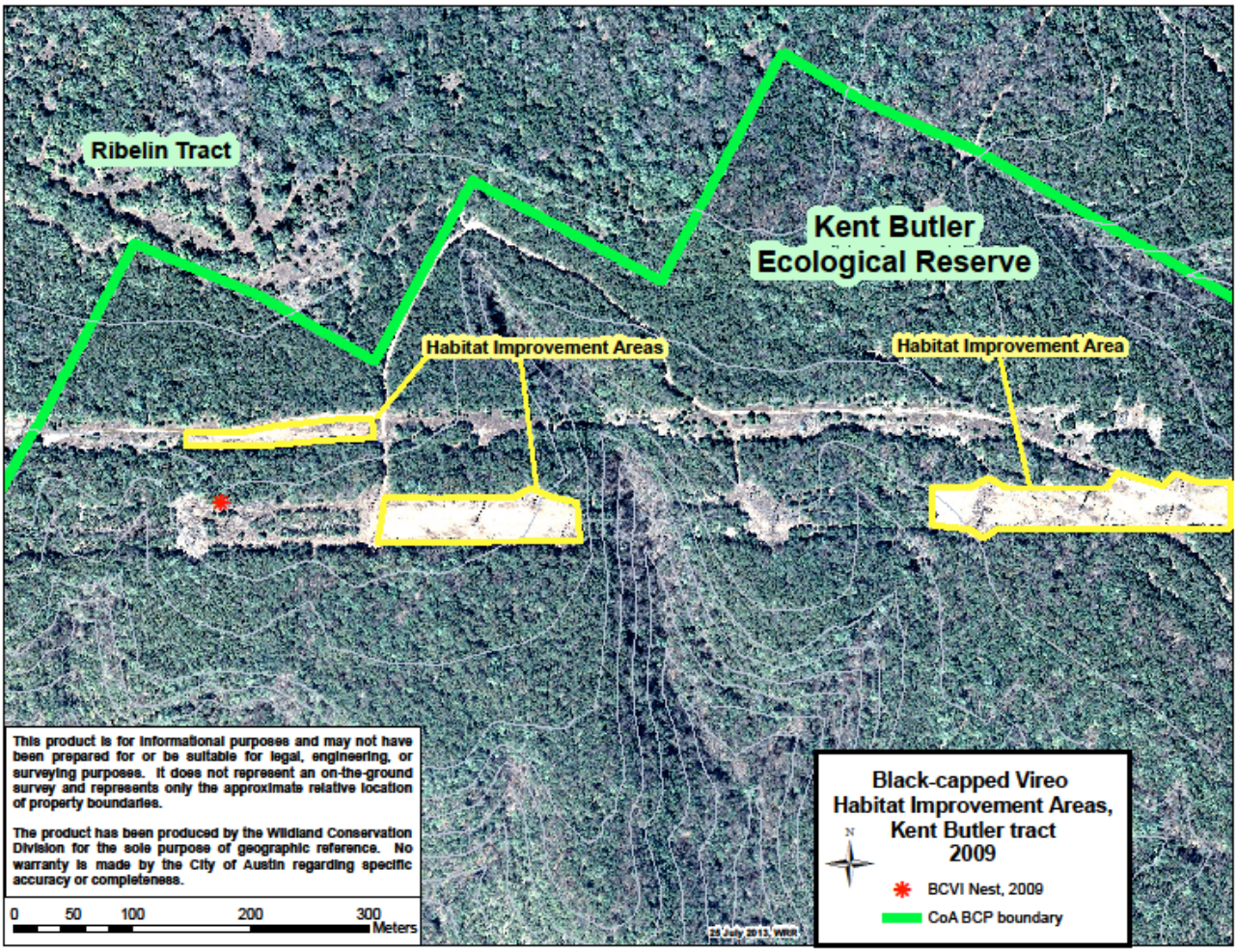


Figure B: Locations of Black-capped Vireos on Kent Butler Ecological Reserve, 2013
(2009 aerial photography)

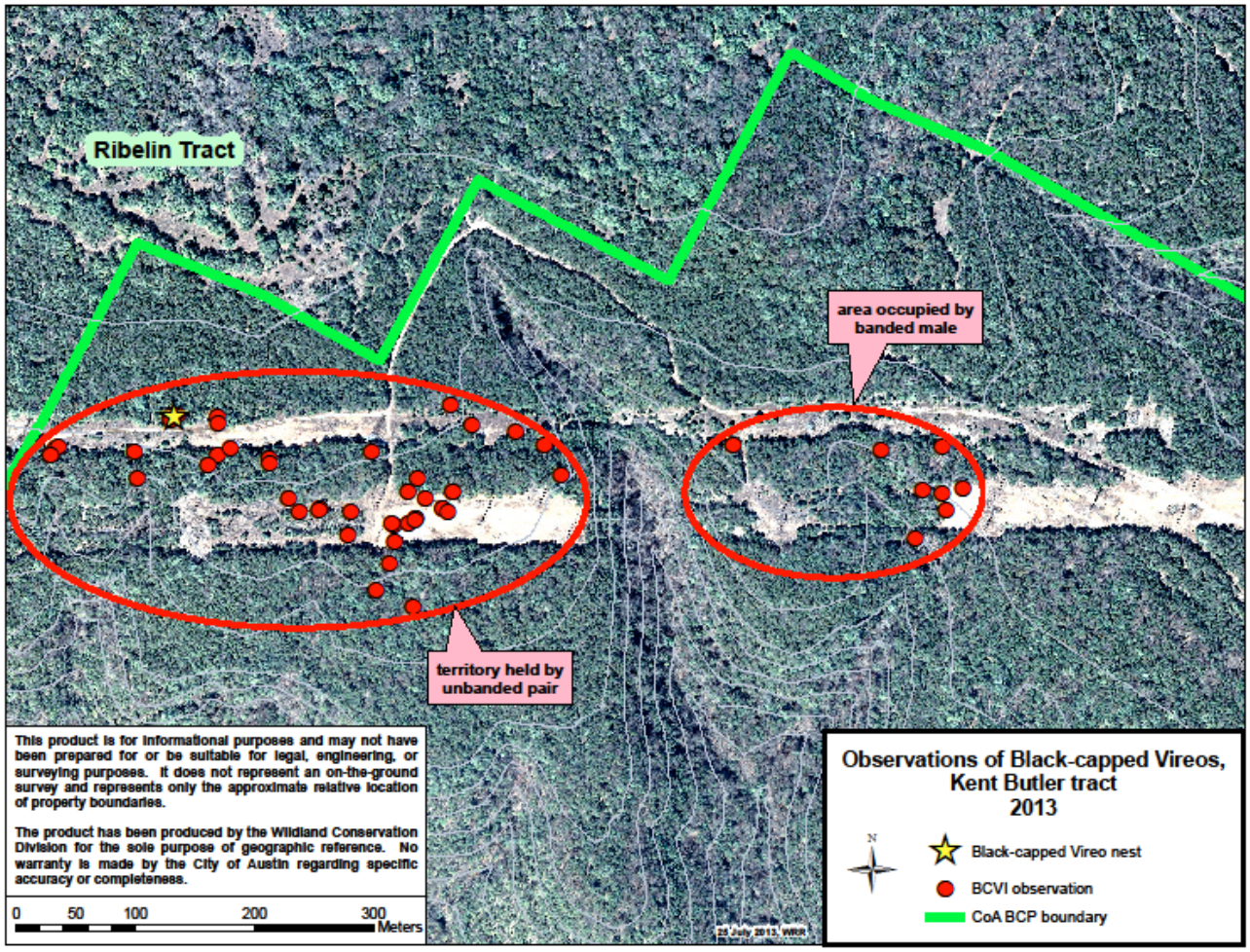


Figure C. Photos of Black-capped Vireo Habitat Restoration/Creation Projects at Wild Basin/Vireo Preserve, 2013



Black-capped Vireo Nesting Guild Project Area, Before Treatment



Black-capped Vireo Nesting Guild Project, Helping Hands, May 2013



Black-capped Vireo Nesting Guild Project, America YouthWorks, September 2013

Figure C. Photos of Black-capped Vireo Habitat Restoration/Creation Projects at Wild Basin/Vireo Preserve, FY 2013 (continued)



Erosion Control Project, Before Treatment



Erosion Control Project, March 2013



Erosion Control Project, October 2013

Figure C. Photos of Black-capped Vireo Habitat Restoration/Creation Projects at Wild Basin/Vireo Preserve, FY 2013 (continued)



Erosion Control Project, Before Treatment



Erosion Control Project, August 2013



Erosion Control Project, August 2013



Erosion Control Project, August 2013 (it's not a Black-capped Vireo, but the Eastern Phoebe really liked this project!)