United States Department of the Interior

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Memorandum

To: Regional Director, Region 2, Albuquerque, New Mexico

Through: Assistant Regional Director, Ecological Services, Region 2, Albuquerque, New Mexico

Through: Texas State Administrator, Austin, Texas

From: Field Supervisor, Austin Ecological Services Field Office, Austin, Texas

Subject: Biological Opinion for the Hays County Regional Habitat Conservation Plan – Permit TE-220793 (Consultation No. 21450-2010-F-0173)

Enclosed is the biological opinion for the proposed Hays County Regional Habitat Conservation Plan (RHCP) to avoid, minimize, and mitigate adverse effects to the endangered golden-cheeked warbler (*Dendroica chrysoparia*) and the endangered black-capped vireo (*Vireo atricapilla*) from activities described in the RHCP over a period of 30 years. We appreciate your staff's assistance throughout this consultation. If you have any questions regarding this biological opinion, please contact Luela Roberts at 512-490-0057, extension 222.

Attachment

TAKE PRIDE® IN AMERICA

This transmits our biological opinion for the issuance of a U.S. Fish and Wildlife Service (Service) 10(a)(1)(B) permit for the Hays County Regional Habitat Conservation Plan (RHCP) to minimize and mitigate, to the maximum extent practicable, adverse effects to the endangered golden-cheeked warbler (*Dendroica chrysoparia*) and the endangered black-capped vireo (*Vireo atricapilla*) from activities described in the RHCP over a period of 30 years. Both the golden-cheeked warbler and the black-capped vireo are listed as endangered pursuant to the Endangered Species Act of 1973, as amended (Act)(16 U.S.C. 1531 et seq.). The issuance of a Service permit to authorize incidental take associated with the proposed RHCP is pursuant to 10(a)(1)(B) of the Act and is the proposed action for this intra-Service consultation pursuant to section 7 of the Act.

Other species listed as threatened or endangered pursuant to the Act that may occur in Hays County are not provided incidental take coverage by the proposed permit. This includes eight listed species that occur in or are otherwise dependent on the Edwards and/or Trinity (Hill Country segment, hereafter referred to as the Trinity) Aquifers: the endangered Texas wild-rice (*Zizania texana*), Comal Springs dryopid beetle (*Stygoparnus comalensis*), Comal Springs riffle beetle (*Heterelmis comalensis*), fountain darter (*Etheostoma fonticola*), San Marcos gambusia (*Gambusia georgei*), Texas blind salamander (*Eurycea rathbuni*), Barton Springs salamander (*Eurycea sosorum*), and the threatened San Marcos salamander (*Eurycea nana*). Effects of the proposed action on Austin blind salamander (*Eurycea waterlooensis*), a candidate species under the Act, are anticipated to be similar to the effects to Barton Springs salamander as both species occupy the same habitat at Barton Springs pool. Incidental take coverage for these species must be accomplished independently of this proposed action.

Once known to occur in the action area, San Marcos gambusia were last successfully collected in 1982 (USFWS 1996) and all available information indicates that this species has been extirpated and no longer occurs in the wild. No captive populations exist that would enable re-establishment of wild populations. Therefore, the Service anticipates that San Marcos gambusia is not likely to occur in Hays County and is therefore not likely to be affected by the proposed action. This species and its designated critical habitat in Hays County will therefore not be discussed further in the following analysis.

The findings and recommendations in this consultation are based on the Hays County RHCP dated June 7, 2010; the accompanying Environmental Impact Statement (EIS) pursuant to the National Environmental Policy Act of 1969 dated June 7, 2010; recommendations provided by the Biological Advisory Team and the Citizens Advisory Committee pursuant to Subchapter B, Chapter 83 of the Texas Parks and Wildlife Code; and other sources of information available to the Service.

Consultation History

April 2005	Hays County Commissioner's Court approved a grant application for Federal funds for planning assistance in developing a Regional Habitat Conservation Plan pursuant to section 6 of the Act;
September 2005	The Service approved the grant application and awarded the Hays County with $753,750;

May 2006	Hays County negotiated an inter-local agreement with the Texas Parks and Wildlife Department (TPW) who administered the grant;
July 5, 2007 – November 13, 2008	Eleven (11) meetings conducted: Citizens Advisory Committee;
May 16, 2008	Publication in the *Federal Register* of a Notice of Intent (NOI) to prepare the EIS
June 4, 2008	Notices of the public scoping meeting were published in area newspapers, including The Daily Record, San Marcos, Texas and Hays County Free Press, Kyle, Texas
June 18, 2008	Public scoping meeting held in San Marcos, Texas
October 9, 2007 – November 18, 2008	Nine (9) meetings conducted: Biological Advisory Team;
March 31, 2009	Hays County submitted a Draft RHCP dated March 4, 2009, and the March 27, 2009, Preliminary Draft Environmental Impact Statement (PDEIS) to the Service;
April 2009 – October 2009	The Service provided review and comment on five drafts of the RHCP;
November 2, 2009	The Service posted a Notice of Availability of a Draft EIS (published October 30, 2009) and a notice of receipt of the draft RHCP, the public hearing, and the public comment period (published November 2, 2009)(74FR56194);
November 18, 2009	Public hearing, San Marcos, Texas;
February 1, 2010	Public comment period for the PDEIS closed;
February 11, 2010	Letter from the Environmental Protection Agency indicating no comment on the PDEIS or the RHCP.

Definitions

Habitat Conservation Plan – A Habitat Conservation Plan (HCP) accompanies a request for Service permit [pursuant to 10(a)(1)(B) of the Act] to take listed species while ensuring their long-term survival and enhancement. The purposes of the permit and accompanying HCP are to: (1) reduce conflicts between endangered or threatened species and economic activity, and (2) develop partnerships between the public and private sectors. Take authorized pursuant to a 10(a)(1)(B) permit is incidental to, and not the purpose of, the proposed activity.

Effect – The direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects

to determine the overall effects to the species for purposes of preparing a biological opinion on the proposed action [50 CFR §402.02].

Indirect Effect – Those effects that are caused by, or will result from, the proposed action and are later in time, but are still reasonably certain to occur [50 CFR §402.02].

Take – To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct [Act §3(19)]. *Harm* is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. *Harass* is also further defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering [50 CFR §17.3]

BIOLOGICAL OPINION

Proposed Action

For more specific information, please refer to the RHCP.

The proposed incidental take permit and accompanying RHCP are proposed to support incidental take authorization for County actions and provide a streamlined approach for private citizens, businesses, and other entities in Hays County to comply with the Act when their individual proposed projects may cause adverse effects to the species covered in the proposed RHCP. The proposed RHCP establishes a conservation program that minimizes and mitigates, to the maximum extent practicable, the adverse effects of authorized take of the golden-cheeked warbler and black-capped vireo in Hays County. The plan area for the proposed RHCP is Hays County (please see Figure 1-1 of the RHCP). For the purposes of this biological opinion, the action area includes the plan area and any area where RHCP implementation is expected to affect listed species or Critical Habitat.

Population growth in Hays County over the next few decades will drive a variety of new land development and infrastructure projects and result in other land use changes across the County. These anticipated land use changes will increasingly come into conflict with sensitive natural resources, including species listed pursuant to the Act. The proposed 30-year permit and accompanying RHCP will provide project proponents with a streamlined mechanism to comply with the Act. The RHCP is incorporated here by reference. The following is a summary of the RHCP:

Non-Federal activities covered by the RHCP include, but may not be limited to:

- the construction, use, and/or maintenance of public or private land development projects, including single- and multi-family homes, residential subdivisions, farm and ranch improvements, commercial or industrial projects, government offices, and park infrastructure;
- the construction, maintenance, and/or improvement of roads, bridges, and other transportation infrastructure;

- the installation and/or maintenance of utility infrastructure, including transmission or distribution lines and facilities related to electric, telecommunication, water, wastewater, petroleum or natural gas, and other utility products or services;
- the construction, use, maintenance, and/or expansion of schools, hospitals, corrections or justice facilities, and community service development or improvement projects;
- the construction, use, or maintenance of other public infrastructure and improvement projects (e.g., projects by municipalities, counties, school districts); and,
- any management activities that are necessary to manage potential habitat for the covered species within the RHCP preserve system that could temporarily result in incidental take.

Section 7 of the Act requires that all Federal agencies consult with the Service to ensure that the Federal actions authorized, funded, or carried out by such agencies do not jeopardize the continued existence of any threatened or endangered species or adversely modify or destroy designated critical habitat of such species. Projects that involve Federal agencies must complete section 7 consultation prior to execution of any proposed conservation measures that may include the use of the proposed RHCP.

Summary of RHCP Elements (*please see the Executive Summary of the RHCP and other sections as denoted*)

Category	Criteria/Amount	Notes
Environmental Baseline		
Potential golden-cheeked warbler habitat	170,355 acres	estimated from Loomis golden-cheeked warbler habitat model (all quality classes)(see Section 3.2.1.3 of the RHCP)
Potential black-capped vireo habitat	23,855 acres	estimate reported in Wilkins et al. (2006)(see Section 3.2.2.3 of the RHCP)
Projected Land Development		
Private-sector Projects	48,095 acres	estimated by TXP and CMR (2008)(see Section 4.2.2 of the RHCP) (TXP is an Austin-based economic analysis and public policy consulting firm and Capital Market Research (CMR) is an Austin-based market research firm specializing in real estate research, land development economics, and market analysis)

Summary of RHCP Elements (*please see the Executive Summary of the RHCP and other sections as denoted*)

Category	Criteria/Amount	Notes
Public-sector Projects	9,600 acres	estimated as 20% of projected private-sector development, based on current distribution of public tax exempt lands vs. residential and commercial lands (see Section 5.2 of the RHCP)
Estimated Habitat Loss/Impact		
Golden-cheeked warbler	22,000 acres	estimates based on projections of land development and distribution of potential habitat across census tracts (see Section 5.2 of the RHCP)
Black-capped vireo	3,300 acres	
Estimated RHCP Participation Rates		
Private-sector	33%	see Section 5.2.1 and Section 5.2.2 of the RHCP
Public-sector	75%	
Authorized Incidental Take		
Golden-cheeked warbler	9,000 acres	expressed as acres of impact to potential habitat; calculated from estimates of habitat loss and participation rates (see Section 5.2.1 and Section 5.2.2 of the RHCP)
Black-capped vireo	1,300 acres	
Preserve System Goal	10,000 to 15,000 acres	assumes preserves will include some areas of non-habitat (see Section 6.3.1 of the RHCP)
Minimum Preserve Block Size (typical)	500 acres	smaller preserves may be allowed with Service approval (see Section 6.3.1 of the RHCP)
Proposed Mitigation Credit Creation (typical)(must be commensurate with Service mitigation policy)		
Golden-cheeked warbler	1 acre of potential habitat = 1 mitigation credit	actual number of credits created by an acquisition determined by consultation with Service (see Section 6.3.2 of the RHCP)
Black-capped vireo	1 acre of dedicated management area = 1 mitigation credit	

Summary of RHCP Elements (*please see the Executive Summary of the RHCP and other sections as denoted*)

Category	Criteria/Amount	Notes
Standard Mitigation Ratios (must be commensurate with Service mitigation policy)		
Direct Impacts	1 acre of direct impact = purchase of 1 mitigation credit	assessed within project area boundaries where vegetation is physically altered by clearing or development or has a substantial change of use (see Section 7.4.3 and Section 7.4.4 of the RHCP)
Indirect Impacts	1 acre of indirect impact = purchase of 0.5 mitigation credit	assessed out to 300 feet from edge of direct impact and may extend outside of project area boundary; may also be assessed on isolated remnant patches of habitat (see Section 7.4.3 and Section 7.4.4 of the RHCP)
Participation Fees (as illustrated in the Funding Plan)		
Application Fees	$500 to $5,000 per application	actual fee depending on level of service required to process application (see Section 7.4.1 of the RHCP)
Mitigation Fees	$7,500 per mitigation credit	estimated starting fee; may be adjusted at discretion of County (see Section 8.2.2 of the RHCP)

Benefits of a Habitat Conservation Plan

By developing and implementing the proposed RHCP, the following anticipated benefits may occur, but may not be limited to:

- Supporting populations of golden-cheeked warblers and black-capped vireos in Hays County by protecting and managing habitat for these species in perpetuity;
- Local solutions to endangered species issues that incorporate stakeholder concerns and give long-term permitting assurances pursuant to the Act to the County and RHCP participants;
- New, voluntary options for compliance with the Act that would be available to private citizens, businesses, and other entities in Hays County. These new compliance options would reduce the time and cost associated with obtaining incidental take authorization pursuant to the Act;

- Coordinated long-term regional conservation planning to maximize conservation opportunities in a rapidly changing landscape;
- Long-term protection and management of natural resources vital to the health of the region's Hill Country ecosystems, including wildlife, woodlands, and water;
- Protection of open spaces that represent the rural tradition of Hays County and contribute to a high quality of life for all citizens; and,
- Compatibility with other Hays County initiatives to protect open spaces and provide nature-based recreational opportunities.

The proposed RHCP will also compliment other regional conservation efforts in central Texas. Several conservation plans or sustainability programs are under development or currently operating in the region, including the Balcones Canyonlands Conservation Plan in Travis County, the Williamson County RHCP, the Comal County RHCP (under development), the San Marcos River HCP (under development), the Barton Springs-Edwards Aquifer HCP (under development), the Southern Edwards Plateau RHCP (under development), and the Edwards Aquifer Recovery Implementation Program (under development). However, the operating areas or missions of these and other central Texas programs do not include incidental take authorization or long-term coordinated protection for the golden-cheeked warbler and black-capped vireo in Hays County. The proposed RHCP will complement and contribute to regional solutions for the conservation of natural resources.

Plan Area and Permit Duration

The plan area for the RHCP is the entire extent of Hays County, Texas (please see Figure 1-1 of the RHCP). Public or private entities conducting otherwise lawful activities within Hays County that may cause incidental take of the species covered by the RHCP may elect to participate in the RHCP to obtain authorization for incidental take of the covered species, as appropriate.

The term for the proposed incidental take permit associated with the RHCP is 30 years from the date of issuance. At the end of the permit term, Hays County will have the option of renewing the permit. Hays County will manage and maintain all lands acquired pursuant to the RHCP in perpetuity.

Description of the Action Area

Area Affected

The action area for terrestrial species considered in this opinion is defined as all golden-cheeked warbler and black-capped vireo habitat that occurs within Hays County (please see Figure 1-1 of the RHCP).

The action area for aquatic species considered in this opinion is defined as the contributing, recharge, and artesian zones of the Edwards and Trinity Aquifers that underlie golden-cheeked warbler and black-capped vireo habitat that occurs within Hays County and where RHCP implementation may affect listed species or Critical Habitat. Of particular concern are Fern Bank Springs, San Marcos Springs, and Barton Springs, and the associated lakes, rivers, and

caves that are an integral part of the larger aquifer ecosystems upon which the considered aquatic species rely (Figure 1).

Vegetation Description

Please refer to Section 2.2 of the RHCP for more detailed information regarding the vegetation types that occur in Hays County. **The following was excerpted from the RHCP. Please refer to the RHCP to locate specific references, as noted.**

The 2001 National Land Cover Dataset (a nation-wide land use and land cover map) identifies 15 different land cover types in Hays County, as shown on Figure 2-2. Forests, shrubland, and grasslands or crop fields are the dominant land cover types in the county. Forested areas cover approximately 42 percent of the county, shrubland vegetation covers approximately 30 percent of the county, and grasslands and crop fields cover approximately 21 percent of the county. The dataset identifies only slightly more than five percent of the county as developed land, associated primarily with the cities of San Marcos, Kyle, Buda, Wimberley, and Drippings Springs, and the Interstate Highway 35 and U.S. Highway 290 corridors. Table 2-1 lists the approximate acreage of each land cover type identified by the 2001 National Land Cover Dataset in Hays County.

Table 2-1. 2001 National Land Cover Dataset Land Use/Land Cover Classifications for Hays County.

Category	Approx. Area (acres)	Percent of County
Open Water	1,901	0.4%
Developed, Open Space	15,139	3.5%
Developed, Low Intensity	4,877	1.1%
Developed, Medium Intensity	2,358	0.5%
Developed, High Intensity	1,144	0.3%
Barren Land	486	0.1%
Deciduous Forest	51,339	11.8%
Evergreen Forest	132,510	30.5%
Mixed Forest	156	0.0%
Shrub/Scrub	130,693	30.1%
Herbaceous	75,983	17.5%
Hay/Pasture	5,131	1.2%
Cultivated Crops	10,512	2.4%
Woody Wetlands	2,086	0.5%
Emergent Herbaceous Wetlands	3	0.0%

The U.S. Geological Survey (USGS) identified changes between the 1992 and 2001 versions of the National Land Cover Dataset (USGS 2003). Between 1992 and 2001, Hays County lost approximately 14 percent of its forest cover, with approximately 81 percent of the lost forest cover converted to grassland/shrub cover and approximately 10 percent converted to urban cover (Table 2-2).

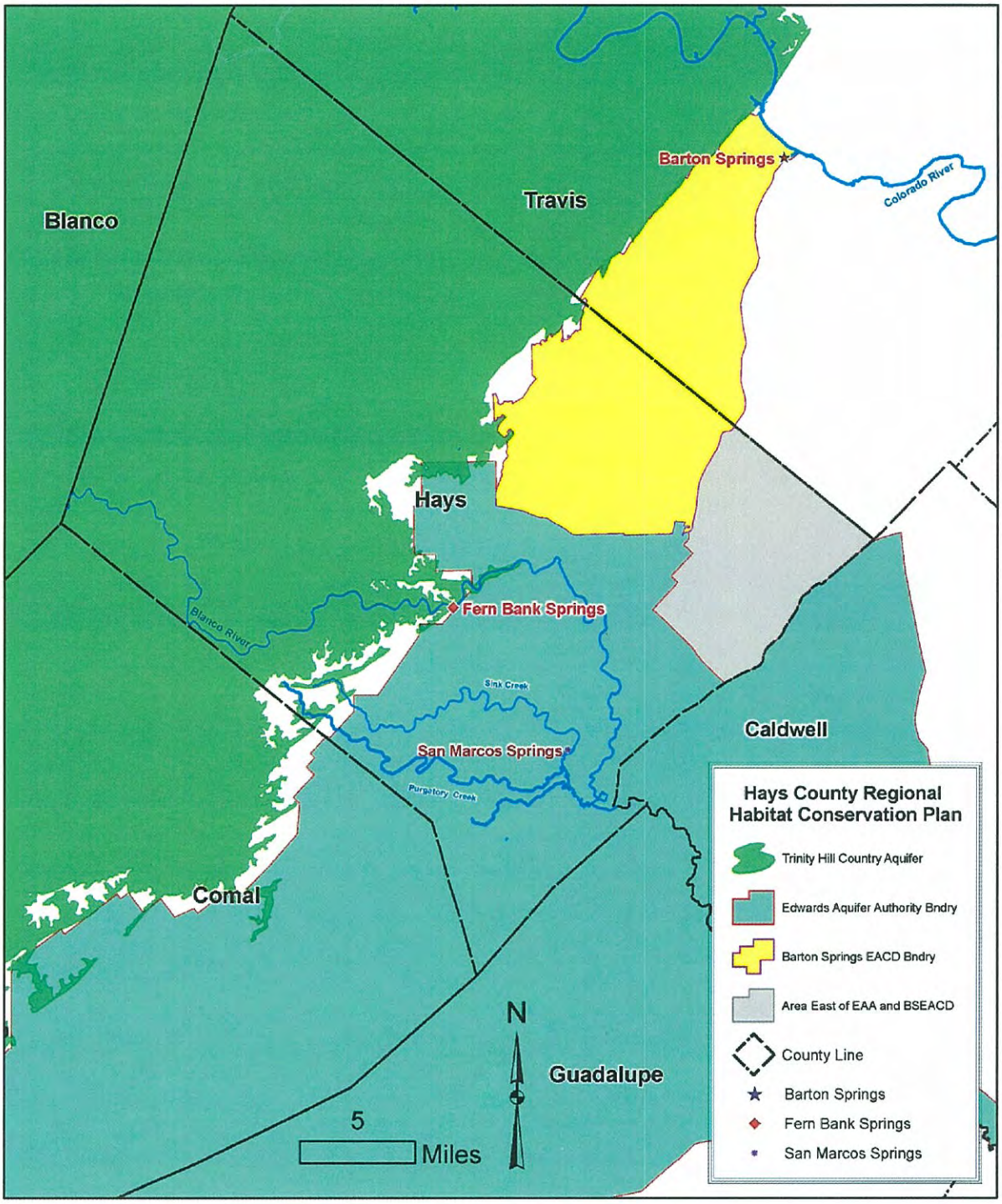


Figure 1. Springs and administratively defined aquifer boundaries associated with the Hays County RHCP.

Aquatic Resources

Segments of the Edwards and Trinity Aquifers are located beneath golden-cheeked warbler and black-capped vireo habitat throughout Hays County and provide the habitat for or are the source of the springflows required by the species considered in this analysis. These aquifers will likely provide the groundwater resources for domestic, commercial, agricultural, industrial, and other uses by those seeking to participate in the RHCP (e.g., landowners, developers, water districts). For a description of the aquifer segments within the permit area, please see Section 4.3 of the EIS.

The main effects considered here are the incremental adverse effects to the listed aquatic species and their designated critical habitats due to aquifer withdrawals and resulting decrease in springflows at San Marcos Springs and Barton Springs. Hydrogeologists have not resolved the source(s) that provide springflow to Fern Bank Springs. The Service's current understanding is that Fern Bank springflow may originate from the Trinity Aquifer, water from the recharge zone of the Edwards Aquifer, water associated from the Blanco River, or some combination of these sources (Veni 2006). Potential effects are expected to be more pronounced when aquifer levels are low because of drought or near-drought conditions.

Status of the species

Terrestrial species

Golden-cheeked warbler

Species Description and Life History

The golden-cheeked warbler was emergency listed as endangered on May 4, 1990 (55 FR 18844). The final rule listing the species was published on December 27, 1990 (55 FR 53160). No critical habitat is designated for this species. For more information, please refer to the 1992 *Golden-cheeked warbler Recovery Plan* (USFWS 1992).

The golden-cheeked warbler is a small, insectivorous songbird, 4.5 to 5 inches long with a wingspan of approximately 8 inches. Average breeding weight is 0.36 ounces for adult males and 0.33 ounces for adult females. Wings are black with two distinct white wing-bars. Males have a black back, throat, and cap, and yellow cheeks with a black eye strip. Females are similar, but duller overall in color (Ridgway 1902, Bent 1953, Griscom and Sprunt 1957, Pulich 1965, Oberholser 1974, Pulich 1976).

Golden-cheeked warblers breed exclusively in the mixed Ashe juniper/deciduous woodlands of the central Texas Hill Country west and north of the Balcones Fault (Pulich 1976). Golden-cheeked warblers require the shredding bark produced by mature Ashe junipers for nest material. Typical deciduous woody species include Texas oak (*Quercus buckleyi*), Lacey oak (*Q. glaucoides*), live oak (*Q. fusiformis*), Texas ash (*Frazinus texensis*), cedar elm (*Ulmus crassifolia*), hackberry (*Celtis occidentalis*), bigtooth maple (*Acer grandidentatum*), sycamore (*Platanus occidentalis*), Arizona walnut (*Juglans major*), and pecan (*Carya illinoinensis*)(Pulich 1976, Ladd 1985, Wahl et al. 1990). Breeding and nesting golden-cheeked warblers feed primarily on insects, spiders, and other arthropods found in Ashe junipers and associated deciduous tree species (Pulich 1976).

Male golden-cheeked warblers arrive in central Texas around March 1st and begin to establish breeding territories, which they defend against other males by singing from visible perches within their territories. Females arrive a few days later, but are more difficult to detect in the dense woodland habitat (Pulich 1976). Three to five eggs are generally incubated in April, and unless there is a second nesting attempt, nestlings fledge in May to early June (Pulich 1976). If there is a second nesting attempt, it is typically in mid-May with nestlings fledging in late June to early July (Pulich 1976). By late July, golden-cheeked warblers begin their migration south (Chapman 1907, Simmons 1924). Golden-cheeked warblers winter in the highland pine-oak woodlands of southern Mexico and northern Central America (Kroll 1980).

Historic and Current Distribution

The golden-cheeked warbler's entire breeding range occurs on the Edwards Plateau and Lampasas Cut Plain of central Texas. Golden-cheeked warblers are confirmed in 34 counties. However, many of the counties where it is known to occur, now or in the past, have only small amounts of suitable habitat (Pulich 1976, USFWS 1996, Lasley et. al. 1997). For the most recent estimate and comparison to previous estimates of golden-cheeked warbler habitat availability rangewide, see Diamond and True (2002).

Several State and federally-owned lands occur within the breeding range of the golden-cheeked warbler, but the overriding majority of the species' breeding range occurs on private lands that have been either occasionally or never surveyed (USFWS 1992). As a result, the population status for golden-cheeked warbler on private lands remains undocumented throughout major portions of the breeding range. Diamond (2007) estimated that the amount of suitable golden-cheeked warbler habitat across the species' range was approximately 4.2 million acres, much of this habitat occurring on private lands.

Travis County contains the greatest amount of golden-cheeked warbler habitat in large, contiguous blocks and lies at the center of the species' range (USFWS 1992). Bexar County also contains golden-cheeked warbler habitat, but the only remaining large blocks are associated with Government Canyon State Natural Area, Camp Bullis, and Indian Springs/Cibolo Canyon preserves. Other smaller areas in Bexar County that provide habitat include land owned and managed by the City of San Antonio Parks and Recreation Department, including Friedrich Wilderness Park, Crownridge, and Ironhorse.

Currently there are only four large golden-cheeked warbler populations receiving some degree of protection: those at the Balcones Canyonlands Preserve in Travis County; the nearby Balcones Canyonlands National Wildlife Refuge in Travis, Burnet, and Williamson counties; Camp Bullis Military Installation in Bexar County; and the Fort Hood Military Reservation in Coryell and Bell counties.

Reasons for Decline and Threats to Survival

Before 1990, the primary reason for golden-cheeked warbler habitat loss was juniper clearing to improve conditions for livestock grazing. Since then, habitat loss has occurred as suburban developments spread into prime golden-cheeked warbler habitat along the Balcones Escarpment. Golden-cheeked warbler populations are limited primarily by the amount and configuration of available habitat. A comparison of Pulich (1976) and Wahl et al. (1990) results in an estimate of

approximately 326,355 acres of potential habitat, or 35 percent, were lost from 1962-1990 and nesting territories declined approximately 25 percent during that same period (USFWS 1992).

Continued threats to golden-cheeked warblers include the clearing of deciduous oaks upon which the golden-cheeked warblers forage, oak wilt, nest parasitism by brown headed cowbirds (Engels and Sexton 1994), drought, fire, stress associated with migration, competition with other avian species, and particularly, loss of habitat from urbanization (Ladd and Gass 1999). Human activities have eliminated habitat within the central and northern parts of their respective ranges, particularly areas associated with the Austin and San Antonio metropolitan areas.

Populations of golden-cheeked warblers and other neotropical migrants are less stable in small habitat patches surrounded by urbanization (Coldren 1998, Engels 1995, Arnold et al. 1996, Bolger et al. 1997, Moses 1996). Some studies indicate that the abundance of several bird species, including golden-cheeked warblers, is reduced within 656-1640 feet of an urban edge (Engels 1995, Arnold et al. 1996, Bolger et al. 1997, Coldren 1998). Coldren (1998) reported that golden-cheeked warbler occupancy declined with increasing residential development and roadway width.

Range-wide Survival and Recovery Needs

The recovery strategy outlined in the Golden-cheeked Warbler Recovery Plan (USFWS 1992) divides the breeding range of the golden-cheeked warbler into eight regions, or units, and calls for the protection of sufficient habitat to support at least one self-sustaining population in each unit. These recovery units were delineated based primarily on watershed, vegetation, and geologic boundaries (USFWS 1992).

Based on the Golden-cheeked Warbler Recovery Plan (USFWS 1992), protection and management of occupied habitat and minimization of degradation, development, or environmental modification of unoccupied habitat necessary for buffering nesting habitat are necessary to provide for the survival of the species. Habitat protection must include elements of both breeding and non-breeding habitat (i.e., associated uplands and migration corridors). Efforts to create new and protect existing habitat will enhance the golden-cheeked warbler's ability to expand in distribution and numbers. Efforts to increase numbers of existing viable populations is critical to the survival and recovery of this species, particularly when rapidly expanding urbanization continues to result in the loss of prime breeding habitat.

Catastrophic fires within occupied habitats could result in the loss of significant portions of habitat and/or entire existing populations within each recovery unit. Efforts to control accidental fires should continue to be a priority to minimize the chance of significant loss of breeding golden-cheeked warblers and the habitat necessary to allow for expansion of distribution and numbers of golden-cheeked warblers.

According to the Golden-cheeked Warbler Population and Habitat Viability Assessment Report (USFWS 1996)(Golden-cheeked warbler PHVA) only a few counties (e.g., Bexar, Travis, Bell, Coryell) have been intensively studied in a manner that produces confident assessments. To better assess the status of the golden-cheeked warbler, formal surveys need to be conducted across its range. However, access to private lands to conduct formal surveys continues to be difficult to obtain.

Population viability assessments on golden-cheeked warblers have indicated the most sensitive factors affecting their continued existence are population size per patch, fecundity (productivity or number of young per adult), and fledgling survival (USFWS 1996, Alldredge et al. 2002). These assessments estimated a minimum of 32,500 acres of prime unfragmented habitat must be preserved to reduce the possibility of extinction of a warbler population to less than five percent over 100 years (USFWS 1996). This acreage is estimated to provide the carrying capacity for a population of 3,000 breeding pairs. Further, this minimum carrying capacity threshold estimate increases with poorer quality habitat (e.g., patchy habitat resulting from urbanization).

Black-capped vireo

For more specific information regarding the black-capped vireo, please refer to the *Black-capped Vireo Recovery Plan* (Service 1991) and the *Black-capped Vireo 5-year Review: Summary and Evaluation* (Service 2007).

Species Description and Life History

The black-capped vireo was federally listed as endangered in 1987 (52 FR 37420-37423). No critical habitat has been designated for this species.

The black-capped vireo is a 4.5 inch (11.4 centimeter) long, insectivorous songbird. Mature males are olive green above and white below with faint greenish-yellow flanks. The crown and upper half of the head are black with a conspicuous white eye-ring. The iris is brownish-red and the beak is black. Mature females are generally duller in color than the males, and have a dark slate gray head (Service 1991).

Although black-capped vireo habitat throughout Texas is quite variable with respect to plant species, soils, and rainfall, habitat types generally have a similar overall appearance. Black-capped vireos typically inhabit patchy shrublands and open woodlands with a distinctive patchy structure. The shrub vegetation generally extends from the ground to about six feet (1.8 meters) above ground and covers about 30 to 60 percent of the total area. In the Edwards Plateau, common plants in black-capped vireo habitat include Texas oak, shin oak (*Q. sinuata*), live oak, mountain laurel (*Sophora secundiflora*), sumacre(*Rhus*. sp), redbud (*Cercis canadensis* var. *texana*), Texas persimmon (*Diospyros texana*), mesquite (*Prosopis glandulosa*), and agarita (*Mahonia trifoliata*). Densities of Ashe juniper are usually low. In the Edwards Plateau, suitable habitat for the black-capped vireo is early successional scrub/shrub created by fire or woodland clearing. Black-capped vireos are opportunistic foragers, however, they prefer insect larvae and seeds (Grzybowski 1995).

Male black-capped vireos arrive in central Texas in late March and begin to establish breeding territories, which they defend against other males by singing within their territories. The females arrive a few days later, but are more difficult to detect in the dense brushy habitat. Three to four eggs are generally incubated in April, and unless there is a second nesting attempt, nestlings fledge in May to early June. In mid-July, black-capped vireos begin their migration south, beginning with females and young and followed by adult males (TPWD 2002, Graber 1957, Oberholser 1974). Typically, black-capped vireos are gone from Texas by mid-September.

Historic and Current Distribution

Black-capped vireos breed from Oklahoma south through central Texas to the Edwards Plateau, then south and west to central Coahuila, Nuevo Leon, and southwestern Tamaulipas, Mexico and they winter on the Pacific slope of Mexico. Populations have been extirpated in Kansas and have been reduced in Oklahoma, suggesting habitat loss and parasitism may be particularly prevalent in that part of the species' range (Grzybowski 1995, Wilkins et al. 2006).

Wilkins et al. 2006, estimated that in 2005, the known U.S. population of black-capped vireos was approximately 6,000 males, a marked increase since its listing. It is unknown whether estimated population numbers have increased due to increased survey efforts, increased habitat due to habitat management efforts, or some combination of both.

Current efforts to monitor black-capped vireo populations in Texas occur on properties owned and/or managed by the Department of the Defense's Camp Bullis and Ft. Hood, Travis County and the City of Austin's Balcones Canyonlands Preserve, the Service's Balcones Canyonlands National Wildlife Refuge (BCNWR), Texas Parks and Wildlife Department's Kerr Wildlife Management Area (Kerr WMA), and properties owned and/or managed by the The Nature Conservancy Texas and Mexico. Approximately 75 percent of the known population is located on the Kerr WMA and Ft. Hood (both in Texas), and on the Wichita Mountains NWR and Ft. Sill (both in Oklahoma)(Wilkins et al. 2006). Many efforts are underway to assist landowners in determining the status of black-capped vireos on their property and to educate landowners on the implementation of management strategies beneficial to the black-capped vireo. Fully understanding the current distribution of the black-capped vireo in Texas largely depends on the data collected through these various efforts.

Reasons for Decline and Threats to Survival

Threats to the black-capped vireo include habitat loss, fragmentation, and degradation due to development, vegetational succession, poor grazing practices, and brown-headed cowbird parasitism. A complete summary of the threats to the species can be found in Federal Register 52: 37420-37423 and updated in the Service's 5-year review (Service 2007).

Range-wide Survival and Recovery Needs

The Black-capped Vireo Recovery Plan includes the criteria that there is a viable vireo population in four of the six Texas regions delineated therein, and one each in Oklahoma and Mexico (Service 1991). The recovery strategy divides the breeding range of the black-capped vireo into six regions for Texas delineated based primarily on physiographic boundaries.

Based on the Black-capped Vireo Recovery Plan, protection and management of occupied habitat and minimization of further degradation, development, or environmental modification of unoccupied habitat are necessary to provide for the survival of the species. Habitat protection must include elements of both breeding and non-breeding habitat (i.e., associated uplands and migration corridors). Efforts to create new, and protect existing, habitat will enhance the black-capped vireo's ability to expand in distribution and numbers. Efforts to increase numbers of existing viable populations are critical to the survival and recovery of this species, particularly when rapidly expanding urbanization continues to result in the loss of prime breeding habitat. Due to the nature of early successional shrub growth preferred by black-capped vireos, fire

should be used to manage, enhance, and create black-capped vireo breeding habitat, as appropriate.

Aquatic species

Eight listed aquatic species occur within the proposed action area. Common to each of these species are adaptations to the consistent flows from the aquifer systems upon which they depend. The unique endemic fauna associated with these springs systems are adapted to narrow ranges of variation in water quantity and quality, such as temperature and dissolved oxygen.

The primary threat to each of these species is a decrease in water quantity and quality. Other threats include effects resulting from physical alteration of the habitats where they are found, recreational use of the San Marcos River, non-native species, and catastrophic hazardous material spills.

Texas wild-rice

For more information, please refer to the *San Marcos/Comal (Revised) Recovery Plan* (USFWS 1996).

Species Description and Life History

Texas wild-rice was listed as endangered on April 26, 1978 (43 FR 17910). Texas wild-rice is an aquatic, monoecious (pistillate and staminate flowers are on the same plant), perennial grass, which is generally 3.3 to 6.6 feet (1-2 meters) long and usually immersed and prostrate in the swift-flowing water of the San Marcos River. When flowering, the inflorescence and the upper culms and leaves emerge above the water surface. In slow moving waters, Texas wild-rice function as annuals, exhibiting less robust vegetative growth, then flowering, setting seed, and dying within a single season.

Critical habitat was designated for this species on July 14, 1980, and consists of Spring Lake and its outflow and the San Marcos River downstream to the confluence with the Blanco River (USFWS 1980). The Texas wild-rice critical habitat designation emphasizes the vulnerability of the species due to its limited range, narrow tolerance for flow and water quality fluctuations, alterations of Spring Lake or the San Marcos River, and physical disturbance to stands of the species (USFWS 1980)

Texas wild-rice forms large stands in the San Marcos River at depths from 0.76 to 3.3 feet (0.23 to 1.0 meter). The species requires clear, relatively cool, thermally constant (approximately 72°F [22°C]) flowing water. Texas wild-rice prefers gravel and sand substrates overlaying Crawford black silt and clay (Poole and Bowles 1999, Saunders et al. 2001; Vaughan 1986).

Spring flow and San Marcos River discharge are critically important for growth and survival of Texas wild-rice (Saunders et al. 2001). Texas wild-rice relies on carbon dioxide as its inorganic carbon source for photosynthesis rather than the more commonly available bicarbonate used by most other aquatic plants (TPWD 1994; Seal and Ellis 1997). Edwards Aquifer water contains relatively high levels of carbon dioxide. Because carbon dioxide diffuses very slowly in water, it is only readily available near spring openings and in relatively fast-moving waters that transport the dissolved gas downstream. Low flow situations can be carbon limiting for carbon dioxide-using obligates including Texas wild-rice.

Reproduction of Texas wild-rice occurs either asexually (clonally) through stolons or sexually via seeds. Asexual reproduction occurs where shoots arise as clones at the ends of rooting stolons (Emery and Guy 1979). Clonal reproduction appears to be the primary mechanism for expansion of established stands, but does not appear to be an efficient mechanism for dispersal and colonization of new areas. Texas wild-rice tillers have, however, been observed floating downstream and some of these tillers may become established plants; but only if lodged in suitable substrate and physical habitat. Seed production is therefore believed to be essential for dispersal and establishment of new stands of Texas wild-rice (USFWS 1996).

Sexual reproduction occurs when wind pollinated florets produce seed. This typically takes place in late spring through fall, though flowering and seed set may occur at other times in warm years (USFWS 1996). Triggers for flowering are not well understood. Texas wild-rice seed is not long-lived, and viability begins to drop markedly within one year of production. No appreciable seed bank is therefore expected.

Historic and Current Distribution

Texas wild-rice was first collected in the San Marcos River in 1892 (USFWS 1996). When the species was originally described in 1933, it was reported to be abundant in the San Marcos River, including Spring Lake and its irrigation waterways (Silveus 1933, Terrell et al. 1978). By 1967 Emery found only one plant in Spring Lake, none in the uppermost 0.5 mile (0.8 kilometers) of the San Marcos River, only scattered plants in the lower 1.5 miles (2.4 kilometers), and none downstream (Emery 1967). Beaty reported about 2,580 square feet (240 square meters) of coverage, though the survey methodology used is not known (1975).

In 1976 Emery again checked abundance of Texas wild-rice and calculated 12,161 square feet (1,131 square meters) in the San Marcos River, primarily concentrated in the extreme upper and lower segments of the area known as the upper San Marcos River (Emery 1977). He found no plants in Spring Lake. Subsequent data were gathered by Vaughan (1986) for several years (1984-1986) and overall areal coverage in 1986 was 4,881 square feet (454 square meters).

The Texas Parks and Wildlife Department has monitored area coverage since June 1989, and coverage has ranged from 10,810 square feet (1,004 square meters) to 46,050 square feet (4,278 square meters). Texas wild-rice only occurs today in the upper two miles (three kilometers) of the San Marcos River above the confluence with the Blanco River (Poole and Bowles 1999).

Reasons for Decline and Threats to Survival

Reduced flow of water from the springs is the greatest threat to the survival of Texas wild-rice. Other threats include water quality degradation, physical alteration of Spring Lake or the San Marcos River, and physical disturbance of the species (USFWS 1980). Non-native species have also been implicated as a threat to the species.

Texas wild-rice is adapted to conditions of clear water, uniform annual flow rate, and constant year-round temperature (Beaty 1975). Low springflows and resulting reduced San Marcos River flows can cause adverse effects to Texas wild-rice and designated critical habitat (USFWS 1996). Drought conditions can adversely affect Texas wild-rice by reducing flows or dewatering portions of the river. Drought conditions in 1996 killed Texas wild-rice stands known from TPWD monitoring efforts when portions of the river were dewatered. Low flows during this

period also allowed floating mats of vegetation fragments (which normally move slowly downriver) to become lodged in wild-rice leaves that were near the surface. This shaded, and may have mechanically damaged, plants and is thought to have interfered with culm emergence thereby interfering with sexual reproduction (Power 1996, 2002, Poole 2006).

Decreased flows can leave Texas wild-rice more susceptible to increased herbivory by waterfowl and non-native nutria and ramshorn snails (Rose and Power 1992). Altered flow conditions may also result in competitive advantages for non-native plants when conditions are sub-optimal for Texas wild-rice.

Physical alteration of Spring Lake and the San Marcos River are also considered threats to the species. Power (1996) found that substrate composition and current velocity affect plant biomass and stem density and argued that population declines can be partially attributed to changes in habitat that have occurred through urbanization and impoundment.

An additional concern is recreational use of the river, which has been shown to have measurable adverse effects on Texas wild-rice (Breslin 1997). Breslin (1997) details the relative impacts of various activities to Texas wild-rice, and Bradsby (1994) discusses the relative quantity of use of the river during different levels of flow. These studies did not, however, quantify effects to the species at various discharge levels. As discharge decreases, a greater percentage of the plants are presumably exposed to recreational users, increasing the potential for adverse effects. Negative effects are thought to increase during low flows because shallow areas leave Texas wild-rice leaves on or near the river surface and therefore more exposed to physical disturbance. Recreational use of the river has also been postulated to interfere with flowering and seed set (USFWS 1996). In September 2006, a significant loss of Texas wild-rice was recorded due to vandalism (Poole 2006).

Range-wide Survival and Recovery Needs

There are numerous actions listed in the Recovery Plan regarding specific recovery efforts. These include ensuring adequate flows and water quality in Spring Lake and the San Marcos River; maintenance of genetically diverse reproductive populations in captivity and creation of reintroduction techniques for use in the event of a catastrophic event; removal or reduction of threats due to non-native species, recreational use of the river, and habitat alteration; and maintenance of healthy, self-sustaining, reproductive populations in the wild. Please refer to the Recovery Plan for additional details and priority actions prescribed for recovery (USFWS 1996). The entire wild population of Texas wild-rice and all designated critical habitat are located within the action area and may be affected by the proposed action.

Comal Springs dryopid beetle

Species Description and Life History

The Comal Springs dryopid beetle was listed as endangered under the Act on December 18, 1997 (USFWS1997) and critical habitat was designated for the species at Comal Springs in Comal County, Texas, and at Fern Bank Springs in Hays County, Texas, on July 17, 2007 (USFWS 2007). Fern Bank Springs is located approximately 0.2 miles (0.4 kilometers) east of the junction of the Blanco River and Sycamore Creek. The spring system consists of a main outlet and a number of small springs that issue forth from a steep cliff overlooking the Blanco River.

Fern Bank Springs is located on privately-owned land in a predominately rural landscape that is today relatively unaffected by urban activities. Designated critical habitat for the Comal Springs dryopid beetle at Fern Bank Springs in Hays County is described as "aquatic habitat and land areas that are within a 50-foot (15.2-meter) distance from spring outlets, including the main outlet of Fern Bank Springs and its associated seep springs" (USFWS 2007).

The Comal Springs dryopid beetle is the only known hypogean- (subterranean) adapted member of the family Dryopidae. Barr and Spangler (1992) described this genus and species based on its unique morphological distinctions including vestigial eyes and wings. Adult beetles are elongate (0.12-0.16 inches, 3-4 mm), parallel-sided and slender, head retractile, with cuticle (skin) coloration reddish-brown and translucent (Barr and Spangler 1992). Larvae are elongate, cylindrical, and yellowish-brown in color (Barr and Spangler 1992). Mature larvae are approximately 0.24 to 0.31 inches (6-8 mm) long.

Little is known about the biology and specific microhabitat preferences of the Comal Springs dryopid beetle. Larvae in the family Dryopidae do not have gills and are considered terrestrial, inhabiting moist soil along stream banks, presumably feeding on roots and decaying vegetation (Brown 1987, Ulrich 1986). Vestigial eyes indicate adaptation to subterranean habitats. Barr and Spangler (1992) presumed the microhabitat for the Comal Springs dryopid beetle to be soil, roots, and debris exposed above the waterline on the ceilings of spring orifices. Larval development is unknown for this species.

Adult Comal Springs dryopid beetles are not capable of swimming, move relatively slowly, and respire through a plastron (gas film produced by area of dense water repelling hairs) which limits them to habitats with high dissolved oxygen (Brown 1987, Resh et al. 2008). Some wild caught adult specimens have survived in captivity 11-21 months (Barr and Spangler 1992, Fries et al. 2004), but lifespan of this species is unknown.

Dryopid adults typically feed on biofilm (microorganisms and debris) scraped from surfaces such as rocks, wood, and vegetation (Brown 1987). Potential food sources may include detritus (decomposed materials), leaf litter, and decaying roots. However, it is possible that this species may feed on bacteria and fungi associated with decaying plant material (Gibson 2006).

Historic and Current Distribution

Comal Springs dryopid beetles were first collected at Comal Springs in Comal County, in 1987 (USFWS 1996). Barr collected specimens at additional spring runs at Comal Springs and at Fern Bank Springs in Hays County in the summer of 1992 (Barr 1993). Representatives of this species have been collected only once at Fern Bank Springs since 2003, when a single Comal Springs dryopid beetle larva was picked up after 305 hours of sampling spring orifices with drift nets (Gibson et al., 2008). Collections during 2003 to 2009 extended the known range of the beetle within the Comal Springs system to all major spring runs, seeps along the western shoreline of Landa Lake, upwellings within the lake, primarily in the Spring Island area, and Panther Canyon Well, all located in Comal County (EAA 2003, EAA 2004, Fries et al. 2004, EAA 2005, EAA 2006, Gibson et al. 2008). The extent of the subterranean range of the species is unknown, though it has been suggested that Comal Springs dryopid beetles may be confined to small areas surrounding spring openings (Barr 1993, USFWS 1997).

Reasons for Decline and Threats to Survival

The leading threat to the Comal Springs dryopid beetle has been described as the reduction or loss of water quantity and quality due primarily to human water withdrawals from the Southern Segment of the Edwards Aquifer (USFWS 1997). In Hays County, the species is known only from Fern Bank Springs, for which source water has yet to be determined. Fern Bank may derive its flows from the Glen Rose formation of the Trinity Aquifer, from drainage associated with the Edwards Aquifer recharge zone, or from the Blanco River (Veni 2006).

The Comal Springs dryopid beetle population in Hays County may be placed at risk by drought conditions or excessive groundwater pumping in the Edwards or Trinity Aquifers that provide the flows at Fern Bank Springs (Mace et al. 2000, USFWS 2007). Fern Bank Springs discharge is not gaged and has only been estimated intermittently. Brune (1981) reported Fern Bank springflow discharge of 4.9 CFS on May 31, 1975, and 0.3 CFS on May 1, 1978. Although no data is available, the elevation of Fern Bank Springs relative to other springs suggests that it may have ceased flowing in the past (USFWS 2007).

Range-wide Survival and Recovery Needs

The Comal Springs dryopid beetle relies on physical and biological factors including high-quality water with no occurrence or minimal levels of pollutants such as soaps, detergents, heavy metals, pesticides, fertilizer nutrients, petroleum hydrocarbons, and semi-volatile compounds such as industrial cleaning agents; low salinity with total dissolved solids that generally range from 307 to 368 mg/L and turbidity of less than 5 nephelometric turbidity units (NTUs); aquifer water temperatures that range from about 68° to 75.2°F (20 to 24 C); a hydrologic regime that allows spring flows to maintain dissolved oxygen levels to range from 4.0 to 10.0 milligrams/liter; and a food supply that includes, but is not limited to, detritus (decomposed materials), leaf litter, and decaying roots (USFWS 2007).

Comal Springs dryopid beetles at and designated critical habitat at Fern Bank Springs may be affected by the proposed action. The Comal Springs dryopid beetle populations and designated critical habitats associated with Comal Springs, Landa Lake, and various wells in Comal County are outside the action area and are therefore not likely to be affected by the proposed action.

Comal Springs riffle beetle

Species Description and Life History

The Comal Springs riffle beetle was listed as endangered on December 18, 1997 (USFWS 1997). Critical habitat was designated on July 17, 2007 in both Comal Springs in Comal County and San Marcos Springs in Hays County, Texas (USFWS 2007). The designated critical habitat within Hays County is composed of Spring Lake aquatic habitat areas upstream of Spring Lake dam, with the exception of the slough portion of the lake upstream of its confluence with the main body (USFWS 2007).

The Comal Springs riffle beetle is a small, aquatic beetle known from Comal Springs in Comal County, Texas and San Marcos Springs in Hays County. Examples of this species were first collected by Bosse in 1976 and described in 1988 (Bosse et al. 1988). Adult Comal Springs riffle beetles are reddish-brown in color, range in length from 0.067 to 0.83 inches (1.7 – 2.1

mm). Females are slightly larger than males (Bosse et al. 1988). The sides of the body are approximately parallel and the entire dorsal surface is coated with fine golden-colored setae (hairs)(Bosse et al. 1988). The hind wings of Comal Springs riffle beetles are short and non-functional (Bosse et al. 1988) and the species is incapable of flying. Larval Comal Springs riffle beetles are elongate, tubular in cross-section and light tan in color. The Comal Springs riffle beetle pupa is pale in color and legs and wing pads project loosely from the body.

The Comal Springs riffle beetle is an epigean (surface-dwelling) species that inhabits gravel and cobble substrates (Bowles et al. 2003). Food sources include, but are not limited to, detritus, leaf litter, and decaying roots. The little known of their life history and habitat preferences is summarized in Bowles et al. (2003). BIO-WEST (2006) reported that riffle beetles may take six months to three years to complete their life cycle from egg, to larvae, to adult. Bowles et al. (2003) indicated that Comal Springs riffle beetles appear to have overlapping and asynchronous generations in Comal Springs and may be associated with aquatic vegetation. Larval and adult populations reach their greatest densities in late fall through winter, but all life stages can be found throughout the year (Bowles et al. 2003).

Historic and Current Distribution

Comal Springs riffle beetle is known from two localities, Comal Springs in Comal County, and San Marcos Springs in Hays County (USFWS 2007). Comal Springs riffle beetle was first described from Comal springs (Bosse et al. 1988). Barr found a single Comal Springs riffle beetle in the impounded headwaters of San Marcos Springs known as Spring Lake (Barr 1993). This record was long thought by many to be in error, but Gibson et al. (2008) later collected Comal Springs riffle beetles from the marginal springs and from upwellings in Spring Lake using cotton-cloth lures. Gibson et al. (2008) found adults and larvae were well represented in their samples, indicating the presence of a reproducing population. The Comal Springs riffle beetle is not known from any other locations.

Reasons for Decline and Threats to Survival

Threats to Comal Springs riffle beetles are described in the final rule for its listing (USFWS 1997) and the designation of critical habitat (USFWS 2007). The primary threat to this species is a decrease in water quantity and quality as a result of water withdrawal and other human activities throughout the Southern Segment of the Edwards Aquifer. Stagnation of water and/or drying within the spring runs and the photic (lighted) zone of the spring orifices would probably be limiting for the riffle beetle, which depends on natural spring flows for respiration and survival (Chapman 1982).

Range-wide Survival and Recovery Needs

The Comal Springs riffle beetle relies on physical and biological factors, including high-quality water with no occurrence or minimal levels of pollutants such as soaps, detergents, heavy metals, pesticides, fertilizer nutrients, petroleum hydrocarbons, and semi-volatile compounds such as industrial cleaning agents; low salinity with total dissolved solids that generally range from 307 to 368 mg/L and turbidity less than 5 NTUs; aquifer water temperatures that range from about 20 to 24°C; a hydrologic regime that allows spring flows to maintain dissolved oxygen levels to range from 4.0 to 10.0 milligrams/liter; a food supply that includes, but is not limited to, detritus

, leaf litter, and decaying roots: and bottom substrates composed of gravel and cobble between 0.3 and 5.0 inches (8 to 128 mm) in size that is free of sand silt (USFWS 2007).
Comal Springs riffle beetle populations and designated critical habitat associated with Spring Lake are located within the action area and may be affected by the proposed action. The populations and designated critical habitat in Comal County are outside the action area and therefore not likely to be affected by the proposed action.

Fountain darter

For more information, please refer to the *San Marcos/Comal (Revised) Recovery Plan* (USFWS 1996).

Species Description and Life History

The fountain darter was listed as endangered on October 13, 1970 (USFWS 1970), and critical habitat was designated on July 14, 1980 (USFWS 1980). The designated critical habitat is described as "Texas, Hays County; Spring Lake and its outflow, the San Marcos River, downstream approximately 0.5 miles below Interstate Highway 35 Bridge." The fountain darter populations in Comal Springs, Landa Lake, and associated with the Comal River are outside the action area and are not likely to be affected by the proposed action. The Comal Springs and associated populations will therefore not be considered further for the purposes of this biological opinion.

The fountain darter is usually less than 1 inch (25 mm) standard length, and is mostly reddish brown in life. The scales on the sides are broadly margined behind with dusky pigment. The dorsal region is dusted with fine specks and has about eight indistinct dusky cross-blotches. A series of horizontal stitch-like dark lines occur along the middle of the sides, forming an interrupted lateral streak. Three small dark spots are present on the base of the tail and there is a dark spot on the opercle. Dark bars appear in front of, below, and behind the eye. The lower half of the spinous dorsal fin is jet-black; above this appears a broad red band, and above this band the fin is narrowly edged with black. (Jordan and Gilbert 1886; Gilbert 1887; Jordan and Evermann 1896, 1900; Strawn 1955, 1956; Collette 1965; Schenck and Whiteside 1977b, Burr 1978).

Fountain darter reproduction was first described by Strawn (1955). Although fountain darters spawn year-round (Schenck and Whiteside 1977b), they appear to have two peak spawning periods, in August and late winter to early spring (Schenck and Whiteside 1977b).

Dowden (1968) found fountain darter eggs attached to bryophytes and to algae in Spring Lake. In a recent study examining egg deposition in the San Marcos River, Phillips and Alexander (USFWS, unpublished data) observed fountain darter eggs deposited on filamentous algae *Rhizoclonium* sp., *Ludwigia repens*, *Sagittaria* sp., and the endangered Texas wild-rice. After hatching, fry are not free swimming, in part due to the reduced size of their swim bladders as in other darters.

Habitat requirements described in the Recovery Plan (USFWS 1996) include: undisturbed stream floor habitats; a mix of submergent plants (algae, mosses, and vascular plants), in part for cover; clear and clean water; invertebrate food supply of living organisms; constant water temperatures within the natural and normal river gradients; and adequate springflows.

Fountain darters use habitat with a mix of submergent vegetation including algae, mosses (e.g., *Riccia* sp.), and vascular plants such as Texas wild-rice (Schenck and Whiteside 1976; Linam et al. 1993; Linam 1993; USFWS, Austin ESFO unpublished data). Fountain darters are rarely found in areas lacking vegetation (BIO-WEST 2001-2009), and in habitat studies within the San Marcos River, Schenck and Whiteside (1976) never found fountain darters in areas without vegetation.

Fountain darters feed primarily during daylight in response to visual cues (Schenck and Whiteside 1977*a*). Bergin (1996) investigated the fountain darter's diet in detail. The food items selected depended on the size of the individual, but primarily included copepods, dipteran (fly) larvae, and emphemeropteran (mayfly) larvae (Bergin 1996).

Historic and Current Distribution

The historic range of the fountain darter is the San Marcos and Comal rivers in central Texas (Jordan and Gilbert 1886, Gilbert 1887, Evermann and Kendall 1894, Jordan and Evermann 1896, Jurgens 1951, Ball et al. 1952, Hubbs et al. 1953, Hubbs 1954, Kuehne 1955, Strawn 1955, Hubbs 1957, Hubbs and Strawn 1957b, Schenck and Whiteside 1976). In 1884, Jordan and Gilbert (1886) collected the type specimens of *E. fonticola* in the San Marcos River from immediately below the confluence of the Blanco River. Fountain darters have been found downstream intermittently between Cumming's Dam and Martindale.

The present distribution of the fountain darter in the San Marcos River includes Spring Lake downstream to an area between the San Marcos wastewater treatment plant outfall and the confluence with the Blanco River, (USFWS 1994 permit report, C. T. Phillips, USFWS, unpublished data).

The population of fountain darters in the San Marcos River was estimated to be approximately 103,000 by Schenck and Whiteside (1976) and 45,900 (downstream of and excluding Spring Lake) by Linam (1993). Fountain darter densities appear to be highest in the upper segments of the San Marcos River and decrease markedly below Cape's Dam (Linam 1993, Whiteside et al. 1994).

Reasons for Decline and Threats to Survival

The Revised San Marcos and Comal Recovery Plan (USFWS 1996) identifies several threats to the fountain darter. The primary threats are related to the quality and quantity of aquifer and spring water. Drought conditions or increased groundwater utilization resulting in reductions to or loss of springflows could threaten the species. Activities that may pollute the Edwards Aquifer and its springs and streamflows may also threaten or harm the species (USFWS 1980, USFWS 1996).

Additional threats include effects from increased urbanization near the rivers, recreational activities, alteration of the rivers, habitat modification (e. g. dams, bank stabilization, flood control), predation, competition, habitat alteration by non-native species, and introduced parasites (USFWS 1996).

A parasite threatening the fountain darter has been documented by Salmon (2000), Mitchell et al. (2000), Cantu (2003), Mitchell et al. (2002), and McDonald et al. (2006). Their research documents a trematode that attacks fountain darter gills in the Comal and San Marcos river systems. The risks posed by these parasites are anticipated to increase during stressful periods of low spring discharge (Cantu 2003) and the parasite's adverse effects may be greater to younger fountain darter life-stages (McDonald et al. 2006).

Range-wide Survival and Recovery Needs

There are numerous actions listed in the Recovery Plan regarding specific recovery efforts. These include ensuring adequate flows and water quality in the San Marcos River; maintenance of genetically diverse reproductive populations in captivity and creation of reintroduction techniques for use in the event of a catastrophic event; removal or reduction of threats due to non-native species, recreational use of the river, and habitat alteration; and maintenance of healthy, self-sustaining, reproductive populations in the wild are needed to achieve recovery. Please refer to the Recovery Plan for additional details and priority actions prescribed for recovery (USFWS 1996).

Populations and designated critical habitat located in the San Marcos River are located within the action area and fountain darters may be affected by the proposed action.

San Marcos salamander

For more information, please refer to the *San Marcos/Comal (Revised) Recovery Plan* (USFWS 1996).

Species Description and Life History

San Marcos Salamander was listed as threatened under the Act and critical habitat was designated on July 14, 1980 (USFWS 1980) and is described as "Texas, Hays County; Spring Lake and its outflow, the San Marcos River, downstream approximately 50 meters from the Spring Lake Dam."

This dark reddish-brown salamander has moderately large eyes with a dark ring around the lens. San Marcos salamanders have well developed and highly pigmented gills, relatively short, slender limbs with four toes on the forefeet and five on the hind feet, and a slender tail with a well developed dorsal fin. The specific name nana is from the Greek nanos or Latin nanus, meaning dwarf, referring to the small adult size (up to 2.35 in. [59.6 mm] total length) of this species (Brown 1967).

San Marcos salamanders are found at San Marcos Springs in the western half of Spring Lake and in the spillway areas below Spring Lake Dam. Flowing water is apparently a requirement for suitable habitat, as no specimens were found in still water areas (Nelson 1993).

The San Marcos salamander occurs in Spring Lake in algal mats (Tupa and Davis 1967), where rocks are associated with spring openings, and in rocky areas up to 492 feet (150 m) downstream of the dams at Spring Lake (Nelson 1993). The salamander also is found in shallow spring areas on the uppermost (northernmost) portion of Spring Lake on a limestone shelf in an area immediately in front of the River Systems Institute (formerly the Aquarena Springs Hotel).

Sandy substrates devoid of vegetation and muddy silt or detritus-laden substrates with or without vegetation are apparently unsuitable habitats for this species. Specimens occasionally are collected from beneath stones in predominantly sand and gravel areas. In view of the abundance of predators (primarily larger fish, but also crayfish, turtles, and aquatic birds) in the immediate vicinity of the springs, protective cover such as that afforded by the moss and cyanophycean bacteria (blue-green algae) is essential to the survival of the salamander. This vegetation also supports a plentiful food supply for the salamander (USFWS 1996).

Prey items for the San Marcos salamander include amphipods (scuds or sideswimmers), tendipedid (midge fly) larvae and pupae, other small insect pupae and naiads (an aquatic life stage of mayflies, dragonflies, damselflies, and stone flies), and small aquatic snails (USFWS 1996).

Feeding behavior observed in the laboratory indicate that these salamanders do not actively pursue their prey. Salamanders remained stationary until prey items were near their head and then abruptly snapped forward while opening their mouths to engulf food items. This information suggests they respond either to visual or vibrational cues from living prey.

The structure of the San Marcos salamander population is fairly uniform throughout the year. Most evidence suggests reproduction occurs throughout the year with a possible peak in May and June (Bogart 1967). San Marcos salamander reproductive biology is described by Bogart (1967), and Tupa and Davis (1976).

Habitat requirements described in the recovery plan (USFWS 1996) include: thermally constant waters; flowing water; clean and clear water; sand, gravel, and rock substrates with little mud or detritus; vegetation for cover; and an adequate food supply.

Historic and Current Distribution

C.E. Mohr collected 20 specimens from San Marcos Springs on 22 June 1938 (Bishop 1941). Tupa and Davis (1976) and Nelson (1993) estimated the number of San Marcos salamanders in and near Spring Lake and found them distributed throughout Spring Lake among rocks near spring openings, in algal mats, mosses, and other plants, and in rocky areas just downstream from the dams (Nelson 1993, BIO-WEST 2007d, 2010). Nelson (1993) estimated a total population of 53,200 salamanders in and just below Spring Lake, including 23,000 associated with algal mats, 25,000 among rocky substrates around spring openings, and 5,200 in rocky substrates within 492 feet (150m) below Spring Lake.

Reasons for Decline and Threats to Survival

The primary threats to the San Marcos salamander are related to the quality and quantity of aquifer and spring water. The restricted distribution of the species, loss of protective cover, contaminants, siltation, and introduced predators may also threaten or harm the species (USFWS 1980, USFWS 1996).

Range-wide Survival and Recovery Needs

Survival and recovery efforts for the San Marcos salamander include ensuring adequate flows and water quality in San Marcos Springs and the San Marcos River; maintenance of genetically

diverse reproductive populations in captivity and creation of reintroduction techniques for use in the event of a catastrophic event; removal or reduction of threats due to non-native species, recreational use of the river, and habitat alteration; and maintenance of healthy, self-sustaining, reproductive populations in the wild are needed to achieve recovery. Please refer to the Recovery Plan for additional details and priority actions prescribed for recovery (USFWS 1996). A contingency plan for the salamanders is being implemented and salamanders are collected for captive propagation/maintenance at the USFWS San Marcos National Fish Hatchery and Technology Center. Techniques for breeding this species and maintaining its genetic diversity have been improved over the past several years. However, the ability to maintain this species in captivity (without supplemental wild caught individuals) over the long term is uncertain (Fries 2002). Reintroduction techniques have not been developed.

San Marcos salamander populations and designated critical habitat in Spring Lake and the San Marcos River are located within the action area and may be affected by the proposed action.

Texas blind salamander

For more information, please refer to the *San Marcos/Comal (Revised) Recovery Plan* (USFWS 1996).

Species Description and Life History

The Texas blind salamander was listed as endangered on March 11, 1967 (USFWS 1967). Critical habitat was designated on July 14, 1980 (USFWS 1980) and is described as "Texas, Hays County; Spring Lake and its outflow, the San Marcos River, downstream to its confluence with the Blanco River."

The Texas blind salamander is a smooth, unpigmented, stygobitic (obligate aquatic cave-adapted) species that lives in the San Marcos area of the Edwards Aquifer. Adults attain an average length of about 4.7 inches (12 centimeters) with a large, broad head, and reduced eyes. The limbs are slender and long with four toes on the forefeet and five toes on the hind feet (Longley 1978).

The Texas blind salamander is a neotenic species believed to be adapted to the relatively constant temperatures (69.8°F, 21°C) of the water-filled subterranean caverns of the Edwards Aquifer in the San Marcos area (Longley 1978). Juveniles have been collected throughout the year, making it likely that this species is sexually active year-round (Longley 1978).

The Texas blind salamander is an active predator that moves its head from side to side as it searches for food on the bottom. It hunts prey by sensing water pressure waves created by prey in the still underground waters where it lives. Observations indicate that this salamander moves through the aquifer by traveling along submerged ledges and may swim short distances before spreading its legs and settling to the bottom of the pool (Longley 1978). Prey items for the Texas blind salamander include amphipods, blind shrimp (*Palaemonetes antrorum*), daphnia, small snails, and other invertebrates. Cannibalism has been documented.

Historic and Current Distribution

The Texas blind salamander was first described by Stejneger (1896) after the type specimen No. 22686, United States National Museum. The type specimens of the Texas blind salamander were collected in 1895 at the Federal Fish Hatchery in San Marcos, Texas, where they were expelled from an artesian well drilled to supply water to the hatchery (Longley 1978). The species has been collected at several other locations including Ezell's Cave, San Marcos Springs, Rattlesnake Cave, Primer's Fissure, Texas State University's artesian well, and Frank Johnson's well (Russell 1976, Longley 1978). The species had been recorded from Wonder Cave (also known as Beaver Cave; Longley 1978) but searches in 1977 did not locate any specimens (Longley 1978).

Little is known about the population size or trends in population size for this species. The total distribution of this species has been hypothesized to be as small as 39 square miles (101 square kilometers) in a portion of the Edwards Aquifer beneath and near the city of San Marcos (Longley 1978).

Reasons for Decline and Threats to Survival

Threats to the Texas blind salamander include: loss of suitable habitat due to decrease in aquifer level; decrease in water quality; encroachment of the saline interface into historical and currently occupied parts of the Edwards Aquifer and resulting in unsuitable water quality; and attrition and death due to entrainment into water wells in the San Marcos area.

Range-wide Survival and Recovery Needs

Texas blind salamanders rely on adequate flows and water quality in the San Marcos River and associated spring habitats; maintenance of genetically diverse reproductive populations in captivity and creation of reintroduction techniques for use in the event of a catastrophic event; removal or reduction of threats due to non-native species, and habitat alteration; and maintenance of healthy, self-sustaining, reproductive populations in the wild are needed to achieve recovery. Please refer to the Recovery Plan for additional details and priority actions prescribed for recovery (USFWS 1996).

A contingency plan has been developed for the Texas blind salamander. Few specimens have been collected and the numbers in captivity are unlikely likely to maintain good genetic representation (Krejca and Gluesenkamp 2007). No techniques have yet been developed to reintroduce this species back into habitat within the aquifer.

Texas blind salamander populations and designated critical habitat in Spring Lake and the San Marcos River downstream to its confluence with the Blanco River are located within the action area and may be affected by the proposed action.

Barton Springs Salamander

For more detailed information please see the Service's recovery plan for the Barton Springs salamander (2005).

Species Description and Life History

The Barton Springs salamander was federally listed as an endangered species on May 30, 1997 (USFWS 1997). Critical habitat has not been designated for this species.

The Barton Springs salamander is a member of the Family Plethodontidae (lungless salamanders) within the genus Eurycea, and inhabits springs, spring-runs, and water-bearing karst formations of the Edwards Aquifer (Chippindale et al. 1993). These aquatic neotenic salamanders do not metamorphose, but live in water throughout their life cycle where they become sexually mature and eventually reproduce.

Adults reach about 2.5 to 3 inches (63-76 mm) in total length. Adult body morphology includes reduced eyes and elongate, spindly limbs that are indicative of a semi-subterranean lifestyle. The head is relatively broad and deep in lateral view, and the snout appears somewhat truncate when viewed from above. On either side of the base of the head is a set of three feathery gills that are bright red. The coloration on the salamander's upper body varies from light to dark brown, purple, reddish brown, yellowish cream, or orange. The tail is relatively short with a well-developed dorsal (upper) fin and poorly developed ventral (lower) fin. The upper and lower mid-lines of the tail usually exhibit some degree of orange-yellow pigmentation.

Gravid females, eggs, and larvae are typically found throughout the year in Barton Springs, which suggests that the salamander can reproduce year-round. Juveniles closely resemble adults (Chippindale et al. 1993). Newly hatched larvae are about 0.5 inch (12 mm) in total length and may lack fully developed limbs or pigment (Chamberlain and O'Donnell 2003). Information obtained from captive-raised Barton Springs salamanders indicates that females can develop eggs within 11 to 17 months after hatching.

Barton Springs salamanders appear to be opportunistic predators of small, live invertebrates. Chippindale et al. (1993) found amphipod remains in the stomachs of wild-caught salamanders. The gastro-intestinal tracts of 18 adult and juvenile Barton Springs salamanders and fecal pellets from 11 adult salamanders collected from Eliza Springs, Barton Springs Pool, and Sunken Garden Springs contained ostracods, copepods, chironomids, snails, amphipods, mayfly larvae, leeches, and adult riffle beetles. The most common organisms found in these samples were ostracods, amphipods, and chironomids (City of Austin, unpublished data).

Historic and Current Distribution

The Barton Springs salamander has one of the smallest geographic ranges of any vertebrate species in North America (Chippindale et al. 1993, Conant and Collins 1998). The species was first collected from Barton Springs in 1946 (Brown 1950, Texas Natural History Collection specimens 6317-6321), was formally described in 1993 (Chippindale et al.), and has been found only at the four spring outlets that make up Barton Springs. Barton Springs, located in Zilker Park near downtown Austin, Travis County, Texas, is an aquifer-fed system consisting of four hydrologically connected springs, referred to as Main Springs (also known as Parthenia Springs or Barton Springs Pool); Eliza Springs (also known as the Elks Pit); Sunken Garden Springs (also known as Old Mill or Walsh Springs); and Upper Barton Springs (Pipkin and Frech 1993). The salamander was first observed in Barton Springs Pool and Eliza Springs in the 1940s, Sunken Garden Springs in 1993 (Chippindale et al. 1993), and the intermittent Upper Barton Springs in 1997 (City of Austin 1998). Various searches have failed to document Barton Springs salamanders at other springs in the Barton Springs Segment of the Edwards Aquifer including Cold Springs, Campbell's Hole, and Backdoor Springs, which are all located along Barton Creek.

The extent of the Barton Springs salamander's range within the Barton Springs Segment of the Edwards Aquifer, and thus the degree of subsurface connection among these spring populations,

is unknown. Sweet (1978) suggested the species was troglobitic (cave-adapted) and that the salamanders observed from the surface were discharged from the springs. However, City of Austin (CoA) biologists have observed Barton Springs salamanders swimming directly into various spring outlets, including Main Springs in Barton Springs Pool (Dee Ann Chamberlain and Lisa O'Donnell, City of Austin, pers. comm. 2004). Chippindale et al. (1993) characterized the species as a predominately surface-dwelling salamander capable of living underground. Reproduction of the Barton Springs salamander is believed to occur inside the Edwards Aquifer since salamander larvae are found in surface water year-round, but very few eggs (which are white and very visible) have been observed in the wild (Chamberlain and O'Donnell 2003).

The CoA initiated salamander surveys in Barton Springs Pool in 1993, Sunken Garden Springs and Eliza Springs in 1995, and in Upper Barton Springs in 1997. Monthly surveys conducted since 1993 have resulted in a number of salamander observations within each spring ranging from 1 to more than 200. Numbers have remained fairly constant within each survey location, with a noticeable spike in Barton Springs salamander numbers in Eliza Spring and Barton Springs Pool in late 2005 and early 2006 (City of Austin 2007). Severe drought in 2006 caused flow within all the springs to drop and remain at less than 40 cfs through December 2006 with a corresponding drop in salamander numbers. This cycle was repeated in 2008 and 2009 with Barton Springs salamander numbers peaking in early 2008 and dropping down again during the drought of 2009.

Reasons for Decline and Threats to Survival

The primary threat to the Barton Springs salamander is the degradation of the quality and quantity of water that feeds Barton Springs as a result of urban expansion over the watershed. The species' restricted range makes it vulnerable to both acute and chronic groundwater contamination. The salamander is also vulnerable to catastrophic hazardous materials spills, increased water withdrawals from the Edwards Aquifer, and impacts to the surface habitat.

An analysis of spring discharge data by the CoA (2000) indicated that degradation of water quality parameters has occurred at Barton Springs over the years. Dissolved oxygen has decreased while conductivity, sulfates, turbidity, nitrate-nitrogen, and total organic carbon have increased. The magnitude of these changes in water quality at Barton Springs has been variable and is dependent on flow conditions (City of Austin 2000, 2005). Changes in water quality at Barton Springs may be related to cumulative impacts of urbanization, including increased groundwater use. Variations in the quality of discharge at Barton Springs may also be related to seasonal changes in the amount of precipitation (City of Austin 1997). The extent to which these water quality changes have affected the Barton Springs salamander or its habitat is unknown.

Salamander habitat may also be affected by excessive deposition of sediment within Barton Springs. Deposition of sediment can physically reduce the amount of available habitat and protective cover for salamanders. Once deposited in large volumes, sediment can become devoid of oxygen and clog the interstitial spaces of the substrates surrounding the spring outlets that offer protective cover, rendering the habitat unsuitable for salamanders.

Range-wide Survival and Recovery Needs

Based on the Barton Springs Salamander Recovery Plan (USFWS 2005) protection and improvement in water quality within the Barton Springs watershed are necessary to provide for the survival of the species. Comprehensive regional plans are needed to address water quality and quantity threats. A number of interested parties are working on comprehensive regional

approaches to aid in the conservation of this species; however, these approaches have yet to be completed or implemented.

The potential for a catastrophic spill to occur at or near Barton Springs, or within the recharge zone of the Barton Springs Segment of the Edwards Aquifer, is of particular concern due to the limited range of this species. There continues to be a need for a comprehensive regional spill response and remediation plan to address the potential impacts of on-site and off-site spills.

The extremely limited range of this species makes captive breeding an important tool to help guard against extinction while other conservation measures are being put in place. Captive breeding, habitat improvement, and other efforts to increase numbers of existing viable populations is critical to the survival and recovery of this species, particularly as expanding urbanization continues to threaten habitat quality. Efforts to protect, manage, and restore surface salamander habitat at the four spring sites, followed by consistent and effective monitoring of Barton Springs salamander populations, continues to yield valuable information regarding the recovery needs of this species.

Environmental Baseline

For more detailed information regarding the occurrence of golden-cheeked warblers and black-capped vireos in Hays County, please refer to Section 3.2 of the RHCP.

Status within the Action Area

Terrestrial species

Golden-cheeked warbler

The golden-cheeked warbler was first reported to occur in Hays County in the early 1890's (Pulich 1976). However, Pulich (1976) found that records of the species in Hays County were not numerous, possibly due to a history of land-clearing activity. Current records of golden-cheeked warblers in Hays County are also sparse, but available data show that the species has been recently recorded from across much of Hays County.

Several golden-cheeked warbler localities in Hays County were identified from available datasets provided by the Service, the Texas Natural Diversity Database, and Loomis Partners, Inc. (Loomis)(generalized warbler locations are shown in Figure 3-2). These localities represent golden-cheeked warbler observations recorded by various observers between 1990 and 2005.

Pulich (1976) estimated that the golden-cheeked warbler population in Hays County was approximately 1,500 pairs in 1962 and approximately 150 pairs in 1974. There are no recent estimates of the total number of golden-cheeked warblers in Hays County reported in the literature.

Pulich (1976) estimated approximately 75,000 acres of potential golden-cheeked warbler habitat in Hays County in 1962 and approximately 7,500 acres of potential habitat in 1974. The *Golden-cheeked Warbler Recovery Plan* reports that approximately 50,644 acres of potential golden-cheeked warbler habitat was present in Hays County in 1988, based on estimates adapted from Wahl et al. (1990).

Loomis developed a more recent estimate of the amount of potentially suitable golden-cheeked warbler habitat in Hays County based on the average amount of canopy cover in an approximately 10-acre landscape (please see Loomis 2008, included in Appendix A of the RHCP). The Loomis habitat model estimates that approximately 34,110 acres of potential high quality golden-cheeked warbler habitat (i.e., areas of woodland vegetation with an average canopy cover of at least 70 percent) may occur in Hays County (please see Table 3-2 of the RHCP). Areas of potential high quality habitat identified by this recent habitat model are likely to be most comparable to the earlier estimates of available habitat, although other moderate or low quality re-growth habitat may also be used by golden-cheeked warblers.

When including more marginal potential habitats (identified as woodland areas with as little as 30 percent average canopy cover), the Loomis habitat model suggests that total extent of potential golden-cheeked warbler habitat in Hays County may include as much as 170,355 acres (Loomis 2008)(please see Table 3-2 of the RHCP). Since golden-cheeked warblers are known to utilize habitats that are less than prime, the amount of habitat currently available across the range of the species is likely to lie between the potential high quality habitat estimates (34,110 acres) and the total potential habitat estimates (170,355) generated by the Loomis model.

Not all areas of potential habitat are expected to be used by golden-cheeked warblers. Magness et al. (2006) developed a spatial model to predict the probability that potential habitat is occupied. Applying the Magness et al. (2006) occupancy model to the Loomis model of potential habitat yields an estimate of 148,638 acres (87 percent) of the potential habitat in Hays County (including potential high, medium, and low quality habitat) with a probability of being occupied (i.e., the habitat occurs in a landscape with at least 40 percent suitable habitat). Only about 50,305 acres (30 percent of the total area of potential habitat) has a probability of occupancy that exceeds 50 percent (i.e., the habitat occurs in a landscape with at least 80 percent suitable habitat)(please see Table 3-2 of the RHCP).

For comparison, other recently developed research identifies potential golden-cheeked warbler habitat across the range of the species, including the Missouri Resource Assessment Partnership (MoRAP) of the University of Missouri (Diamond 2007) and the Biodiversity and Biocultural Conservation Laboratory at the University of Texas at Austin (Fuller et al. 2008a). The preferred models described in Diamond (2007) suggest that there may be as much as 64,441 acres to 71,784 acres of potential high quality golden-cheeked warbler habitat in Hays County (i.e., habitat quality ranks 4 and 5 from preferred models "C" and "D"), and the preferred Diamond (2007) habitat models identify as much as approximately 161,000 acres of potential golden-cheeked warbler habitat in Hays County in all quality classes. Fuller et al. (2008a) are working on a niche model based on a maximum entropy algorithm to identify areas with a probability of being suitable golden-cheeked warbler habitat. Preliminary work by Fuller et al. (2008a) predicts that approximately 26,608 acres in Hays County may have a "high" probability of being suitable habitat and approximately 67,629 acres in Hays County may have a "good" or "high" probability of being suitable golden-cheeked warbler habitat.

In summary, the estimate of available suitable habitat that may occur in Hays County based on the models presented above ranges from 148,638 - 170,355 acres of potential habitat varying from high to low quality. The estimate of available high quality habitat that may occur in Hays County based on the models is estimated to range from 26,608 - 64,441 acres.

Black-capped vireo

Graber (1957) identified breeding populations of the black-capped vireo in Hays County in the late 1950's located at the El Rancho Cima Boy Scout Camp and at locations within a couple of miles south and east of Wimberley. Accurate locations for these three historic observations are not available. The Texas Natural Diversity Database maintained by TPW (which is a limited dataset based on voluntary submissions of sighting records) identifies three occurrences of the black-capped vireo in Hays County (one reported in 1993 and the other two reported in 1999)(Texas Parks and Wildlife Department 2008). However, the Service has not received any records of the species in the County since 2000 (Wilkins et al. 2006).

The habitat estimates reported in Wilkins et al. (2006), which are based on the results of roadside surveys in the late 1990's (Maresh and Rowell 2000), identify approximately 23,855 acres of potential black-capped vireo habitat in Hays County. However, due to sampling issues associated with the original roadside surveys, the County-wide estimates of potential black-capped vireo habitat are likely to overestimate the amount of occupied and potential suitable habitat. Therefore, they may not be reliable and are of limited utility (Wilkins et al. 2006). The distribution of this potential habitat across the County is not available.

The Biodiversity and Biocultural Laboratory at the University of Texas at Austin has been developing a model that predicts the location of suitable black-capped vireo habitat in Hays County. Fuller et al. (2008b) have used a niche model constructed using a maximum entropy algorithm to identify areas with a probability of being suitable black-capped vireo habitat. Preliminary work by Fuller et al. (2008b) predicts that approximately 2,069 acres in Hays County may have a "high" probability of being suitable black-capped vireo habitat and approximately 11,772 acres in Hays County may have a "good" or "high" probability of being suitable black-capped vireo habitat.

The current population of black-capped vireos in Hays County is unknown, since a detailed population survey of the County has not been completed and only a few observations of the species have been reported in recent years. However, given the increasingly optimistic status of the black-capped vireo overall (the recent status review proposed that the species be downlisted in part due to the larger number of known populations)(USFWS 2007), the documented presence of the species on many private lands in the region (USFWS 2007), and the likely abundance of potential habitat in the County (Wilkins et al. 2006), the species is still likely to occur in Hays County.

The recovery criteria listed in the 1991 *Black-capped Vireo Recovery Plan* included a call for the protection of at least one viable black-capped vireo population composed of at least 500 to 1000 breeding pairs in each of six recovery regions in Texas, Oklahoma, and Mexico. It is not clear whether a viable black-capped vireo population is currently protected in the recovery region that includes Hays County.

Aquatic species

Texas wild-rice

The entire range and all designated critical habitat for Texas wild-rice is contained within the action area. Texas wild-rice occurs in the upper two miles (three kilometers) of the San Marcos River above the confluence with the Blanco River (Poole and Bowles 1999). Designated critical habitat consists of Spring Lake and its outflow and the San Marcos River downstream to the confluence with the Blanco River (USFWS 1980).

Comal Springs dryopid beetle

Within the action area the Comal Springs dryopid beetle is known only from Fern Bank Springs. Designated critical habitat in Hays County was described as "aquatic habitat and land areas that are within a 50-ft (15.2-m) distance from spring outlets, including the main outlet of Fern Bank Springs and its associated seep springs" (USFWS 2007).

Comal Springs riffle beetle

The Comal Springs riffle beetle is known from Spring Lake and the range of this species is partially contained within the action area. One of two designated critical habitat areas are within the action area. The designated critical habitat within Hays County is composed of Spring Lake aquatic habitat areas upstream of Spring Lake dam, with the exception of the slough portion of the lake upstream of its confluence with the main body (USFWS 2007).

Fountain darter

Within the action area, the fountain darter is known from the San Marcos River including Spring Lake downstream to an area between the San Marcos wastewater treatment plant outfall and the confluence with the Blanco River, (USFWS 1994 permit report, C. T. Phillips, USFWS, unpublished data). Designated critical habitat is described as "Texas, Hays County; Spring Lake and its outflow, the San Marcos River, downstream approximately 0.5 miles below Interstate Highway 35 Bridge" (USFWS 1980).

San Marcos salamander

The entire range of the San Marcos salamander is contained within the action area. Designated critical habitat is defined as Spring Lake and its outflow, the San Marcos River, downstream approximately 50 meters from the Spring Lake Dam (USFWS 1980).

Texas blind salamander

The entire range of the Texas blind salamander is contained within the action area. Designated critical habitat Includes Spring Lake and its outflow, the San Marcos River, downstream to its confluence with the Blanco River (USFWS 1980).

Barton Springs salamander

The entire range of the Barton Springs salamander consists of the four spring outlets that make up Barton Springs, located in Zilker Park near downtown Austin, Travis County, Texas (USFWS 2004). The Barton Springs salamander relies on recharge within the Barton Springs Segment of the Edwards Aquifer which is partially contained in the action area. Critical habitat has not been designated for this species.

Factors affecting terrestrial species within and adjacent to the Action Area

Golden-cheeked warblers

Attaining the recovery goals for the golden-cheeked warbler includes the identification of "focal areas" for protection that include a single, viable warbler population or one or more smaller populations that are interconnected (USFWS 1992). Within Recovery Region 5, where the action area is located, significant habitat has been protected through the establishment of the Balcones Canyonlands Preserve and the Balcones Canyonlands National Wildlife Refuge in Travis, Williamson, and Burnet counties (please see Figure 3-3 of the RHCP). Currently, these areas comprise approximately 48,250 acres of permanently preserved and managed lands dedicated to the protection of endangered species.

Continued threats to golden-cheeked warblers near the action area (Hays County), but outside of Hays County, include the clearing of deciduous oaks upon which the golden-cheeked warblers forage, oak wilt, nest parasitism by brown headed cowbirds (*Molothrus ater*)(Engels and Sexton 1994), drought, fire, stress associated with migration, competition with other avian species, and particularly, loss of habitat from urbanization (Ladd and Gass 1999). Some studies indicate that the abundance of several bird species, including golden-cheeked warblers, is reduced within 656-1,640 feet of an urban edge (Engels 1995, Arnold et al. 1996, Bolger et al. 1997, Coldren 1998). Coldren (1998) reported that golden-cheeked warbler occupancy declined with increasing residential development and roadway width, two types of projects that may be covered by the proposed permit. Therefore, it is reasonable to conclude that effects from projects that result in habitat loss or degradation near Hays County within Recovery Region 5 will likely affect golden-cheeked warblers occurring within Hays County, especially proposed projects near mitigation banks or preserve boundaries. However, due to all of the activities associated with high-density development, it is impossible to quantify potential adverse effects to golden-cheeked warblers occupying specific locations throughout Hays County.

Further, as large blocks of good quality habitat within Recovery Region 5, where the action area is located, become developed, opportunities to meet recovery goals become more limited due to increased development pressure, increased land prices, and fragmentation.

Black-capped vireos

As discussed above in the Status of the Species section, little protection of black-capped vireo habitat exists throughout the range, and even less within the Hays County area.

Continued threats to black-capped vireos near the action area (Hays County), but outside of Hays County, include the clearing of broadleaf low shrub vegetation used for nesting cover, nest parasitism by brown headed cowbirds (Engels and Sexton 1994), drought, fire, stress associated

with migration, competition with other avian species, and particularly loss of habitat from land clearing activity. Therefore, it is reasonable to conclude that effects from projects that result in habitat loss of degradation near Hays County within the same Recovery Region will likely affect black-capped vireos occurring within Hays County, especially proposed projects near mitigation banks or preserve boundaries. However, due to all of the activities associated with high-density development, it is impossible to quantify potential adverse effects to black-capped vireos occupying specific locations throughout Hays County.

Further, as large blocks of good quality habitat within the Recovery Region boundary become developed, opportunities to meet recovery goals become more limited due to increased development pressure, increased land prices, and fragmentation.

In addition, the response of the golden-cheeked warbler or the black-capped vireo to climate change is uncertain. However, the limited distribution of breeding habitat for the golden-cheeked warbler indicates that this species may be vulnerable to the effects of climate change. The potential for additional golden-cheeked warbler habitat to grow in new areas in response to climate change may be limited by factors such as geology and soil type. This coupled with the continuing loss and fragmentation of breeding habitat due to urbanization and agricultural practices may further limit the distribution of breeding habitat in the future.

Twenty-eight previous golden-cheeked warbler and/or black-capped vireo consultations have been completed for actions within Hays County:

21450-1992-I-0472: 383 acres on Bliss Spillar Road on Travis-Hays county line
21450-2000-I-1077: Canyon Regional Hays/Caldwell
21450-2000-I-9000: Hays Co. 25 year road plan
21450-2001-I-0122: Communications Tower - Hays City - TX2150
21450-2001-I-0202: Cedar Oaks Mesa Water Supply/ Hays County
21450-2002-I-0024: Rutherford Rim, John Lloyd
21450-2002-I-9040: Dripping Springs / Hays County Water Quality Plan
21450-2003-I-0031: Hill Country Courtyard
21450-2003-I-0102: RR 12 in Wimberley
21450-2003-TA-0167: Prescribed Burn on Hays County Ranch
21450-2003-TA-0411: Hays County rock crushing and asphalt plant
21450-2004-I-0010: Kinder Morgan Rancho Pipeline Conversion Project
21450-2004-I-0046: Hays-967 development
21450-2004-I-0241: Hays Street Bridge Rehabilitation Project in San Antonio
21450-2005-TA-0161: Regional Water Quality Protection Plan
21450-2007-I-0138: Hays County Flood Warning Improvements, Hays County
21450-2007-TA-0058: MST CFAN campus expansion, Hays County
21450-2008-I-0023: Texas Gas Service line, Nutty Brown Rd, Hays and Travis Co
21450-2008-TA-0019: FEMA Flood Control signage installation, Hays County
21450-2008-TA-0102: Texas Gas Service Co.
21450-2008-TA-0163: Salt Lick Development Tract, Hays County

21450-2009-I-0165: Health Care Facility on Beebe Rd. and Darcy Ln. in Kyle, Tx.
21450-2009-I-0166: Creekside Villas Senior Village in Buda, Hays County, TX.
21450-2009-TA-0143: Dripping Springs ISD high school, Hays County
21450-2009-TA-0175: New coordinates for construction of 150 ft. Monopole Tower in Kyle, Hays Co. with ECA
21450-2010-F-0173: Hays County RHCP Biological Opinion
21450-2010-I-0128: Winters Mill / Blue Hole Trail, Wimberley, Texas
21450-2010-I-0149: GBRA wastewater treatment plant Blue Hole Park, Hays County

Factors affecting aquatic species' environment within the action area

The main factors affecting the aquatic species considered in this analysis are the quantity and quality of aquifer water and the resulting springflows upon which they depend. Threats to water quantity include, but may not be limited to, pumping, lack of rainfall (drought), creation of impervious surfaces that alter infiltration rates, and other activities that result in removing water from the aquifer systems. Threats to water quality include, but may not be limited to, development that affects recharge capability, contaminants/dissolved materials, and water temperature. Additional threats are discussed above in the Status of the Species section. The discussion below will focus on three distinct areas: Southern Segment of the Edwards Aquifer, Barton Springs Segment of the Edwards Aquifer, and the Trinity Aquifer . The discussion will first address water quantity and then water quality.

Water Quantity

Southern Segment of the Edwards

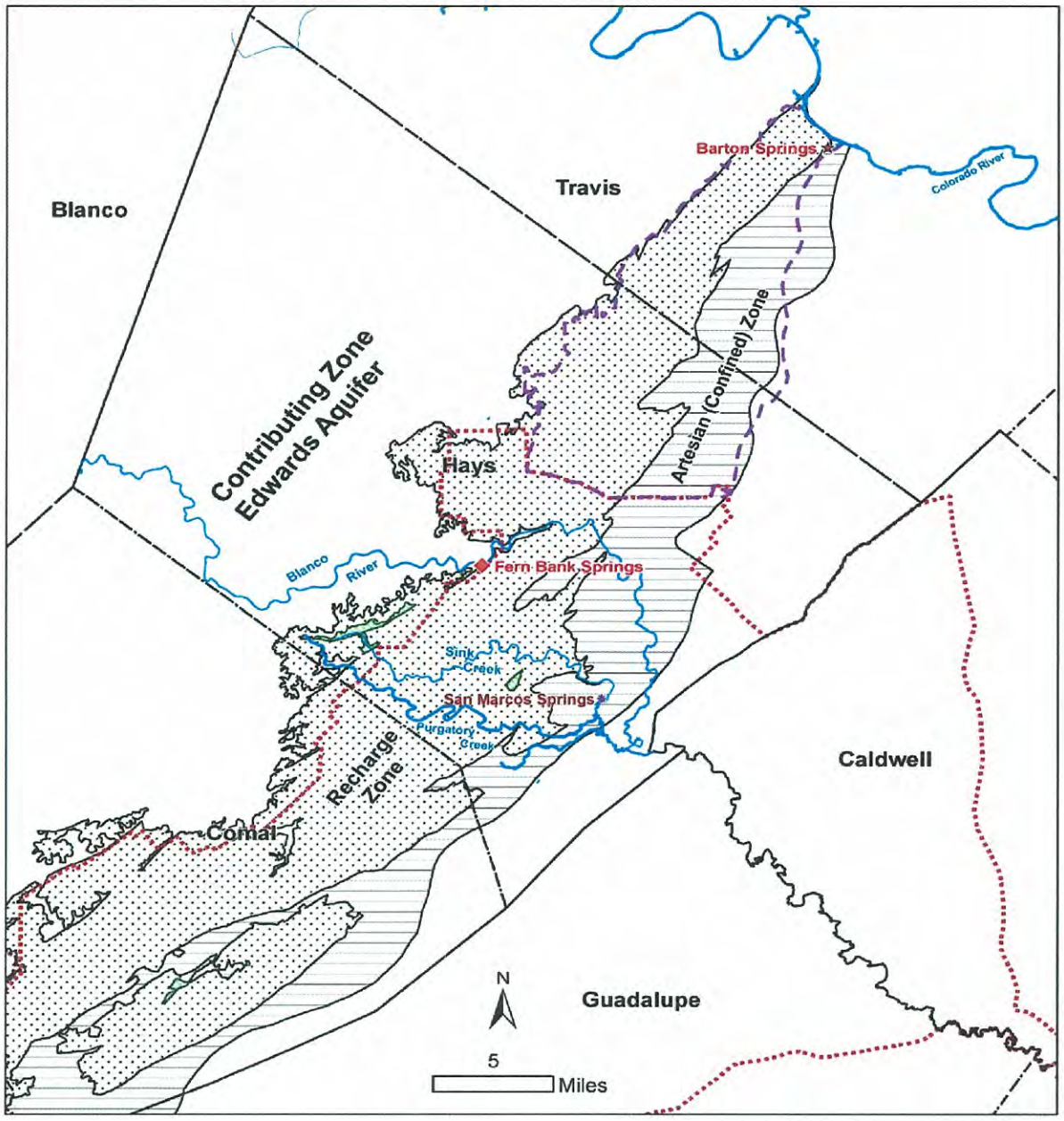
The Southern Segment of the Edwards Aquifer underlies portions of southwest Texas from Kinney and Uvalde Counties to the northeast through Hays County. The Southern Segment stretches for approximately 180 miles and varies from approximately 5 to 40 miles in width. Water within the Southern Segment generally flows from areas of higher elevation in the southwest to areas of lower elevation to the northeast. The Southern Segment of the Edwards Aquifer is the primary water source for municipal, industrial, agricultural, and domestic uses for over two million people throughout the region.

The Southern Segment of the Edwards Aquifer has three distinct zones, each with unique hydrogeological characteristics (Figure 2). The contributing zone consists of approximately 5,400 square miles (13,986 square kilometers) and includes portions of Kinney, Edwards, Real, Uvalde, Bandera, Medina, Kerr, Kendall, Bexar, Comal, Blanco and Hays counties. The contributing zone is composed of the watersheds of the creeks and streams that cross the recharge zone, thereby providing the source of most of the water that will enter the aquifer as recharge.

The recharge zone consists of approximately 1,250 square miles (3,237 square kilometers) of porous Edwards Limestone that lies exposed at the ground surface. Recharge takes place as runoff infiltrates the exposed water receiving geologic strata in this zone. Water enters the aquifer by infiltration through the soils and rock strata overlying the aquifer, by percolation through upland recharge features (caves, sinkholes, faults, fractures, and other open cavities); or

by percolation through recharge features in creeks that cross the recharge zone. Creeks and streams flowing generally south and east across central Texas often lose much or all of their baseflow to the aquifer as they cross the recharge zone.

The artesian zone of the Edwards Aquifer is characterized by high surface springflows resulting from the hydraulic pressure of the confined waters in this zone. The porous water bearing strata of the Edwards Aquifer are surrounded in the artesian zone by less permeable geology that confines waters flowing down gradient from the recharge zone. Faults and fissures through these overlaying strata allow these pressurized waters to be released at the surface in numerous springs and seeps. The artesian zone is the source of the Hays County springflows that create Spring Lake and the San Marcos River. Spring Lake and the San Marcos River provide habitat for five of the listed species considered in this biological opinion.



Hays County Regional Habitat Conservation Plan

Edwards Aquifer Zone
- Recharge
- Contributing In Recharge
- Artesian

- Barton Springs EACD Bndry
- Edwards Aquifer Authority Bndry
- County Line

- Barton Springs
- Fern Bank Springs
- San Marcos Springs

Figure 2. Contributing, recharge and artesian zones of the Edwards Aquifer in Hays County with the administrative boundaries of the BSEACD and the EAA relative to Barton, San Marcos and Fern Bank Springs.

Springflows at San Marcos springs are directly related to water use within the Southern Segment of the Edwards Aquifer. The average discharge at San Marcos Springs during the period of record from 1940 to 2009 was approximately 164 cubic feet per second. The minimum recorded flow was 46 cubic feet per second on August 15 and 16, 1956. This recorded minimum was due to an extended period of drought that lasted 18 months (September 1955 through February 1957), known as the Drought of Record. The minimum monthly average springflow of 53.5 cubic feet per second also occurred in August 1956, with a monthly mean springflow of 68.6 cubic feet per second and ranged from 76.8 cubic feet per second (September 1955) to 53.5 cubic feet per second (August 1956) during the Drought of Record. This springflow condition, coupled with the duration of this event, resulted in an extreme low flow condition that likely affected these species and their habitat. There are no records of population distribution or abundance for these species immediately prior to or after that extended event.

The Southern Segment of the Edwards Aquifer has a high capacity for rapid recharge, and rainfall over the contributing and recharge zones can quickly increase water levels within the aquifer. The Southern Segment of the Edwards can also experience rapid drops in water levels due to pumping, especially during drought periods.

Continued population growth in the region and associated increases in water demand may exacerbate declining springflows if future water needs are met by increased pumping from the Edwards Aquifer.

An underground water authority, the Edwards Aquifer Authority (EAA) was created (Chapter 626, Laws of the 73rd Texas Legislature, 1993, as amended by Chapter 621, Laws of the 74th Texas legislature, 1995), to manage and issue permits for the withdrawal of groundwater from the Edwards Aquifer for the purposes of water conservation and drought management and to make and enforce rules. The Edwards Aquifer was found to be a unique aquifer and a distinctive natural resource of this State. The Edwards Aquifer is a complex hydrological system and the sole or primary source of water for a diverse group of social and economic interests. The EAA was designated a special regional management district and charged with protecting terrestrial and aquatic life, domestic and municipal water supplies, the operation of existing industries, and the economic development of the state.

The EAA is mandated to pursue all reasonable measures to conserve water; protect water quality in the aquifer; protect water quality of surface streams provided with springflows from the aquifer; maximize the beneficial use of water available to be drawn from the aquifer; protect aquatic and wildlife habitat; protect threatened and endangered species under Federal or State law; and provide for instream uses, bays and estuaries.

Barton Springs Segment of the Edwards Aquifer

The Barton Springs Segment of the Edwards Aquifer provides water for the springs of the Barton Springs complex. The Barton Springs Segment is located in northern Hays and southern Travis Counties, covers about 155 square miles (401 square kilometers)(Slade et al. 1985, 1986) and

provides groundwater for municipal, industrial, agricultural, and domestic uses for over 50,000 people, including the city of Buda and surrounding areas (BS/EACD 2004).
The contributing zone of the Barton Springs Segment of the Edwards Aquifer spans about 264 square miles (683 square kilometers) and includes portions of Travis, Hays, and Blanco counties. The recharge and contributing zones together make up the total area that provides water to the Barton Springs Segment of the Edwards Aquifer, which equals about 354 square miles (916 square kilometers)(Slade et al. 1986).

The recharge zone of the Barton Springs Segment covers about 90 square miles (233 square kilometers). Most of the water recharging the Barton Springs Segment of the Edwards Aquifer is derived from percolation through creeks that cross the recharge zone (Slade et al. 1985, Barrett and Charbeneau 1996). Because recharge features in creek bottoms throughout the recharge zone allow only a limited flow of water during a storm event, water volumes in excess of the flow capacities of recharge features leave the recharge zone as creek flow.

Impermeable layers of clay cover and confine the water in the artesian zone located in the eastern portion of the Barton Springs Segment of the Edwards Aquifer. The pressurized groundwater in this zone is forced to the surface where it creates the naturally flowing artesian Barton Springs. Barton Springs provide habitat for the only known populations of the Barton Springs salamander, which may be affected by permit issuance.

USGS data indicate the average annual flow at Barton Springs for the years 1979 through 2009 was 61.30 cfs, with a high of 131.51 cfs in December of 1991 and a recorded low of 13.93 cfs during the drought of the 1950's. This springflow condition likely affected habitats and populations of the Barton Springs salamander. There are no records of population distribution or abundance for these species immediately prior to or after that event.

Like the Southern Segment, the Barton Springs Segment of the Edwards Aquifer has a high capacity for rapid recharge, and rainfall over the contributing and recharge zones can quickly increase water levels within the aquifer. The Barton Springs Segment of the Edwards is also subject to rapid drops in water levels due to pumping, especially during drought periods.

The Barton Springs Edwards Aquifer Conservation District (BSEACD) was created in 1987 by the 70th Texas state Legislature with a directive to conserve, protect and enhance the groundwater resources under its authority. The BSEACD jurisdictional area includes approximately 24 square miles (62.2 square kilometers) in portions of Hays, Travis, Caldwell, and Bastrop Counties. The BSCEACD southern boundary is generally along the established groundwater divide or "hydrologic divide" between the Barton Springs and the Southern Segments of the Edwards Aquifer in Hays County. The area covers the recharge and artesian zones of the Barton Springs Segment of the Edwards Aquifer, but not its contributing zone. It includes the locations of all wells in the Barton Springs Segment and also the locations of the natural outlets of the aquifer at Barton Springs and several other smaller springs along the Colorado River.

Under the authority provided by Texas Water Code (Chapter 36, Subsection 36.101), groundwater conservation districts may limit aquifer withdrawals under rules governed by Chapter 36 and by their enabling legislation, in order to conserve, preserve, and protect groundwater or groundwater recharge, and to prevent waste of the groundwater resource or

groundwater reservoirs in their jurisdiction as part of a comprehensive, approved groundwater management plan.

The BSEACD is responsible for creating, implementing, and enforcing permitted water withdrawals within their jurisdiction. The District's drought management plan utilizes flows at Barton Springs and at an index well to trigger mandatory withdrawal reductions in order to protect flows and water availability.

Trinity Aquifer

The Trinity Aquifer stretches across central Texas in a narrow band from the Red River on the Oklahoma border through Hays County and south to Bandera and Medina Counties. The Trinity Aquifer underlies and provides much of the available groundwater in the western half of Hays County, including the cities of Dripping Springs and Wimberley and surrounding areas. In some areas, the Trinity is overlaid by the Edwards and contributes recharge to the Edwards Aquifer through faults and fissures that allow for upwelling of pressurized groundwater (Mace 2000). The extent of the mixing and relationship between these aquifers at this interface is poorly understood; though a recent Texas Water Development Board study assessing current groundwater trends for the Trinity modeled current discharge at approximately 60% to springs, rivers and reservoirs, 25% to wells, and the remaining 15% to recharge of the Edwards Aquifer (Anaya and Jones 2009).

Unlike the segments of the Edwards Aquifer, the Trinity Aquifer is recharged very slow, with only about four to five percent (4 to 5%) of rainfall in the area recharging the Trinity aquifer.

The Hays Trinity Groundwater Conservation District (HTGCD) was created in May of 2003. Like the BSEACD, the HTGCD relies on User Drought Contingency Plans that must meet the District's water plan for water withdrawal restrictions during drought conditions.

Fern Bank Springs provides designated critical habitat for the Comal Springs dryopid beetle and lies on the edge of the Trinity Aquifer near the edge of the Edwards Aquifer. The USGS (Heitmuller and Reece 2006) assigned Fern Bank Springs to the upper zone of the Trinity Aquifer. Fern Bank Springs discharges water from the upper member of the Glen Rose Formation, and its flow could originate primarily from that unit; however, water discharged from the springs could also be drainage from the nearby Edwards Aquifer recharge zone, water lost from the Blanco River, or a combination of all three sources (Veni 2006).

Water Quality

The general sources of water quality concerns are common to all of the aquifer systems in Hays County and are considered together here.

Land use changes throughout the region may increase risks of aquifer, springflow, and streamflow contamination. Pollution threats include:

(1) groundwater pollution from land-based hazardous material spills and leaking underground storage tanks;

(2) cumulative impact of urbanization (road runoff, leaking sewer lines, residential pesticide and fertilizer use, etc.);

(3) increased impact of contaminants due to decreased dilution from smaller volumes of water in the aquifer and springflows; and,
(4) surface, stormwater, and point and nonpoint source discharges into the streamflows.

The September 2007 "*Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer*" and "*Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer and Related Karst Features that May Be Habitat for Karst Dwelling Invertebrates*" are appendices to the TCEQ technical guidance document detailing best management practices for compliance with the Edwards Aquifer Rules (Title 30, Texas Administrative Code, Chapter 213). The Service concurred that implementation of these voluntary water quality measures in their entirety "will protect endangered and candidate species from impacts due to water quality degradation." These voluntary measures, if fully implemented by a project proponent, will likely minimize and avoid adverse effects to the aquifer-dependent species.

Effects of the Proposed Action

This analysis does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Terrestrial species

It is anticipated that up to 22,000 acres of golden-cheeked warbler habitat and up to 3,300 acres of black-capped vireo habitat (25,300 collectively) will be directly and/or indirectly affected by land development in Hays County over the 30 year permit period. The anticipated effects from the covered activities that result in habitat loss (please see Section 5.1 of the RHCP), is likely to result in a reduction of breeding habitat for golden-cheeked warblers and black-capped vireos.

Take is anticipated to occur as a result of the activities covered by the RHCP for various reasons including, but not limited to, the proximity of known golden-cheeked warblers and black-capped vireos to construction areas, disturbance severity associated with land development (e.g., land clearing and/or noise) and project schedule seasonality and longevity. Activities that would likely result in harassment include, but are not limited to, blasting, cut and fill operations, construction of retaining walls, persistent use of heavy equipment, and continuous disturbances associated with general construction. As proposed, no habitat clearing will occur during the breeding seasons, therefore, no mortality of individuals from the covered activities is likely if appropriate precautions are taken as stipulated by the permit conditions.

Anticipated effects of the proposed actions primarily revolve around (1) habitat loss from vegetation clearing, (2) fragmentation due to development patterns, and, (3) the insertion of a disturbance that did not previously exist near known occupied or likely to be occupied habitat, which could result in take in the form of harassment. The effects of human disturbance or intrusion related to construction activities include, but are not limited to, elevated noise levels, presence of humans and machinery, and lighting. The adverse effects of human activities, (e.g., urban development) on avian communities have been well studied (e.g., Blair 1996, Friesen, et

al. 1995, Gutzwiller et al. 1998, Riffell et al. 1996, Wilcove 1988, John Cornelius, Ft. Hood, pers. comm. 2006).

The presence and operations of construction crews and heavy equipment will likely result in harassment of some individuals where construction is adjacent to occupied habitat. It is reasonable to conclude that harassment would occur when covered activities associated with specific projects are conducted directly adjacent to habitat for one or both species. These effects could be exacerbated by construction schedules that (1) occur over multiple breeding seasons; (2) occur early in the breeding season of either species when males are attempting to establish territories and attract mates; and, (3) continue through nesting and rearing seasons when nest abandonment could occur or when fledglings could be exposed and subsequently harassed. It is likely that behavioral changes associated with breeding, feeding, or sheltering would occur for at least one individual of either species, resulting in take in the form of harassment. These types of adverse effects have been acknowledged, addressed, and supported in numerous biological documents, assessments, and Service biological opinions.

Golden-cheeked warbler

Although the RHCP indicates that approximately 22,000 acres of golden-cheeked warbler habitat may be lost over the 30 year permit period, Hays County is estimating that the RHCP will require incidental take coverage on and provide mitigation for approximately 9,000 acres of that estimated loss with a net loss of approximately 13,000 acres over 30 years due to development activities that may occur throughout Hays County that are not mitigated through the RHCP. Habitat lost over the 30 year permit period is anticipated to range from high to low quality, depending on specific project proposals and locations.

The entire breeding range of the golden-cheeked warbler contains an estimated 1,771,883 acres of breeding habitat (Diamond 2007). The Loomis model estimates that 170,355 acres of golden-cheeked warbler habitat occurs within Hays County, 34,110 acres of which is high quality habitat. The amount of take authorized by the permit will be a maximum of 9,000 acres, approximately 0.5 percent of the range-wide estimate (Diamond 2007) or approximately 5 percent of golden-cheeked warbler habitat in Hays County. Therefore, it is not anticipated that the take of up to 9,000 acres is likely to have a major impact on the breeding population as a whole.

Further, Hays County lacks the very large, contiguous blocks of potential golden-cheeked warbler habitat that are present in some adjacent counties (i.e., Travis County and, to a lesser extent, Comal County)(please see Figure 3-3 of the RHCP). The potential golden-cheeked warbler habitat in Hays County, while fairly abundant, is distributed in smaller, more isolated patches (please see Figure 3-2 of the RHCP). Therefore, Hays County generally lacks an obvious "focal area" to contribute to the recovery goals for Recovery Region 5. Achieving the recovery goals for the golden-cheeked warbler also requires the protection and management of "abundant and scattered patches of habitat" outside of the focal protection areas (USFWS 1992). The RHCP will protect patches of habitat for the golden-cheeked warbler outside of the established and potential focal protection areas to the north and south of Hays County. In this way, the RHCP will contribute to the recovery of the species.

Black-capped vireo

Although the RHCP indicates that approximately 3,300 acres of black-capped vireo habitat may be lost over the 30 year permit period, Hays County is estimating that the RHCP will provide mitigation for approximately 1,300 acres of that estimated loss with a net loss of approximately 2,000 acres over 30 years due to development activities that may occur throughout Hays County that are not mitigated through the RHCP. Habitat lost over the 30 year permit period is anticipated to range from high to low quality, depending on specific project proposals and locations.

Little is known about the status and habitat distribution of the black-capped vireo in Hays County. It is not practical to assign relative habitat values to the total delineated habitat as was done for the more common and well-studied golden-cheeked warbler. The estimated 23,855 acres of potential habitat estimated by the Loomis model is used as the base value for estimating take under the RHCP. The amount of take authorized by the permit will be a maximum of 3,300 acres, approximately 13 percent of black-capped vireo habitat estimated to occur in Hays County. Further, the RHCP black-capped vireo mitigation plan provides an equal or greater restoration or preservation for every acre affected over the life of the RHCP and conservation strategies pursuant to the RHCP will encourage the collection and reporting of data for black-capped vireos facilitating the Service's ability to determine recovery potential. Additionally, mitigation areas and/or preserves acquired pursuant to this RHCP may add to the small number of acres currently protected in Hays County, most of which has been protected pursuant to water quality protection strategies for the City of Austin. Therefore, it is not anticipated that the take of up to 3,300 acres is likely to have a major impact on the breeding population as a whole.

Under the assumption that Hays County will achieve their goal of preserving 10,000 - 15,000 acres of habitat to mitigate for the covered activities over the duration of the 30 year permit, the Service anticipates an increase in the permanent protection of golden-cheeked warbler and black-capped vireo habitat and an improvement in the quality of golden-cheeked warbler and black-capped vireo habitat protected in the long-term. Currently, there is very little permanent protection of large, viable blocks of golden-cheeked warbler or black-capped vireo habitat in Hays County.

Aquatic species

Texas wild-rice, fountain darter, San Marcos salamander, and Texas blind salamander critical habitat designations pre-date the requirement for identification of physical and biological factors that are essential for the conservation of the listed species. As required by Section 4(b) of the Act, the Service relies upon the best scientific and commercial data available to determine the essential features, that is, the physical and biological features in the appropriate quantity and spatial arrangement, for the conservation of the species.

The key factor related to the adverse modification determination is whether, with implementation of the proposed Federal action, the affected designated critical habitat would remain functional (or retain the current ability for the physical and biological factors to be functionally established) to serve the intended conservation role for the species. Generally, the conservation role of designated critical habitat units is to have each unit support viable populations in the wild.

Activities that may adversely modify designated critical habitat are those that alter the physical and biological factors required by each species to an extent that the conservation value of designated critical habitat is appreciably reduced. Activities that, when carried out, funded, or

authorized by a Federal agency, may affect designated critical habitat and therefore result in consultation for these listed species include, but are not limited to actions that can negatively affect the physical and biological factors required by the species; or activities that would significantly and detrimentally alter the water quality in any of the spring systems listed above and would thereby destroy or adversely modify the designated critical habitat for any of these species. These activities include, but are not limited to, sedimentation from construction or release of chemical or biological pollutants into the surface water or connected groundwater at a point source or by dispersed release (non-point source); such activities could also alter water conditions to a point that negatively affects these invertebrate species; actions that change the existing and historic flow regimes and would thereby significantly and detrimentally alter the physical and biological factors necessary for conservation of these species. Such activities could include, but are not limited to, water withdrawal, impoundment, and water diversions. These activities could eliminate or reduce the habitat necessary for the growth, reproduction, or survival of these invertebrate species; and actions that remove hydraulic connectivity of the aquifer and the spring areas where it exists and would thereby negatively affect the physical and biological factors of the designated critical habitat of these species and the population dynamics of the species. Alteration of subsurface water flows through destruction of geologic features (for example, excavation) or creation of impediments to flow (for example, concrete filling), especially in proximity to spring outlets, could negatively alter the hydraulic connectivity necessary to sustain these species. It is necessary for subsurface habitat to remain intact with sufficient hydraulic connectivity of flow paths and conduits to ensure that physical and biological factors (water quality, water quantity, and food supply) for the designated critical habitat units remain adequate for the listed invertebrates (USFWS 2007).

The recovery plans for the Edwards Aquifer spring species and the Barton Springs Salamander (USFWS 1996, 2005) identify a number of regional and local threats to the aquifer and spring systems, and to the threatened and endangered species dependent upon these ecosystems.

Water withdrawals

As proposed in the RHCP, Hays County will receive authorization for the incidental take of up to 9,000 acres of golden-cheeked warbler and up to 1,300 acres of black-capped vireo habitat. For this analysis, the full extent of authorized incidental take over a thirty year period is assumed to occur.

The RHCP relied on a model developed by Loomis Partners (Model L) describing the location of potential golden-cheeked warbler habitat throughout Hays County. Since the RHCP will provide incidental take authorization for loss or harm to golden-cheeked warbler and black-capped vireo habitat, participation in the RHCP will occur in areas with potential golden-cheeked warbler and black-capped vireo habitat in Hays County. For this analysis, areas of potential participation are therefore defined by Model L.

Black-capped vireo habitat in Hays County is considered most likely to be occupied in sub-climax successional vegetation communities that may persist on the landscape for varying time periods. Suitable habitat for this species is therefore often considered a dynamic shifting mosaic of vegetation of suitable structure that moves across the landscape in response to disturbance and land use. The amount and location of potential habitat is expected to change and move during the duration of the proposed permit. Black-capped vireo habitat, for the purposes of this analysis, is assumed to be distributed across the land surface overlying the Trinity and Edwards

Aquifers within Hays County in proportion to potential brush habitat areas as described in the HCP.

Water withdrawals are assumed to have localized effects associated with the groundwater supplying aquifers from which water is withdrawn within the County. It is generally accepted that reduced aquifer levels may result in reduced spring flows which may affect the species being considered in this analysis.

Aquifer segments were mapped (see Figure 1) to illustrate the three groundwater resources available within the County: the Southern Segment of the Edwards Aquifer, the Barton Creek Segment of the Edwards Aquifer, and the Trinity Aquifer (referred to as aquifer polygons) based on the administrative boundaries associated with the Edwards Aquifer Authority, Barton Springs Conservation District, and the Hays County Trinity Groundwater Conservation District, respectively.

The HCP provided projected population distribution by census tract for years 2000 and 2040. Changes in population density were determined by dividing the increase in population by the respective acreage of each census tract. Census tracts and modeled potential golden-cheeked warbler habitat and likely black-capped vireo habitat were superimposed over aquifer polygons to determine where participation in the RHCP could occur that may result in effects to the aquifers.

For the purposes of this analysis, participation in the RHCP was assumed to create water demand at 132.0 gallons per day (gpd) per person, based on Texas Water Development Board (TWDB) Region L planning area projections. Most of Hays County lies within the Region L water planning area. Though a portion of Hays County lies within the TWDB Region K water planning area, TWDB mapped wells in this portion of the County are associated with the Trinity Aquifer, and not with the Colorado River-associated sources upon which Region K projections are based. Water supply and projected demand are therefore assumed to follow the estimates for the remainder of the County for this analysis.

Because the actual location of future participation and the source water for participants is unknowable, for the purposes of this analysis water demand created by participants in the plan is assumed to be met from the aquifer associated with the location of the development. This assumption has the effect of overstating the likely actual water demand, as some participants may be served by municipal utilities that receive some portion of their water from alternate sources. The city of San Marcos, for example, has initiated diversification of their water supplies and the cities of Kyle and Buda have entered into agreements that will begin providing water from alternate sources during the life of the permit.

The main effects considered here are the incremental adverse effects to the listed aquatic species and their designated critical habitats due to aquifer withdrawals and resulting decrease in springflows. Water demand was therefore estimated for anticipated RHCP participants by likely groundwater source to derive anticipated effects to the springs resulting from pumping.

Analysis for effects of the action

Permit issuance will be associated with some increased water demand throughout the permit area. It is understood that pumping throughout the Edwards and Trinity Aquifers affects aquifer

levels and resulting springflows. Therefore, it is reasonable to conclude that pumping resulting from development associated with the proposed RHCP may affect springflows and listed species dependent upon the Edwards and Trinity Aquifers within the action area.

Though the location of specific projects over the life of the permit is unknowable at this time, information from the EIS and other sources was analyzed to project likely RHCP participation throughout the County. The Service reviewed population projections, potential golden-cheeked warbler and black-capped vireo habitat, and groundwater resource locations to estimate where participation in the RHCP and resulting effects would be expected to occur.

Although the proposed action would likely decrease water availability in the Southern Segment of the Edwards Aquifer, the projected increased water demand appears to be minimal (less than 0.07545 cubic feet per second (cfs) (487,681 gpd) based on a yearly mean, or approx. 0.0044%) relative to the long-term average springflows at San Marcos Springs to support the estimated 3,695 people associated with activities covered by the RHCP. The mean discharge of San Marcos Springs for the period May 26, 1956 – December 31, 2009, is 173.3 cfs (112,006,715.8 gpd). When compared to the minimum flow of 53.5 cfs (34,577,884.8 gpd) recorded during the drought of record in August 1956, the increased demand associated with the RCHP represents 0.0141% of the total flow at San Marcos Springs.

The proposed action would likely also decrease water availability in the Barton Springs Segment of the Edwards Aquifer. The projected water demand from the anticipated 532 people anticipated to be associated with activities covered by the RHCP also appears to be minimal (less than 0.1493 cfs [96,515 gpd] based on a yearly mean, or approx. 0.0024%) relative to the 61.30 cfs (39,619,224.9 gpd) average springflow recorded for Barton Springs (USGS 2010). When compared to the minimum flow of 13.93 cfs (9,003,132.2 gpd) recorded during the 1950's drought of record, the increased demand associated with the RCHP represents 0.0107% of the total flow at Barton Springs.

These calculations rely on the simplifying assumption that all water pumped within an aquifer has a direct effect at the respective associated springs.

Due to the differential effect related to aquifer source of likely water withdrawals and the changing recharge conditions over time in the Edwards and Trinity Aquifers, specific effects are unknown at this time. Although there is a possibility that habitat for the species addressed in this analysis could be adversely affected, it is impossible to determine to what extent adverse effects may occur.

Regulation of water outside the control of the RHCP Applicant

In addition to the determination above specifically with regard to the RHCP, the Service also considered the effects of existing regulatory mechanisms to monitor water availability with regards to potential effects to listed species and anticipates that multiple mechanisms will be triggered to protect listed species to the greatest extent practicable. Existing regulatory mechanisms include, but may not be limited to, the following.
The Service anticipates that during drought conditions, the state-mandated EAA Critical Period Management regulations are likely to maintain flows at San Marcos. The Barton Springs Edwards Aquifer Conservation District (BSEACD) has jurisdiction over pumping within the

Barton Springs Segment of the Edwards Aquifer, and is expected to implement and enforce pumping restrictions during critical periods in order to maintain flows at Barton Springs.

Under authority granted by Texas Water Code (Chapter 36, Subsection 36.101) and by their enabling legislation, the Hays Trinity Groundwater Conservation District (HTGCD) has jurisdiction over pumping within the Trinity Aquifer within the Action area, and is expected to implement and enforce pumping restrictions during critical periods in order to conserve, preserve, and protect groundwater or groundwater recharge.

During normal conditions, spring discharge is expected to be near the reported average at each of the springs and the potential for adverse effects to the species or designated critical habitat is anticipated to remain low. The proposed permit issuance and associated water demand is not expected to appreciably alter the distribution or population size of any of the species addressed in this analysis during normal conditions.

During extreme drought periods, such as those that might occur in a repeat of the drought of record, the efforts of the EAA, BSEACD and the HTGCD alone may not be sufficient to prevent reduction in habitats, decreased food supplies, increased risk of predation, and changes to water quality for all of the species associated with these systems.

Potential future actions that may affect the species within the action area

Efforts are currently underway outside of the Hays County RHCP to address the needs of the aquatic species considered here. If completed and implemented, these approaches may provide additional regulatory protections over groundwater withdrawals and conservation measures for the aquifer and springs dependant species.

The BSEACD received Section 6 grant assistance to develop an HCP to address management of the Barton Springs Segment of the Edwards Aquifer and ensure conservation of the Barton Springs salamander. If completed and implemented, this HCP effort may provide additional benefits for this species and its spring-fed habitats.

In 2006, the Service initiated the formation of the Edwards Aquifer Recovery Implementation Program (EARIP) to engage region-wide stakeholders in an effort to develop a cooperative plan to balance water use and development with the recovery of threatened and endangered species. This collaborative effort includes stakeholders from across the region, including municipal governments, non-governmental organizations, Federal agencies, and concerned citizens.

The 80th Texas Legislature enacted Senate Bill 3 (SB 3) which was signed into law by the Governor on June 16, 2007. Article 12 of SB 3 directs the EAA to authorize annual groundwater withdrawal through various types of permits and provides for increased critical period (drought) management efforts. SB 3 also required EAA, Texas Parks and Wildlife Department, and Texas Water Development Board to participate as stakeholders in the EARIP and directed that a Habitat Conservation Plan be developed to ensure protective springflows for the listed species associated with the Southern Segment of the Edwards Aquifer in the event of a repeat of conditions that resulted in the drought of record.

The EARIP effort is currently underway and anticipates delivering an HCP to the Service for consideration and approval no later than September of 2012. The implementation of such a

regional aquifer management plan that significantly influences the magnitude and duration of springflows is considered to be among the most important actions needed to protect and recover the species associated with this system.

Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

An undetermined number of future land use conversions and routine agricultural practices are not subject to Federal authorization or funding and may alter the habitat or increase incidental take of golden-cheeked warblers and black-capped vireos are, therefore, cumulative to the proposed project. These additional cumulative effects include: (1) unpredictable fluctuations in habitat due to urbanization; (2) increase in impervious cover due to urbanization (i.e., roads); (3) use of pesticides on listed species habitat; (4) contaminated runoff from agriculture and urbanization; (5) nest parasitism; and, (6) predation by feral animals and pets.

For the aquatic species, additional cumulative effects include: increased pumping demands due to non-participating development within Hays County; increase in impervious cover due to development, (e.g., roads); recreational activities; contaminated runoff from agriculture and urbanization; aquatic habitat modification (e.g., dams, bank stabilization, flood control); and, habitat alteration by invasive exotic / non-native species.

The most important cumulative effect is the continued level of well withdrawal from the Edwards Aquifer by all non-Federal users. As population in the region grows, water demand is expected to increase.

Conclusion

After reviewing the current status of the golden-cheeked warbler,black-capped vireo, Texas wild-rice, fountain darter, Comal Springs dryopid beetle, Comal Springs riffle beetle, San Marcos salamander, Texas blind salamander, and the Barton Springs salamander, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of these species. As stipulated throughout the RHCP, pursuant to section 10(a)(1)(B) of the Act, and the intent to provide some recovery benefit to the covered species (please refer to Section 6.1.2 of the RHCP), the proposed action is an effort on the part of Hays County to add to the recovery potential for the golden-cheeked warbler and the black-capped vireo.

The issuance of the RHCP and accompanying incidental take permit will have no bearing on economic growth in Hays County. It is reasonable to conclude that development will occur regardless of the implementation of the proposed action. In fact, without the conservation measures in the RHCP it will likely occur and would have no conservation strategy to offset habitat loss associated with development. Due to conservation strategies pursuant to the RHCP

and to the lack of habitat protection that currently exists in Hays County, it is reasonable to assume that, although there will be habitat lost from development covered by the RHCP, habitat for the golden-cheeked warbler and black-capped vireo will also be preserved in perpetuity by implementing the RHCP resulting in a net benefit to the golden-cheeked warbler and the black-capped vireo in the long-term.

Permit issuance is not expected to appreciably alter the distribution or population size of any of the aquatic species addressed in this analysis during normal conditions. Indeed, it is likely that permit issuance could result in some benefit to these species if the proposed preserve system of approximately 10,000 to 15,000 acres containing potential golden-cheeked warbler and black-capped vireo habitat in Hays County is achieved, assuming all incidental take coverage is utilized. Protection of these terrestrial habitats over aquifer resources may provide benefits otherwise unavailable to the species considered here. However, it is difficult, if not impossible, to measure potential benefits, largely because the preserve locations are unknown at this time.

No critical habitat has been designated for the golden-cheeked warbler or the black capped vireo; therefore, none will be affected.

After reviewing the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is Service's biological opinion that issuance of the Hays County RHCP is not likely to destroy or adversely modify designated critical habitat for the considered aquatic species, as appropriate. Should new information become available (e.g. critically-low springflow levels) that might suggest adverse modification to any designated critical habitat, Hays County will re-initiate consultation with the Service to address any potential adverse modification to designated critical habitat at that time.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined by the Service as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is further defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding and sheltering (50 CFR §17.3). Harm is also further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns, including breeding, feeding, and sheltering. Incidental take is defined by the Service as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are nondiscretionary and must be implemented by the Service so that they become binding conditions of any authorization issued to implement a project covered by this biological opinion, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Service (1) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the authorizations, and/or (2) fails to retain

oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Service must report the progress of the action and its effect on the species. [50 CFR 402.14(i)(3)].

Amount or Extent of Take

The Service anticipates incidental take of golden-cheeked warblers and black-capped vireos will occur as a result of the proposed action. Individual golden-cheeked warblers and black-capped vireos are difficult to detect unless they are observed, undisturbed, in their environment. Most close-range observations of golden-cheeked warblers and black-capped vireos represent chance encounters that are difficult to predict. Because quantifying take of individual golden cheeked warblers is difficult (clearing of habitat typically results in harm or harassment through displacement, not in death or injury of individuals), this biological opinion instead evaluates acres of habitat removed as a surrogate for the level of incidental take. This approach has been used for incidental take of golden-cheeked warbler in Travis County (RECON and Service 1996) and Williamson County (Service 2008). The incidental take from the proposed action is expected to occur in the form of harm and harassment through direct loss of habitat and indirect adverse effects resulting from the issuance of an incidental take permit pursuant to 10(a)(1)(B) of the Act. The following amount of incidental take will be authorized by the proposed permit:

1. No more than 9,000 acres of golden-cheeked warbler habitat that occurs within the Hays County may be adversely affected; and,

2. No more than 1,300 acres of black-capped vireo habitat that occurs within the Hays County may be adversely affected.

The Service expects that groundwater withdrawals that may result from actions associated with the Hays County RCHP may result in adverse effects, however, those adverse effects will not likely rise to the level of jeopardy for the fountain darter, Comal Springs dryopid beetle, Comal Springs riffle beetle, San Marcos salamander, Barton Springs salamander and Texas blind salamander, during periods of normal rainfall and aquifer levels.

During severe drought conditions or when springflows drop to critically low levels, take or harm to these aquatic species may occur as a result of groundwater withdrawals associated with the RHCP. Because the RHCP does not provide take coverage for these aquatic species, conditions that are shown to result in incidental take due to actions associated with the RHCP will nullify Hays County's permit. The Service will notify Hays County that their permit is no longer valid, if any direct or indirect take occurs, as soon as we become aware of such take.

The Service recognizes that: (1) the permit applicant does not control pumping from the aquifers within the County, (2) for the period covered under this opinion; water withdrawal associated with permit issuance from the aquifers in Hays County will generally be less than one percent (1%) of total withdrawals. Efforts to reduce withdrawals, and provide springflows for the listed species to reduce the risk of jeopardizing the species or adversely modifying their designated critical habitats to low levels is the responsibility of all Edwards Aquifer users. However, it is the applicant's responsibility to avoid unauthorized take of any listed species and avoid adverse effects to designated critical habitat for any listed species within the action area.

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to the incidental take of listed plant species like Texas wild-rice. However, protection of listed plants is provided to the extent that Act prohibits the removal, reduction to, and possession of federally listed endangered plants or the malicious damage of such plants on areas under Federal jurisdiction, or the destruction of endangered plants on non-Federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

Effect of the Take

In the accompanying biological opinion, the Service has determined that this level of anticipated take is not likely to result in jeopardy of the golden-cheeked warbler or black-capped vireo due to the long-term beneficial effects associated with the proposed action. No critical habitat has been designated for the golden-cheeked warbler or the black-capped vireo; therefore, none will be affected.

The Service expects that groundwater withdrawals that may result from actions associated with the Hays County RCHP may result in some adverse effects, however, those adverse effects will likely not rise to the level of jeopardy for of the Texas wild-rice, fountain darter, Comal Springs dryopid beetle, Comal Springs riffle beetle, San Marcos salamander, Barton Springs salamander, and Texas blind salamander. Further, due to the implementation of mitigation strategies that will result in preserve lands, some of which may occur over the aquifers, the Service anticipates some benefits to aquifer-dependent species may occur over the life of the permit. Since the aquatic species are not fully covered in the *Hays County Regional Habitat Conservation Plan* dated June 7, 2010 and were not requested to be included on the permit, the Habitat Conservation Plan Assurances, "No Surprises Rule", (63 FR 8859) are not applicable for these species.

Critical habitat has been designated for: Texas wild-rice, Comal Springs dryopid beetle, Comal Springs riffle beetle, fountain darter, and San Marcos salamander; however, the Service does not anticipate that the proposed action will adversely modify designated critical habitat for these species.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of golden-cheeked warblers and black-capped vireos and avoid take of listed aquatic species in the action area. The Service shall:

1. require that the applicant fully implements the Hays County RHCP and complies with all terms and conditions of the issued section 10(a)(1)(B) incidental take permit; and

2. nullify the applicant's permit if new information becomes available or under new conditions (e.g. critically-low springflow levels, severe drought conditions) that is shown to cause direct or indirect take of listed aquatic species. The Service will notify Hays County that their permit is no longer valid as soon as we become aware of such take.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Service must comply with the following term and condition that implements all of the reasonable and prudent measures

described above and outlined reporting/monitoring requirements. This term and condition is non-discretionary.

1.1 Ensure that Hays County fully complies with avoids and minimizes incidental take, in the form of harassment and harm, of golden-cheeked warblers and black-capped vireos through full implementation of the *Hays County Regional Habitat Conservation Plan* dated June 7, 2010;

1.2. ensure that Hays County fully mitigates the effects of the incidental take of golden-cheeked warblers and black-capped vireos from all covered activities, as described in the *Hays County Regional Habitat Conservation Plan* dated June 7, 2010;

1.3. ensure that Hays County produces and implements a public education/outreach program to inform Hays County citizens and project RHCP participants of the RHCP permit conditions and mitigation strategy proposed by the RHCP; and,

1.4 the authorization granted by the permit is subject to compliance with all terms and conditions contained in the permit.

2.1 The service shall work with the permit holder to monitor conditions and collect data necessary to monitor effects of implementation of the permit on aquatic species to determine future conservation measures and if take is likely to occur; and

2.2 The Service shall reinitiate consultation on the aquatic species if new information becomes available that indicated reinitiation is needed on the issuance and implementation of the section 10(a)(1)(B) incidental take permit and the *Hays County Regional Habitat Conservation Plan* dated June 7, 2010.

The reasonable and prudent measures, with their implementing term and condition, are designed to minimize the effects of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring re-initiation of consultation and review of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered or threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or designated critical habitat, to help implement recovery plans, or to develop information.

1. The Service with the Permittee should work to institute water conservation designs in residential and business development and landscape projects.

2. The Service recognizes that Fern Bank Springs is located on private property, and urges cooperation with the landowner or party responsible for Fern Bank Springs and/or the U.S. Geological Survey to secure access and institute a regular monitoring program for springflow and the status of the Comal Springs dryopid beetle and its designated critical habitat at this location.

3. The Service should encourage the applicant to ensure compliance with the TCEQ "*Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer*" and "*Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer and Related Karst Features that May Be Habitat for Karst Dwelling Invertebrates*", described above, a component of RHCP participation to best protect the listed aquatic species in Hays County.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Review Requirements

The reasonable and prudent measures, with their implementing term and condition, are designed to avoid, minimize, and mitigate effects of incidental take that might otherwise result from the proposed action. If, during the course of the authorized activities, this level of incidental take is exceeded prior to the annual review, such incidental take represents new information requiring review of the reasonable and prudent measure provided. The Service must immediately provide an explanation of the causes of the taking and review the need for possible modification of the reasonable and prudent measures. This biological opinion will expire at the expiration of the incidental take permit issued to implement the RHCP. Issuance of a new biological opinion will be subject to evaluation of the recovery of the species.

Reinitiation Notice

This concludes formal consultation on the issuance of a Service 10(a)(1)(B) permit for the Hays County Regional Habitat Conservation Plan to minimize and mitigate, to the maximum extent practicable, adverse effects to the endangered golden-cheeked warbler or black-capped vireo from covered activities described in the RHCP over a period of 30 years. As provided in 50 CFR Sec. 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of authorized incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species not considered in this biological opinion; or, (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Although critical habitat has been designated for several of the listed aquatic species found within the action area, the Service does not anticipate that the proposed action will adversely modify any designated critical habitat during periods of normal rainfall. However, should springflows significantly decline, as may occur during severe drought, the Service believes the probability of adverse modification as a result of implementing the RHCP will likely increase. If such adverse modification occurs, the Service will reinitiate consultation and notify Hays County that their permit is no longer valid. Should the Permittee become aware of new information (e.g. critically-low springflow levels) indicating that implementation of the RHCP is likely to result in adverse modification of designated critical habitat, the Permittee shall formally notify and meet

with Austin ESFO to address any potential adverse modification to designated critical habitat at that time.

If you have any questions regarding this biological opinion, please contact Luela Roberts at (512) 490-0057, extension 222.

Approved:

Adam Zerrenner, Field Supervisor
Austin Ecological Services Field Office

1/31/11
Date

Concur:

Jay E. Nicholopoulos

Deputy Regional Director
Region 2

Date

4/28/11

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